

Development Collective Know-how and Us

#LSEHausmann

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Chair: Professor Riccardo Crescenzi

Professor of Economic Geography at LSE.

Hosted by the Department of Geography and Environment.

Development, Knowhow and Us

Ricardo Hausmann
Harvard University

Lecture at LSE, January 2018



*Presented to the St Austell Public Library
by Mr. Petherick of St Austell*



AN

INQUIRY

INTO THE

NATURE AND CAUSES

OF THE

WEALTH OF NATIONS.

By ADAM SMITH, L.L.D. F.R.S.

WITH

A LIFE OF THE AUTHOR.

ALSO,

A VIEW OF THE DOCTRINE OF SMITH, COMPARED WITH THAT OF THE
FRENCH ECONOMISTS; WITH A METHOD OF FACILITATING THE
STUDY OF HIS WORKS; FROM THE FRENCH OF M. GARNIER.

IN THREE VOLUMES.

VOL. I.

LONDON:

PRINTED FOR J. MAYNARD, PANTON STREET, HAY-
MARKET; AND F. ZINKE, 448, STRAND.

1811.

Malawi

\$226 per capita



Haiti

\$819 per capita





Morocco

\$3,108 per capita

Poland

\$13,431 per capita

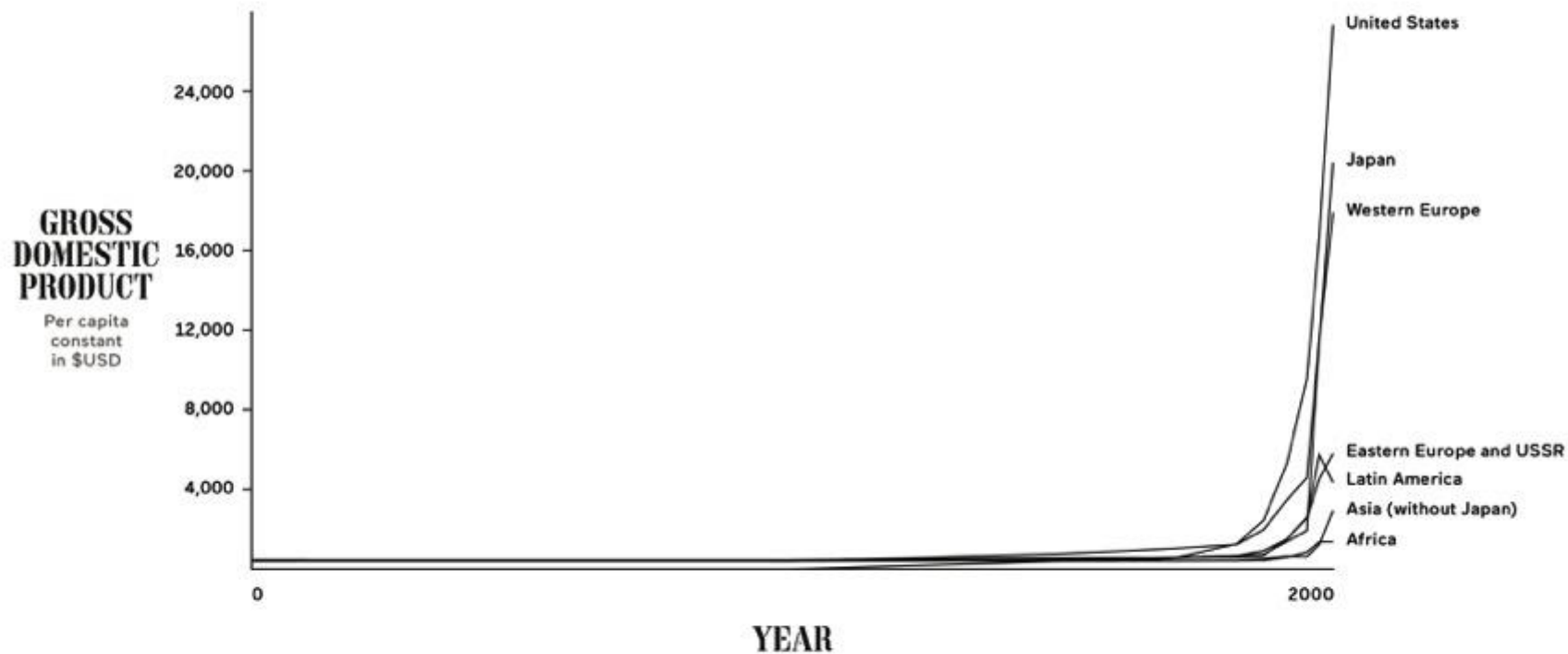


Singapore

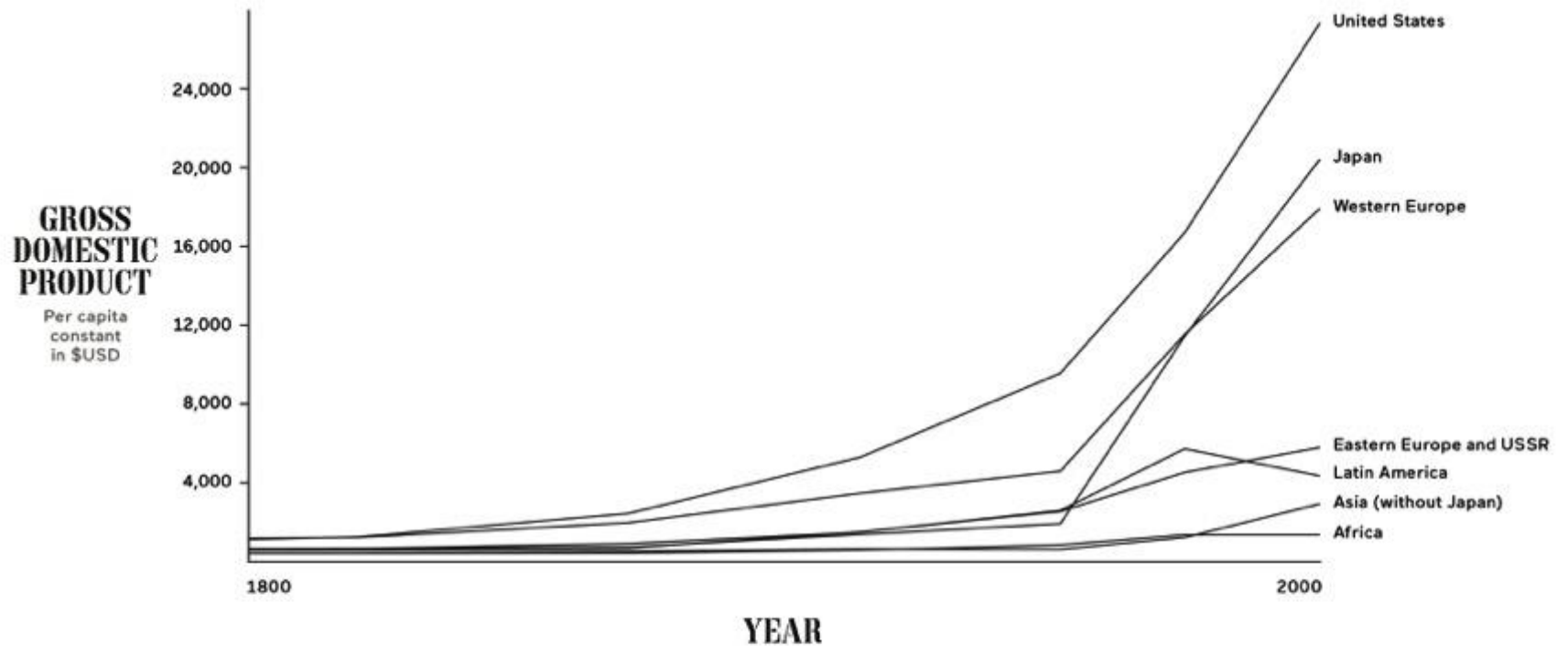
\$55,182 per capita



The Great Acceleration



The Great Divergence





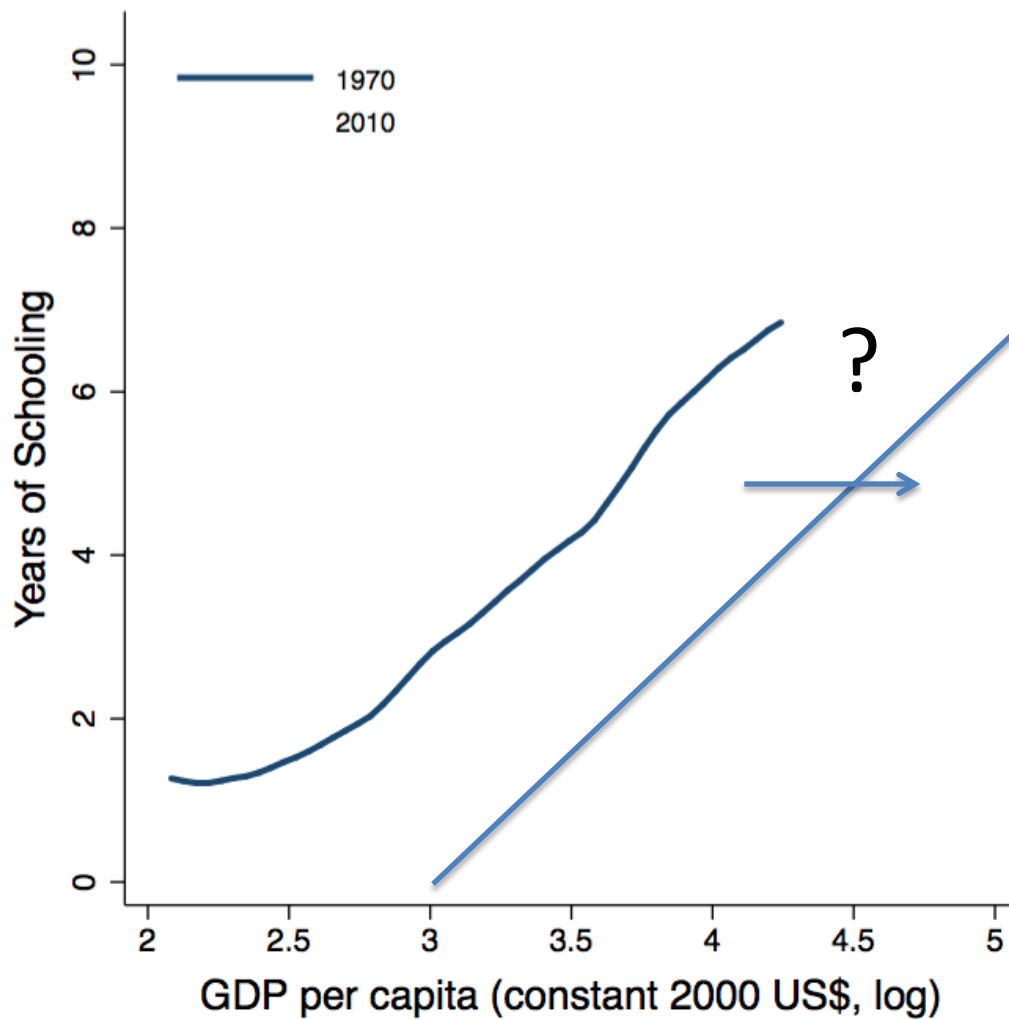


Neo-classical characters in the story

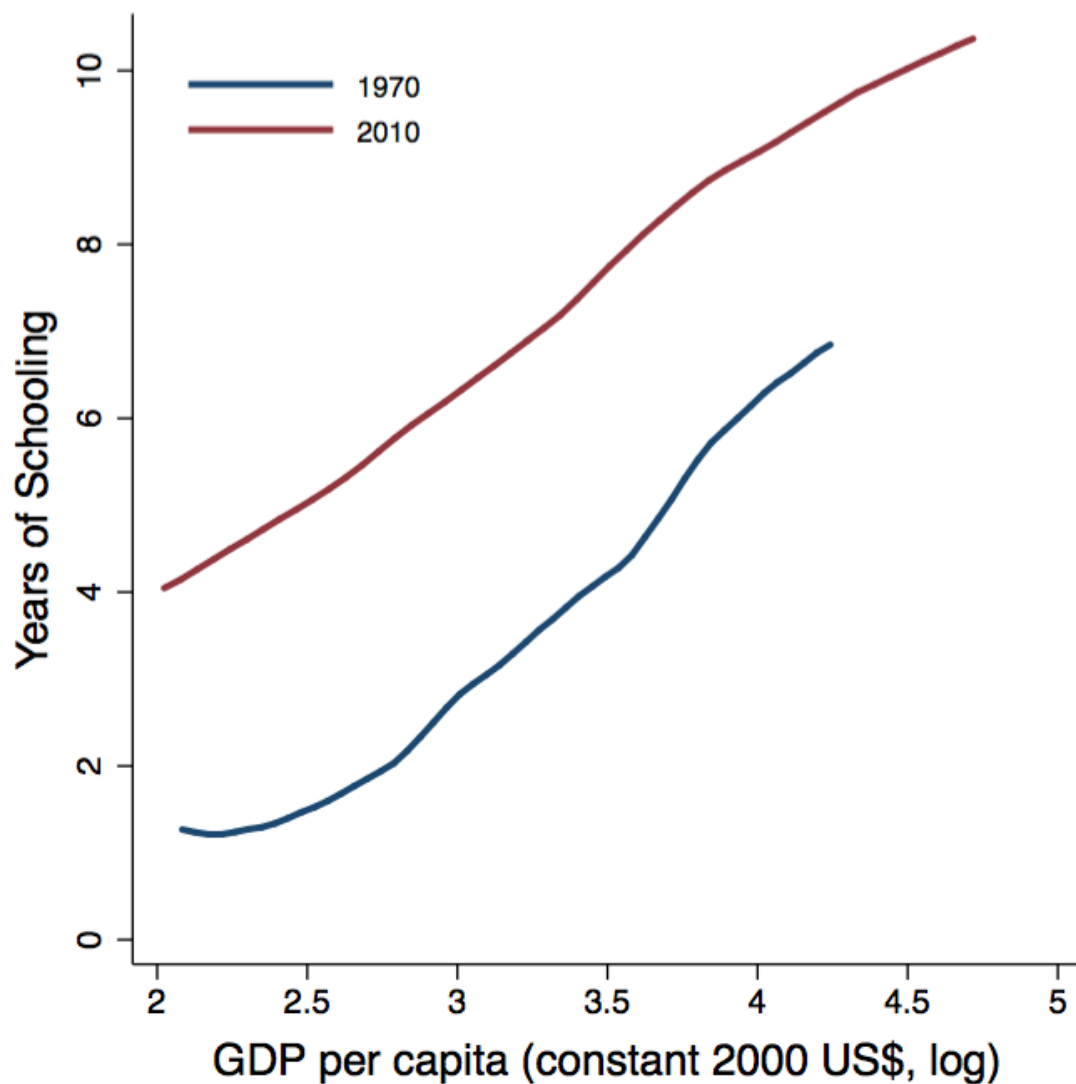
- Capital
 - Machines or money?
 - Assumes complete markets
- Human capital
 - (PISA) Quality-adjusted schooling
- Technology
 - Mostly in the air or in machines
- The secret of growth is mostly technology
 - Solow

SCHOOLING AND GROWTH

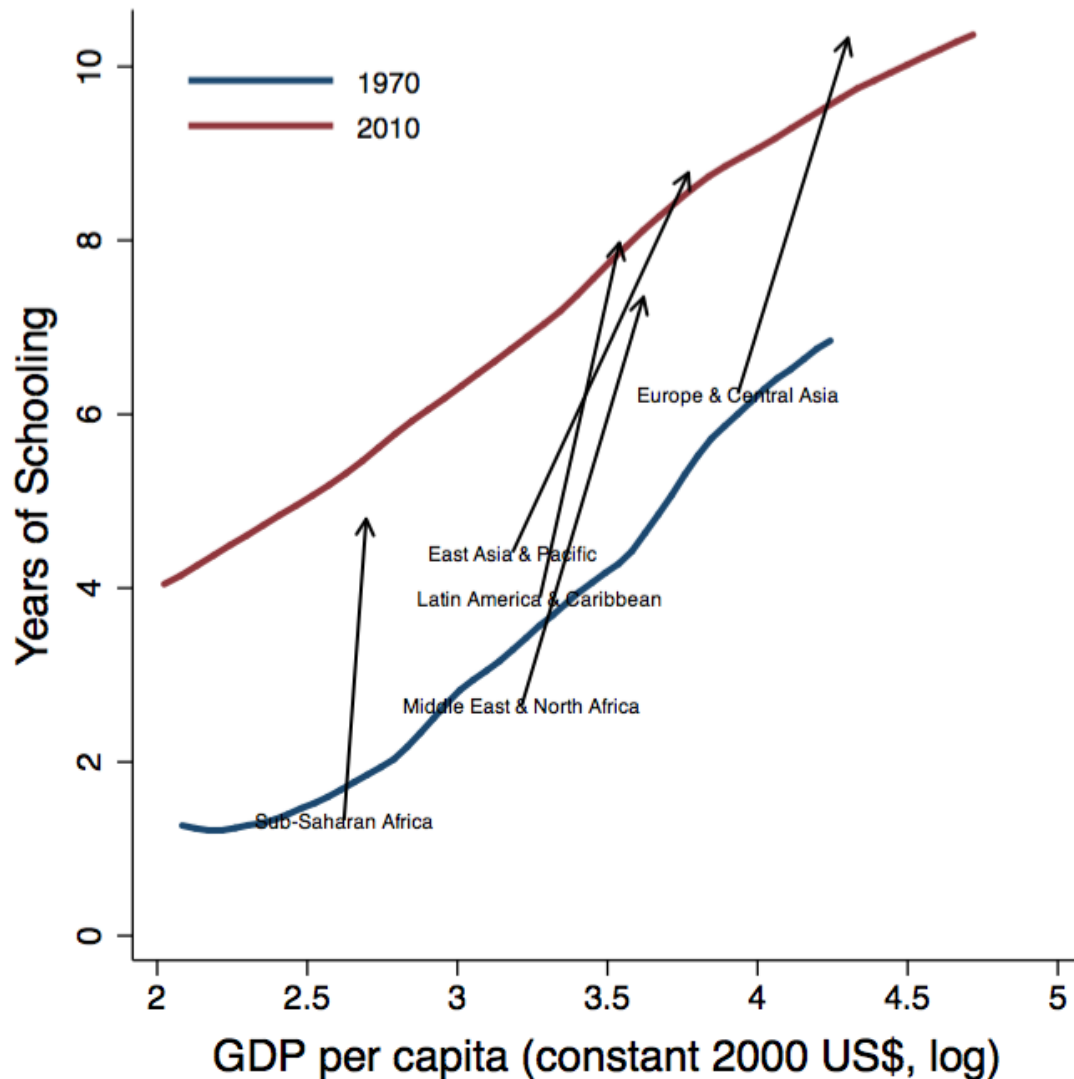
YEARS OF SCHOOLING



Years of schooling

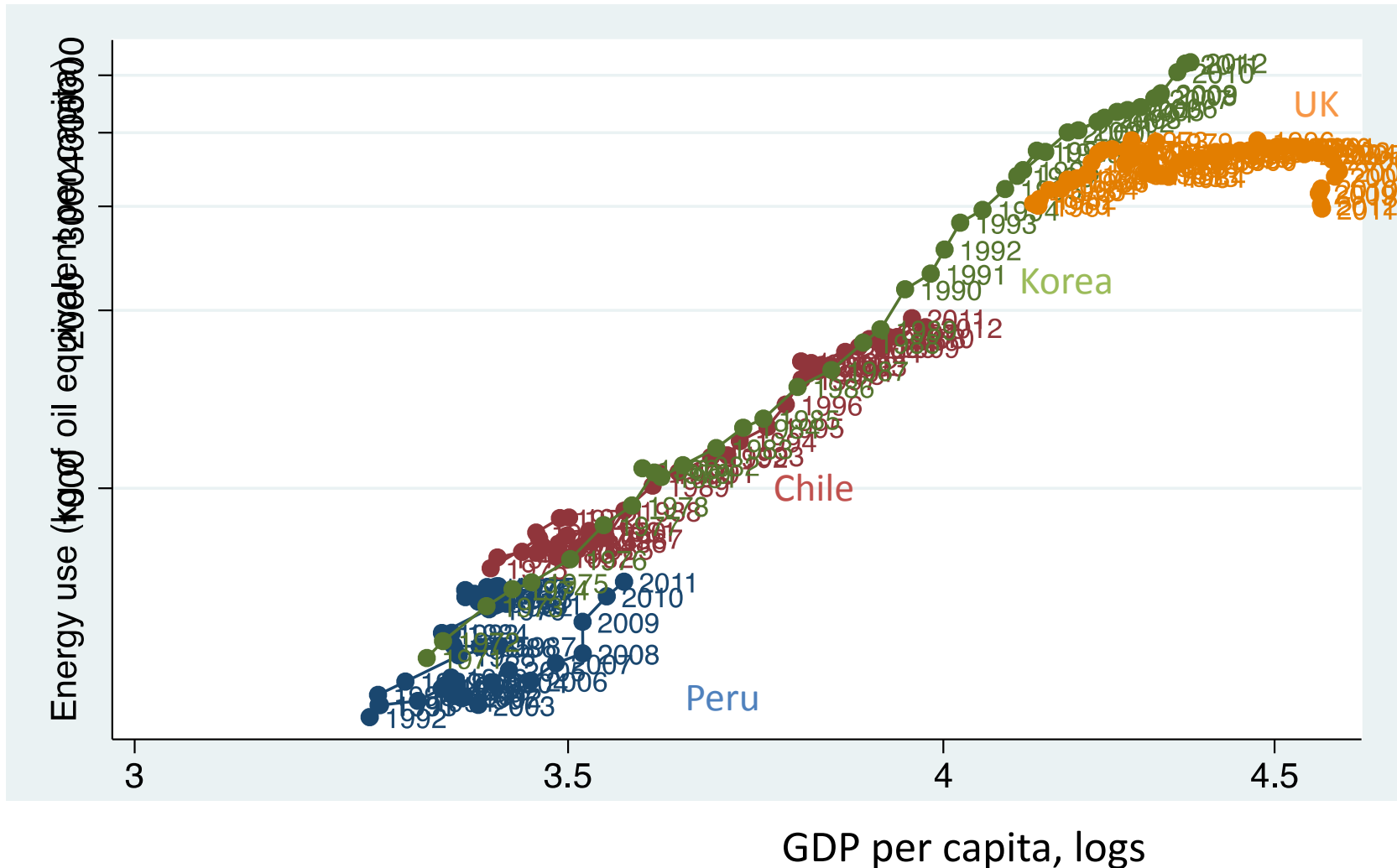


Years of schooling

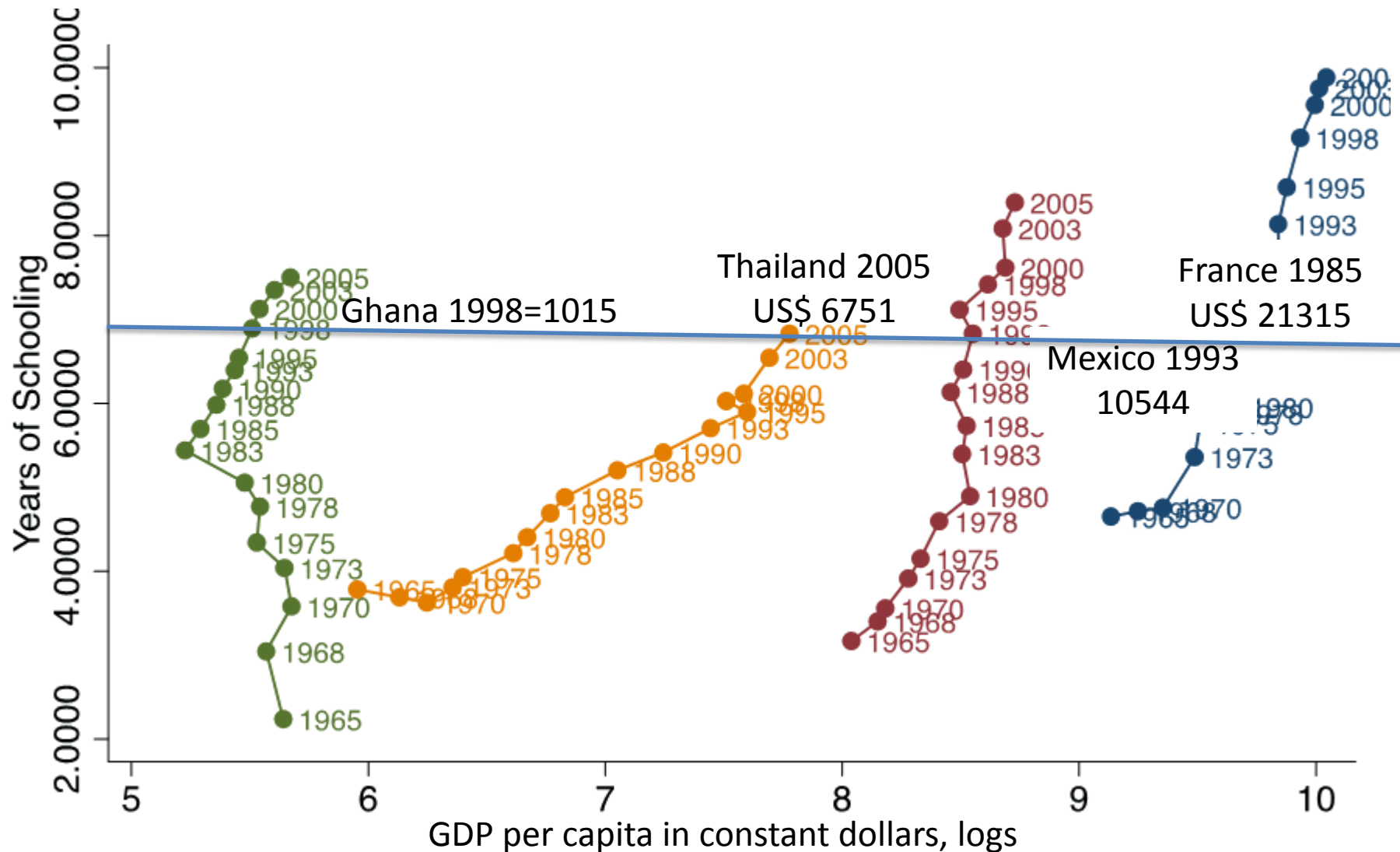


- Increased schooling is not generating the expected income pay-off
- Decreasing returns to human capital accumulation?

Energy use and GDP per capita



Years of schooling and income per capita





Why does technology not diffuse?

THE SOUNDS OF
POWER, PRODUCTIVITY, AND POLITICS

WHY NATIONS FAIL

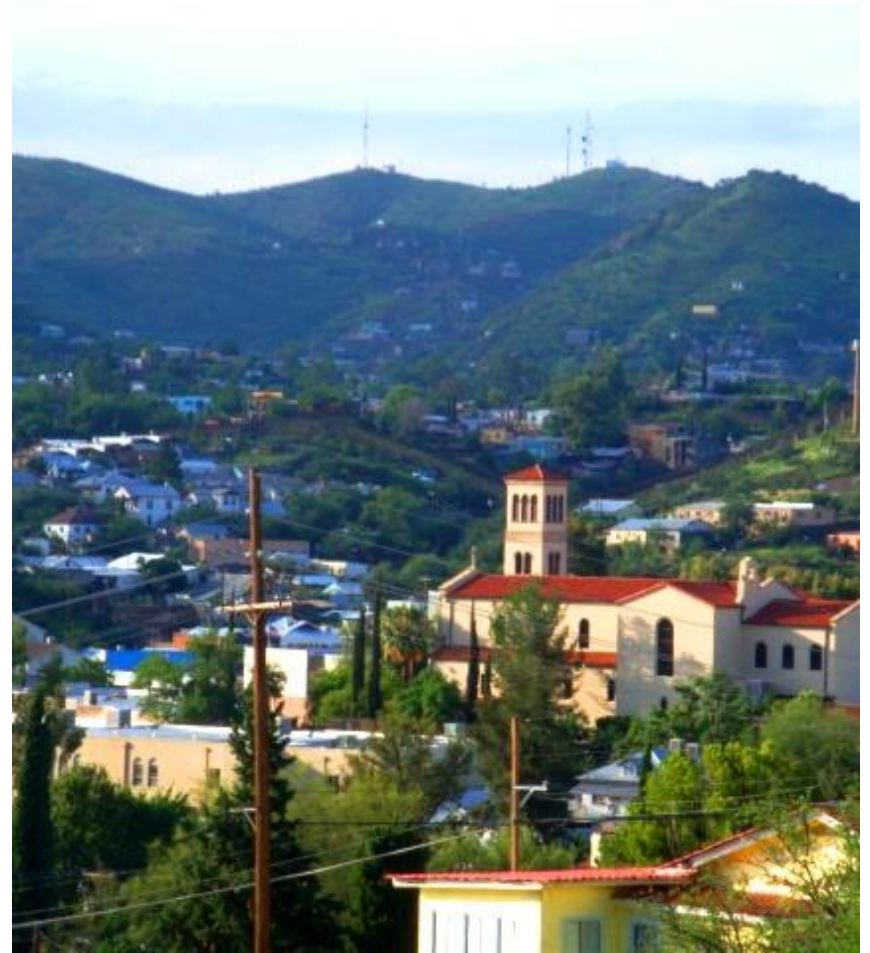
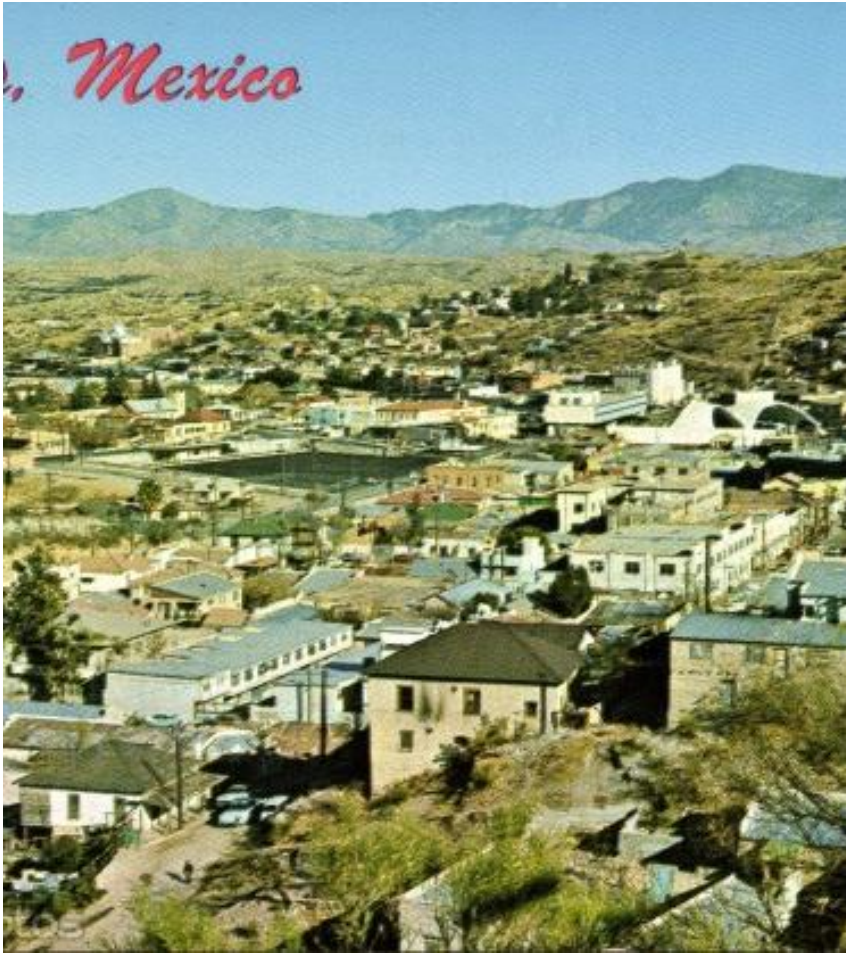
JAMES A. ROBINSON



WHY
NATIONS
FAIL

LEADS ACROSS THE
JAMES A. ROBINSON

The two Nogales



Guerrero

\$5,281 per capita



Sinaloa

\$10,945 per capita



Guanajuato

\$20,827 per capita



Nuevo Leon

\$42,281 per capita



A productivity gap that is consistent wth...

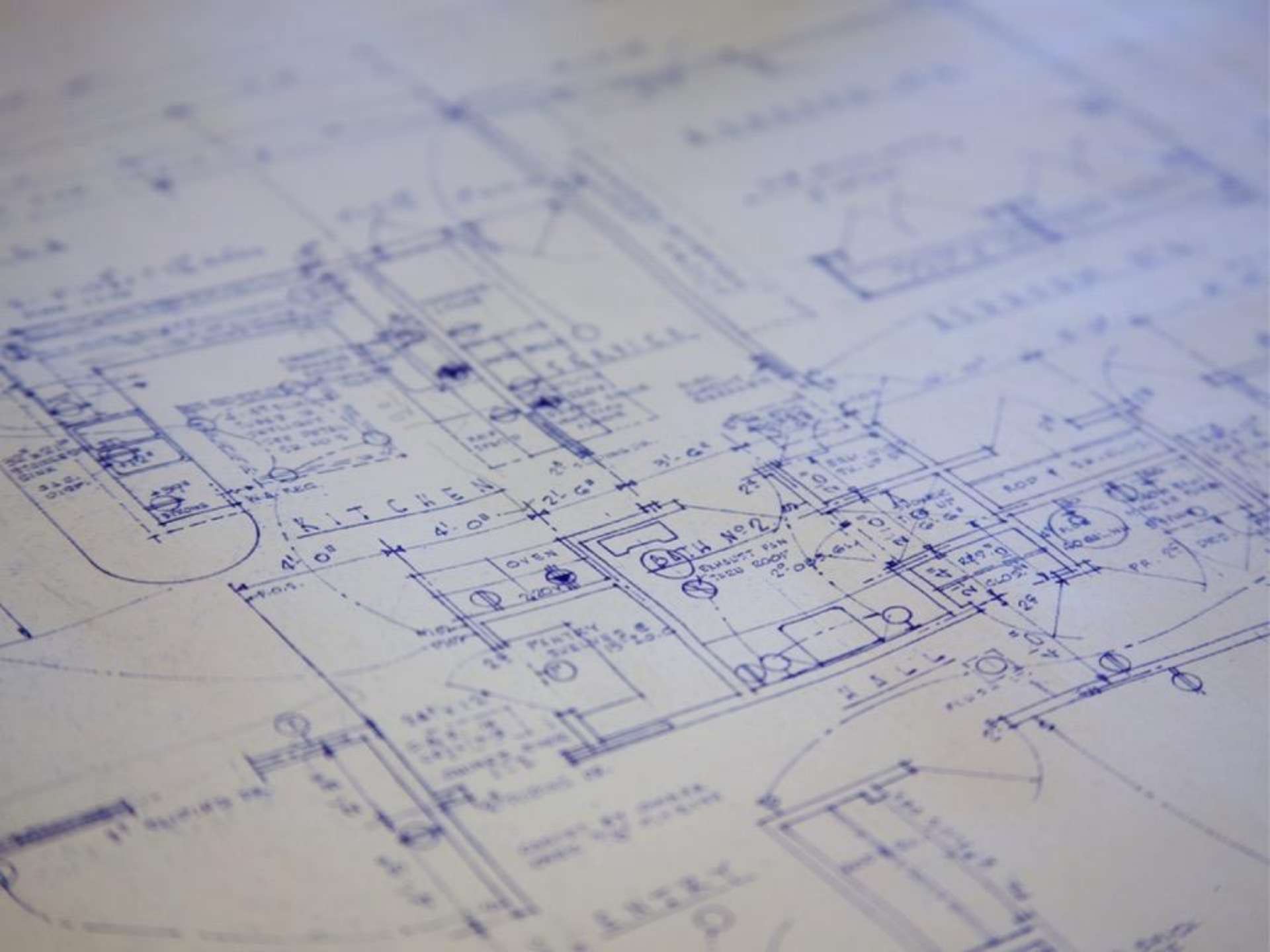
- ...same legal framework
- ...same federal judicial system
- ...same political representation system
- ...mostly same language and religion
- ...same exchange rate
- ...same interest rate
-same macroeconomic setup
-same financial architecture

Maybe technology does not
diffuse because of the nature of
technology itself



But then, what is technology?









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Languages

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العربية
Български
Català
Čeština
Dansk
Deutsch
Español
Esperanto
فارسی
Français
Galego
ગુજરાતી

Article Talk

Lift (force)

From Wikipedia, the free encyclopedia

*For other uses, see **Lift** (disambiguation).*

A fluid flowing past the surface of a body exerts a force on it. **LIFT** is the component of this force that is perpendicular to the oncoming flow direction.^[1] It contrasts with the **drag** force, which is the component of the surface force parallel to the flow direction. If the fluid is air, the force is called an aerodynamic force. In water, it is called a hydrodynamic force.

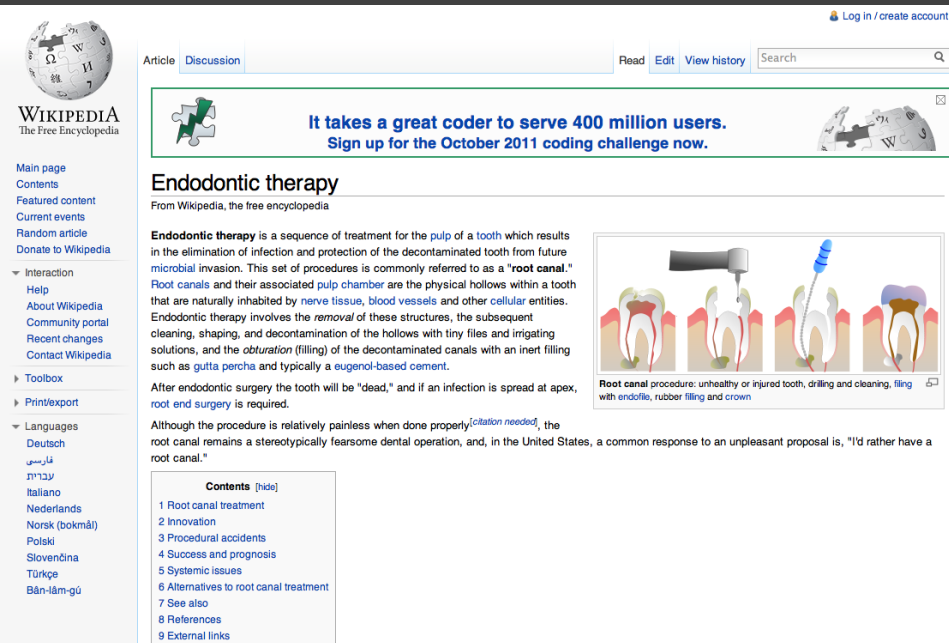
Contents

- Overview
- Simplified physical explanations of lift on an airfoil
 - Flow deflection and Newton's laws
 - Limitations of deflection/turning
 - Increased flow speed and Bernoulli's principle
 - Conservation of mass
 - Limitations of explanations based on Bernoulli's principle
- Basic attributes of lift
 - Pressure differences
 - Angle of attack
 - Airfoil shape
 - Air speed and density
 - Lift coefficient
 - Pressure integration
- A more comprehensive physical explanation
 - Lift involves action and reaction at the airfoil surface and is felt as a pressure difference
 - The airfoil affects the flow over a wide area around it
 - The pressure differences and the changes in flow speed and direction support each other in a mutual interaction
- The understanding of lift as a physical phenomenon
- Mathematical theories of lift
 - Navier-Stokes (NS) equations
 - Reynolds-Averaged Navier-Stokes (RANS) equations
 - Inviscid-flow equations (Euler or potential)
 - Linearized potential flow
 - Circulation and the Kutta-Joukowski theorem
 - Momentum balance in lifting flows
- Lift of three-dimensional wings
- Viscous effects: Profile drag and stalling
- Lift forces on bluff bodies
- Alternative explanations, misconceptions, and controversies
 - False explanation based on equal transit-time
 - Controversy regarding the Coandă effect
 - Misconception regarding the role of viscosity



Boeing 747-400 landing

What do you do when your tooth hurts?



The screenshot shows the Wikipedia article for "Endodontic therapy". At the top, there's a banner for a coding challenge: "It takes a great coder to serve 400 million users. Sign up for the October 2011 coding challenge now." The article title "Endodontic therapy" is prominently displayed, followed by the subtext "From Wikipedia, the free encyclopedia". The main text explains that endodontic therapy is a sequence of treatment for the pulp of a tooth, aiming to eliminate infection and protect the tooth from future microbial invasion. It mentions that root canals and pulp chambers are physical hollows within a tooth, naturally inhabited by nerve tissue, blood vessels, and other cellular entities. The procedure involves removing these structures, followed by cleaning, shaping, and decontamination of the hollows with tiny files and irrigating solutions, and finally obturation (filling) with an inert filling like gutta percha and eugenol-based cement. A diagram illustrates the root canal procedure: drilling and cleaning, filling with endofilo, rubber filling, and crown. Below the diagram, it states that after endodontic surgery, the tooth will be "dead," and if an infection is spread at the apex, root end surgery is required. A table of contents is visible on the left side of the article.

WIKIPEDIA
The Free Encyclopedia

Log in / create account

Article Discussion Read Edit View history Search

It takes a great coder to serve 400 million users.
Sign up for the October 2011 coding challenge now.

Endodontic therapy

From Wikipedia, the free encyclopedia

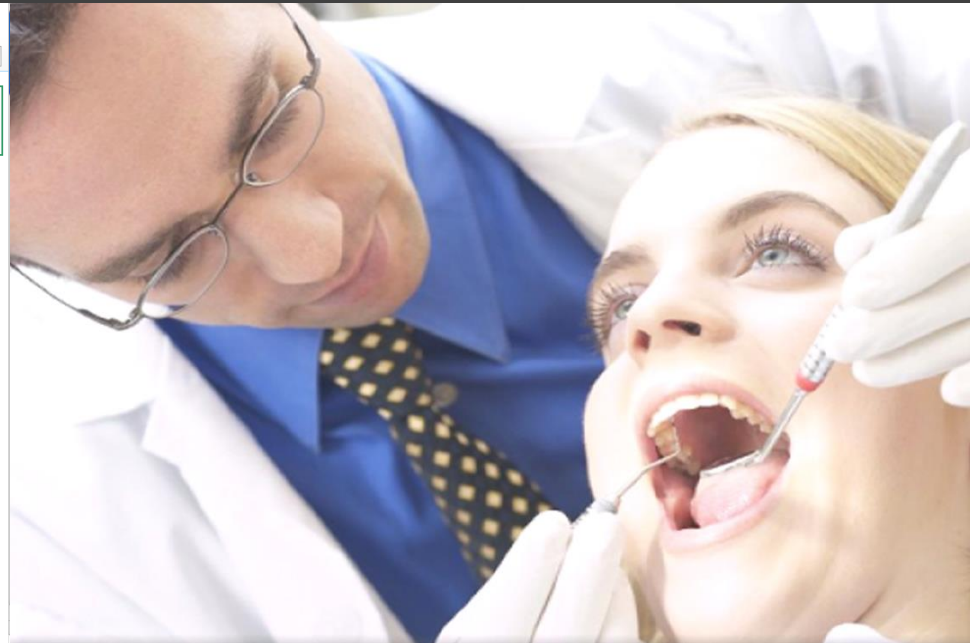
Endodontic therapy is a sequence of treatment for the pulp of a tooth which results in the elimination of infection and protection of the decontaminated tooth from future microbial invasion. This set of procedures is commonly referred to as a "**root canal**." Root canals and their associated pulp chamber are the physical hollows within a tooth that are naturally inhabited by nerve tissue, blood vessels and other cellular entities. Endodontic therapy involves the removal of these structures, the subsequent cleaning, shaping, and decontamination of the hollows with tiny files and irrigating solutions, and the obturation (filling) of the decontaminated canals with an inert filling such as gutta percha and typically a eugenol-based cement.

After endodontic surgery the tooth will be "dead," and if an infection is spread at apex, root end surgery is required.

Although the procedure is relatively painless when done properly^[*citation needed*], the root canal remains a stereotypically fearsome dental operation, and, in the United States, a common response to an unpleasant proposal is, "I'd rather have a root canal."

Contents [hide]

- 1 Root canal treatment
- 2 Innovation
- 3 Procedural accidents
- 4 Success and prognosis
- 5 Systemic issues
- 6 Alternatives to root canal treatment
- 7 See also
- 8 References
- 9 External links



Search the web and fix it
yourself?

...or look for a dentist

Knowhow needs to be in brains



*Knowhow $\neq$
Comprehension*



Source:

<http://en.wikipedia.org/wiki/File:Michaelpolanyi1-2.jpg>







TEAM KNOWHOW



Who has more knowhow?

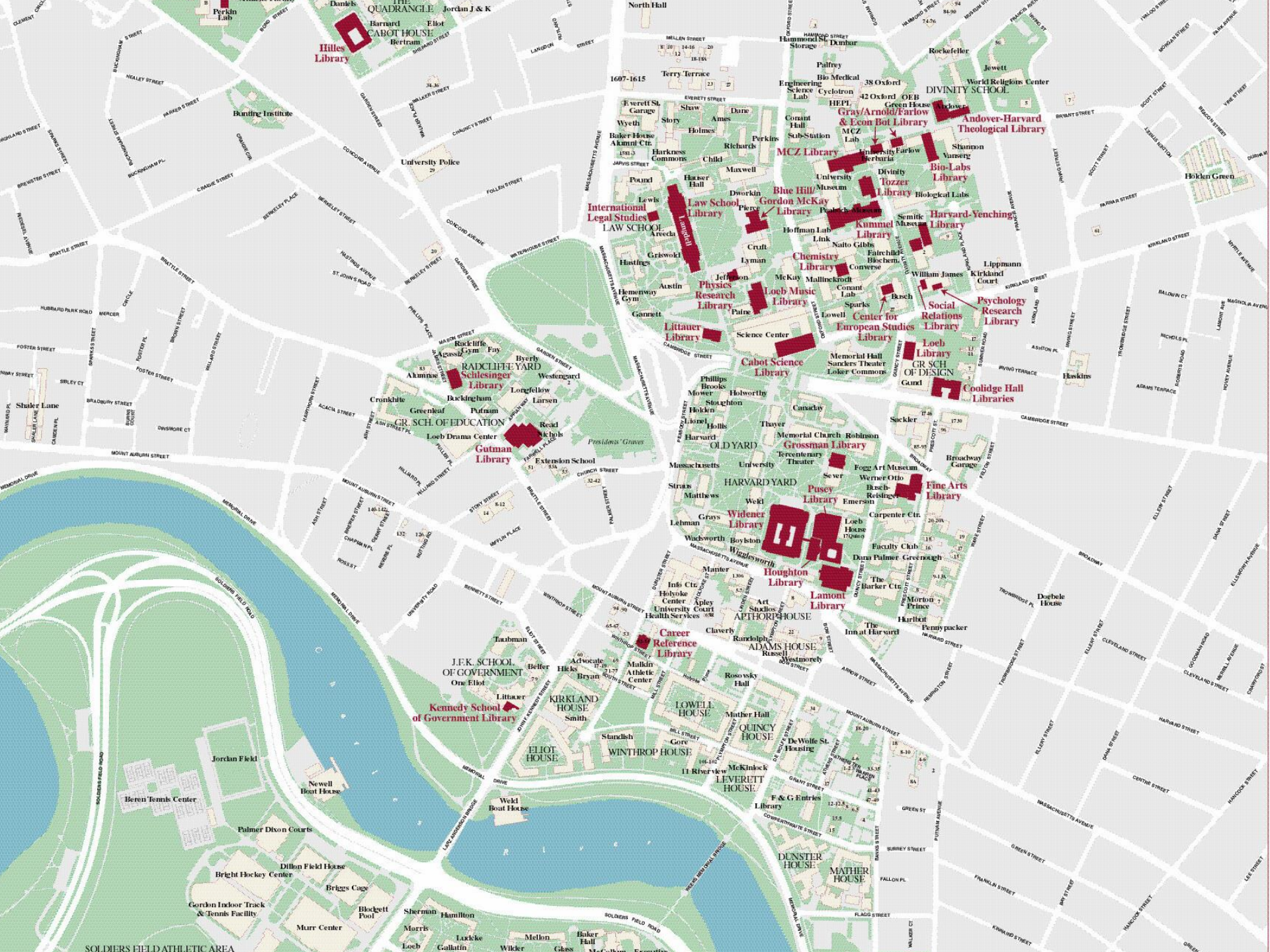








If knowledge increases, where do
you store it?



Hilles Library

Bundling Institute

University Police

St. John's Road

Acacia Street

GR. SCH. OF EDUCATION

Loeb Drama Center

Putnam

Greenleaf

Radcliffe Yard

Schlesinger Library

Gutman Library

Read Hall

Extension School

Presidents' Graves

Church Street

Palmer House

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Palmer House

Palmer House

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Major areas of concentration at Harvard

50

Standard Fields of Study

- African and African American Studies
- Anthropology
- Applied Mathematics
- Astrophysics
- Biomedical Engineering
- Chemical and Physical Biology
- Chemistry
- Chemistry and Physics
- Classics
- Computer Science
- Earth and Planetary Sciences
- East Asian Studies
- Economics
- Engineering Sciences
- English
- Environmental Science and Public Policy
- Folklore and Mythology
- Germanic Languages and Literatures
- Government
- History
- History and Literature
- History and Science
- History of Art and Architecture
- Human Developmental Biology
- Human Evolutionary Biology
- Linguistics
- Literature
- Mathematics
- Molecular and Cellular Biology
- Music
- Near Eastern Languages and Civilizations
- Neurobiology
- Organismic and Evolutionary Biology
- Philosophy
- Physics
- Psychology
- Comparative Study of Religion
- Romance Languages and Literatures
- Slavic Languages and Literatures
- Social Studies
- Sociology
- South Asian Studies
- Special Concentrations
- Statistics
- Visual and Environmental Studies
- Studies of Women, Gender, and Sexuality

The Personbyte

How do we use productive knowledge

- Products differ in the number of personbytes they require
- To create products with more than 1 personbyte, you need to aggregate personbytes
- This is done in networks of individuals we call firms
 - Firms can do things individuals cannot
- ...and in networks of firms
 - Firms cannot make all they need



Division of knowledge *then*



Butcher



Baker



Candlestick
maker



数量限定、先着順プレゼント
Nikon
D200
感謝キャンペーン
D200をご購入の方にラジエター
プレゼント
ご来店時にお名前を
お書きください
キャンペーンは入店時までに
マルチメディアのコーナー



CASHIER

Nikon

Nikon
D70s

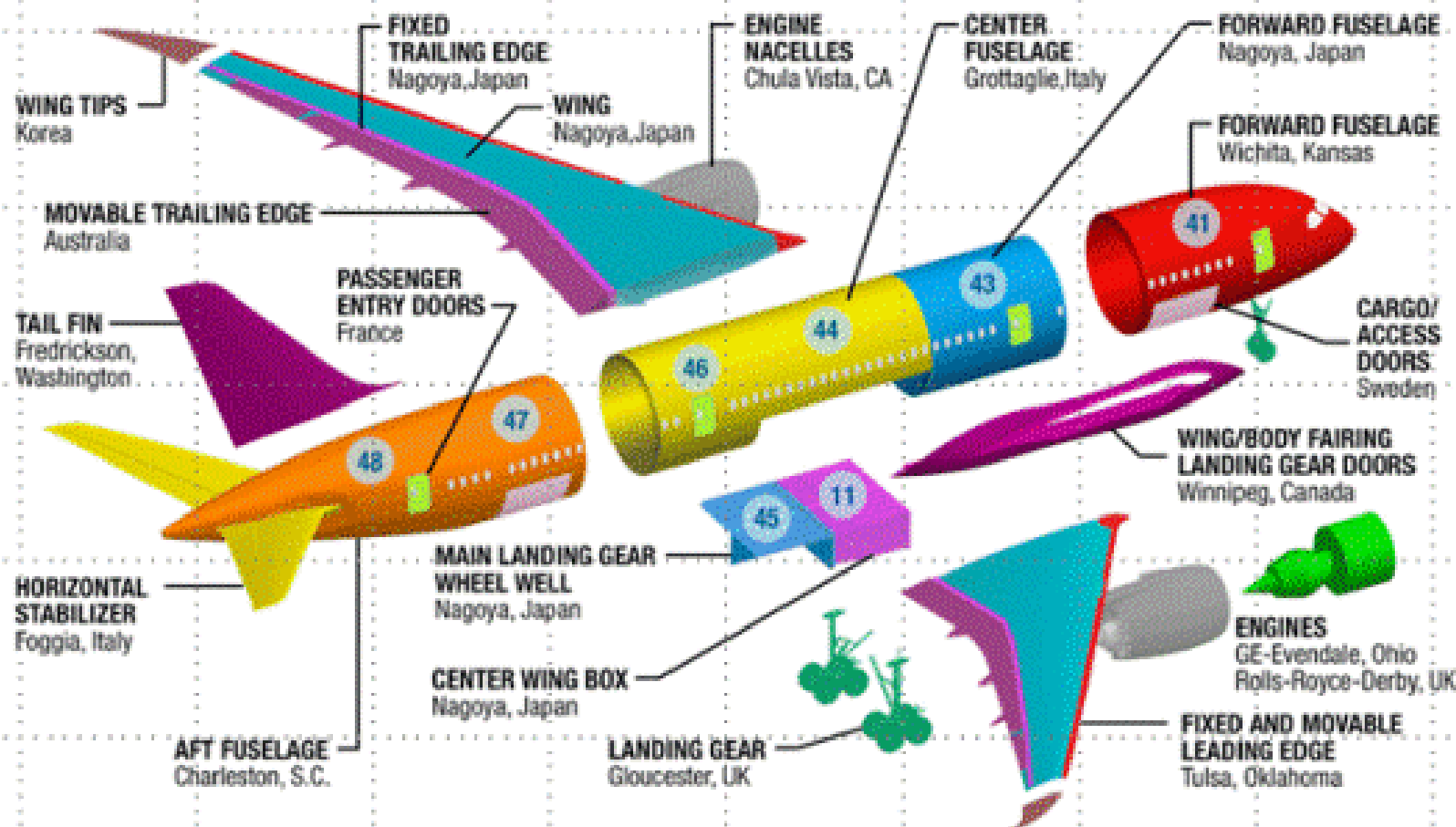
Niko

ヨドバシカメラ
D70s
¥83,800
¥11,800

Yodobashi Camera

THE COMPANIES

U.S.	CANADA	AUSTRALIA	JAPAN	KOREA	EUROPE
Boeing	Boeing	Boeing	Kawasaki	KAL-ASD	Messier-Dowty
Spirit	Messier-Dowty		Mitsubishi		Rolls-Royce
Vought			Fuji		Latecoere
GE					Alenia
Goodrich					Saab





The *SCRABBLE* Theory of Economic Development

With **1** letter,



a

You can make **1** word, of **1** letter

With **3** letters,



a
at

cat
act

You can make **4** words, of up to **3** letters

With **4** letters,



a
at
cat

art
rat
car

act
tar
cart

You can make **9** words, of up to **4** letters

With **10** letters,



cilantros	clangors	ratlings	agnosic	carlots	closing	garcons
contrails	clarinos	roasting	agonist	carotin	coaling	garlics
gnostical	clarions	saltoing	alnicos	carting	coating	gastric
nostalgic	clarting	scarting	alongst	cartons	coltans	gastrin
triclosan	coasting	sclating	angicos	casting	colting	girasol
agnostic	coatings	slarting	anglist	cations	contras	gitanos
antilog	congrats	solacing	antilog	catling	cornist	glorias
calorist	contrail	solating	arcings	catlins	cortina	gnostic
cantoris	cortinas	starling	argotic	cistron	cortins	gratins
carlings	cotingas	tonsilar	aroints	citolas	costing	ignaros
caroling	locating	tracings	atonics	citrals	cotinga	lacings
carotins	oracling	trigonal	caligos	citrons	crating	lasting
castling	organics	actings	cantors	clangor	cratons	latigos
catlings	organist	actions	carling	clarino	crotals	latinos
cilantro	cargolis	agistor	carlins	clarion	gallots	latrons

You can make **595** words, of up to **10** letters

What explains these differences in productivity?



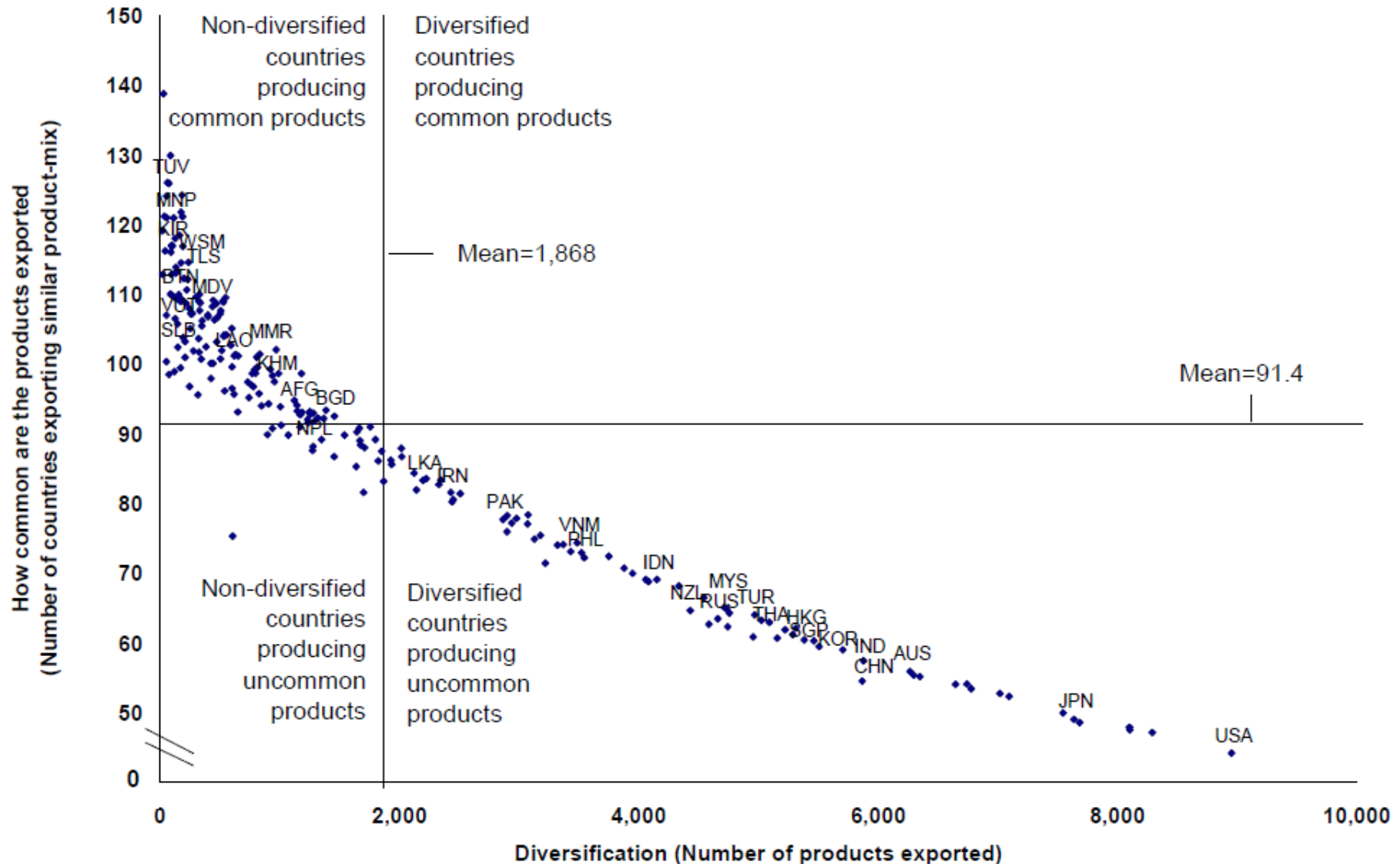
Some technologies diffuse quickly



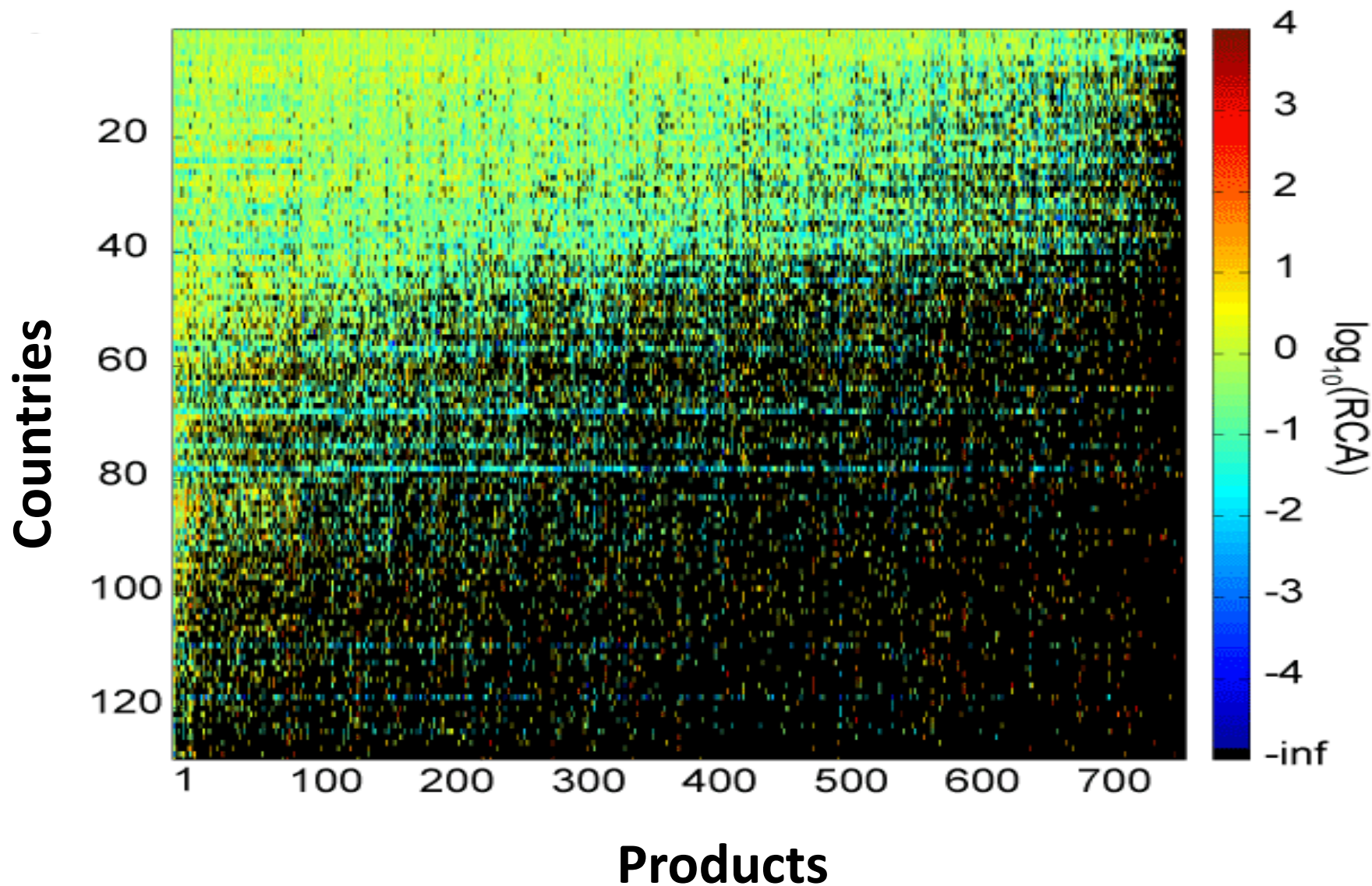
INTUITION

- Countries that have more personbytes will be able to make more products
They would be more diversified
- Products that require more personbytes will be made by fewer countries
Products will be less ubiquitous
- Countries that have more personbytes will be able to make products that require more personbytes
- **Products that are less ubiquitous will be made by countries that are more diversified**
- **Countries that have more personbytes should be more diversified and able to make less ubiquitous products**

Diversification vs. Ubiquity (2009)

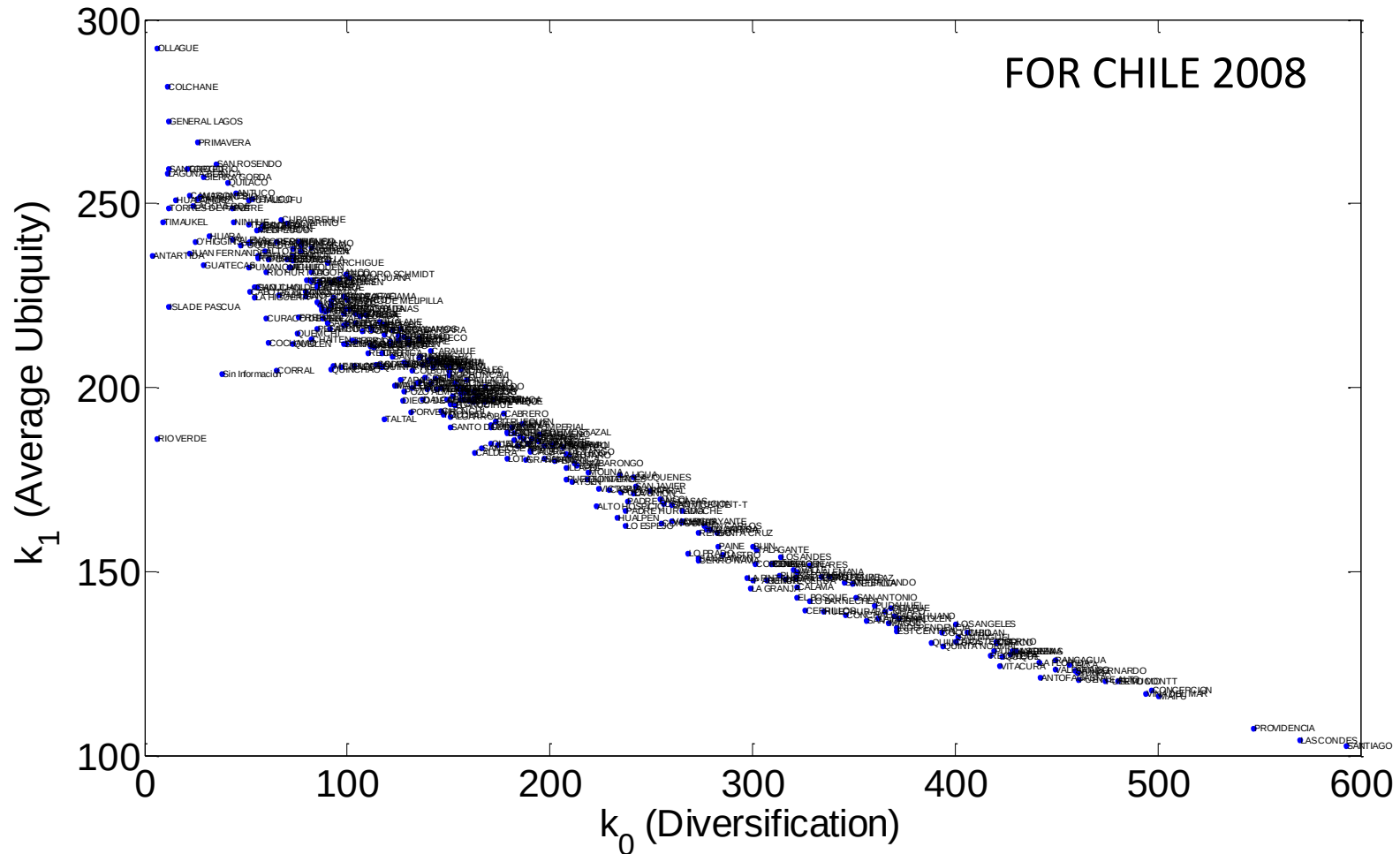


A picture of world trade



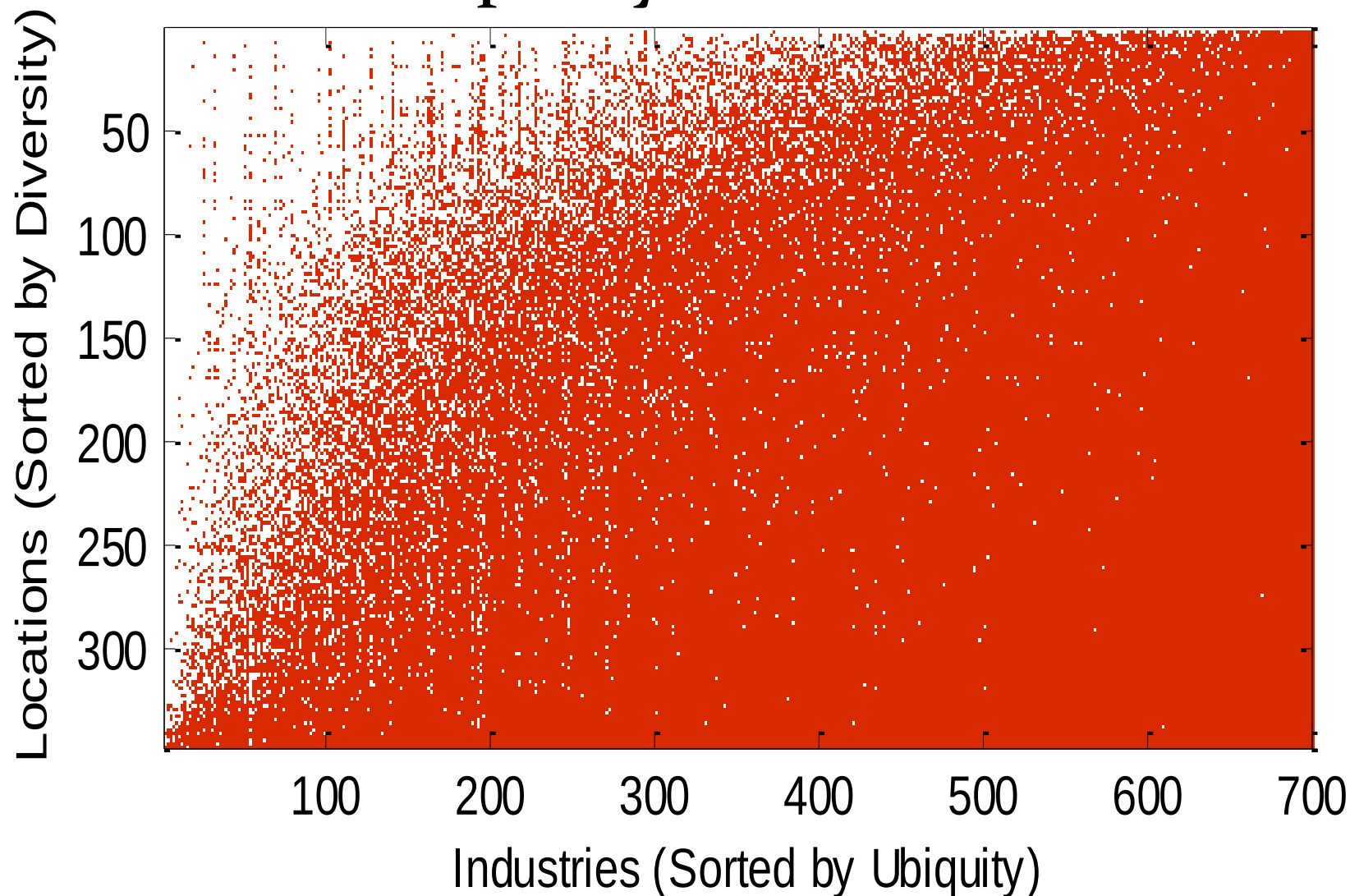
SITC-4 Rev 2: 772 Products, 129 Countries (Year 2000)

Diversification vs. Ubiquity



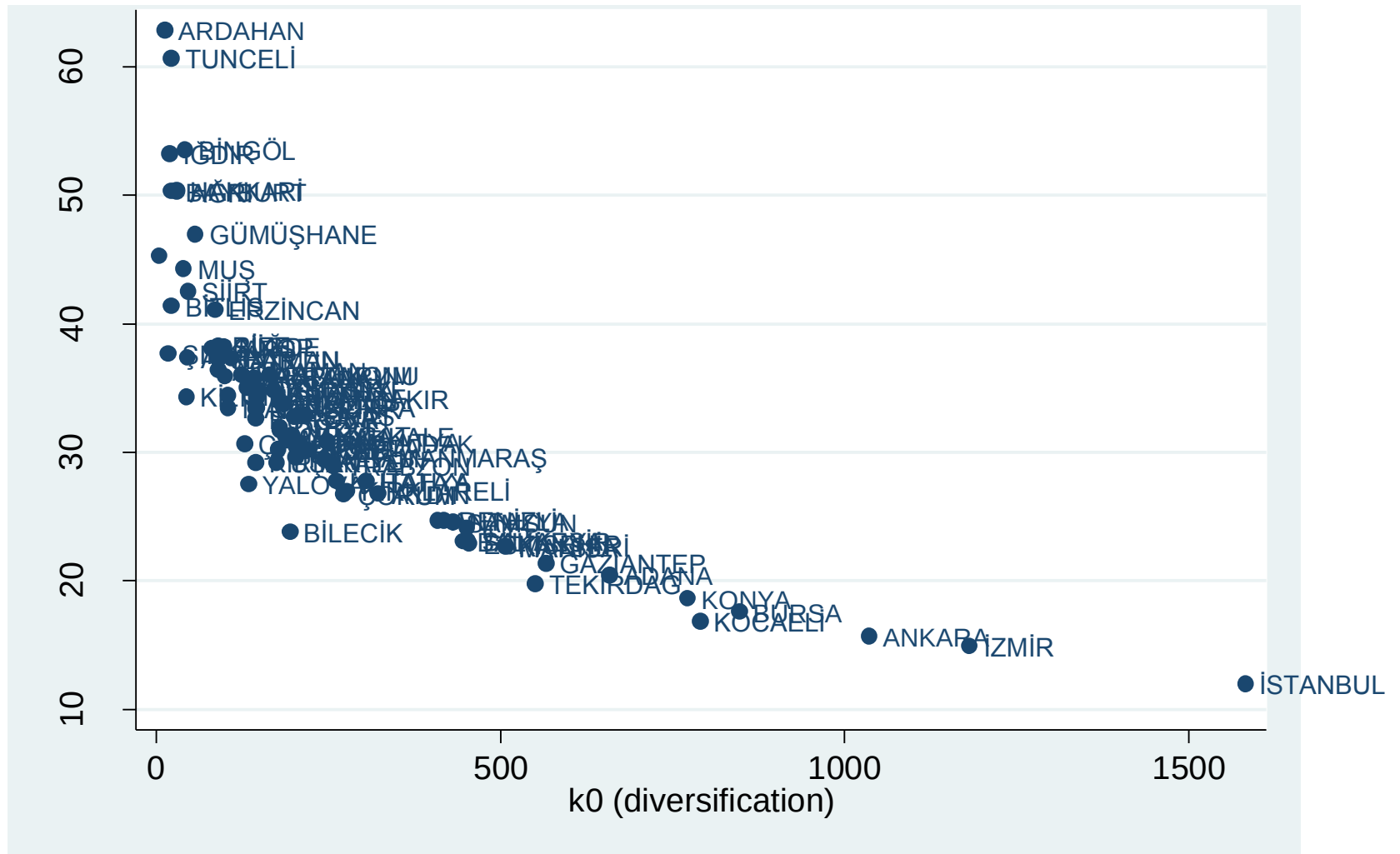
Industries in Chilean Municipalities

Municipality-Product Pairs



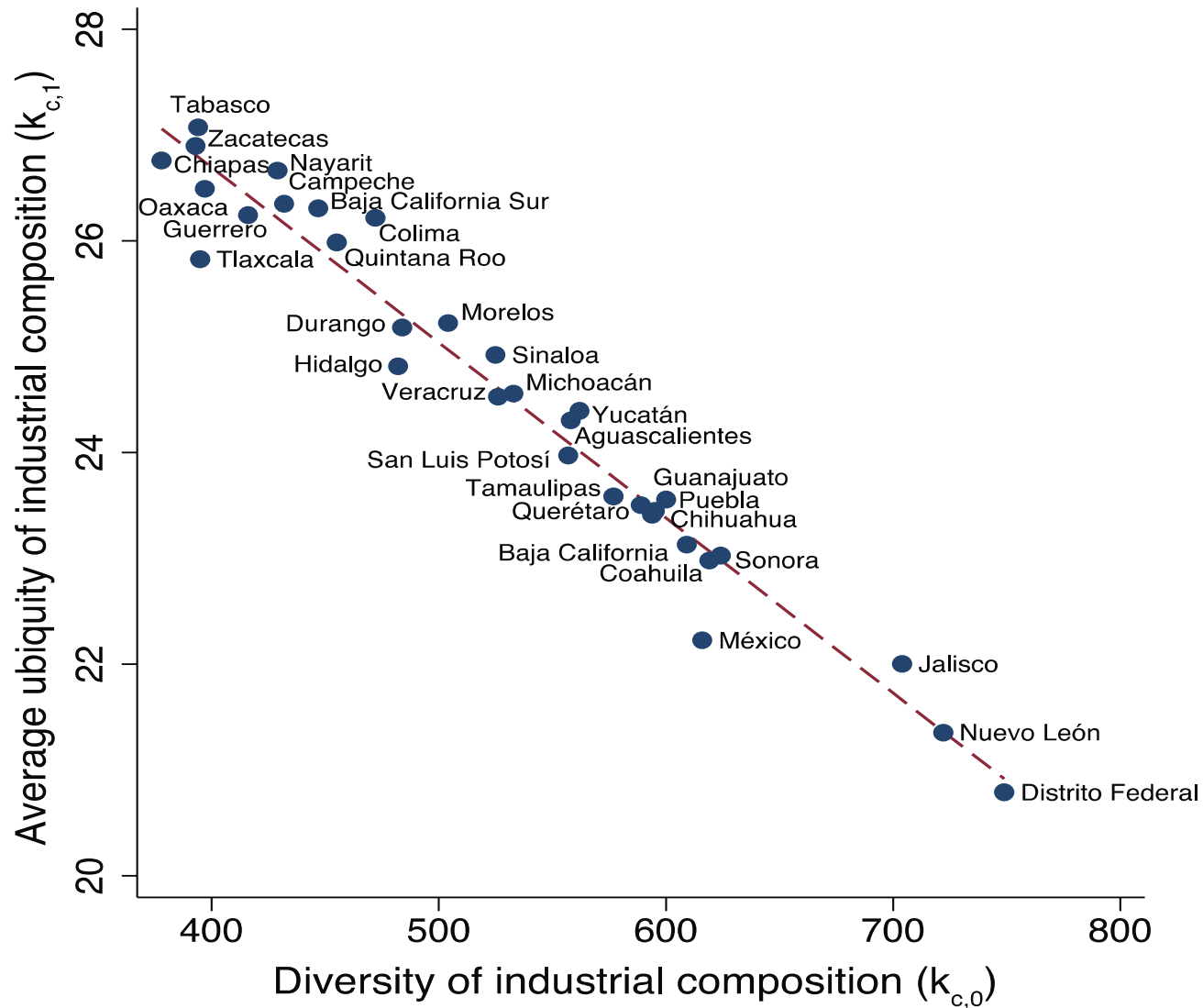
Cities in Turkey

Diversification vs. Ubiquity



States in Mexico

Diversification vs. Ubiquity



Diversification vs. Ubiquity

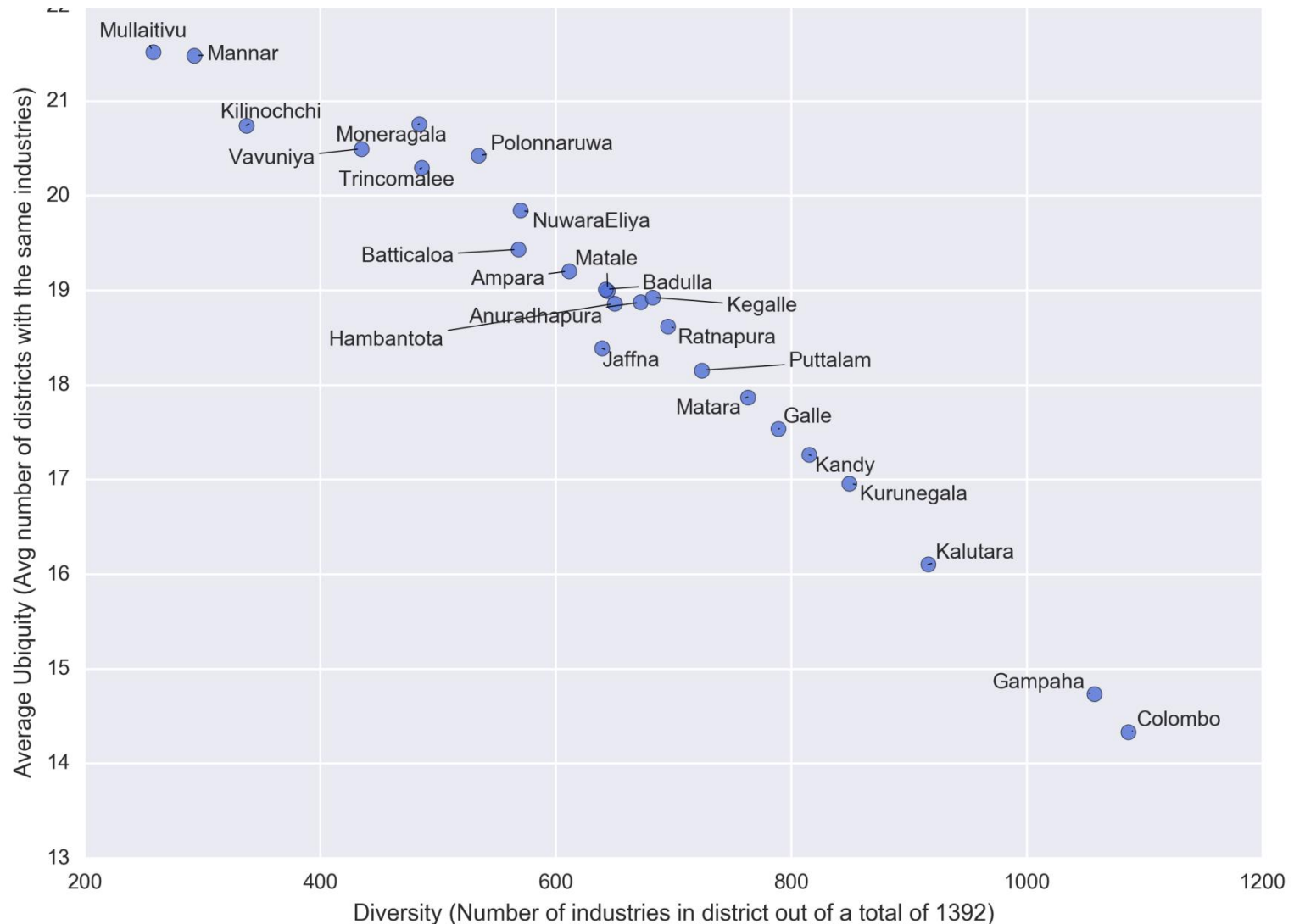
Scatter plot showing the relationship between Country Diversity (X-axis) and Country Richness (Y-axis) for various countries. The X-axis ranges from 0 to 500, and the Y-axis ranges from 4 to 12. A red regression line shows a negative correlation. Data points are labeled with country names: GUAVIARE, VAUPES, AGUAPITIA, SUCRE, ARICAQUETA, CHOCO, VICHADA, AGUADORA, LA GUAYANA FRANCESA, PUTUMAYO, HUILA, MAGDALENA, CAQUETIA, SAN ANDRÉS Y PROVIDENCIA, CASANARE, NORTE DE SANTANDER, CAUCA, RISARALDA, BOLDWIN, ATLANTICO, CUNDINAMARCA, VALLE DEL CAUCA, ANTIOQUIA, and BOGOTÁ.

- av_ubq

Fitted values

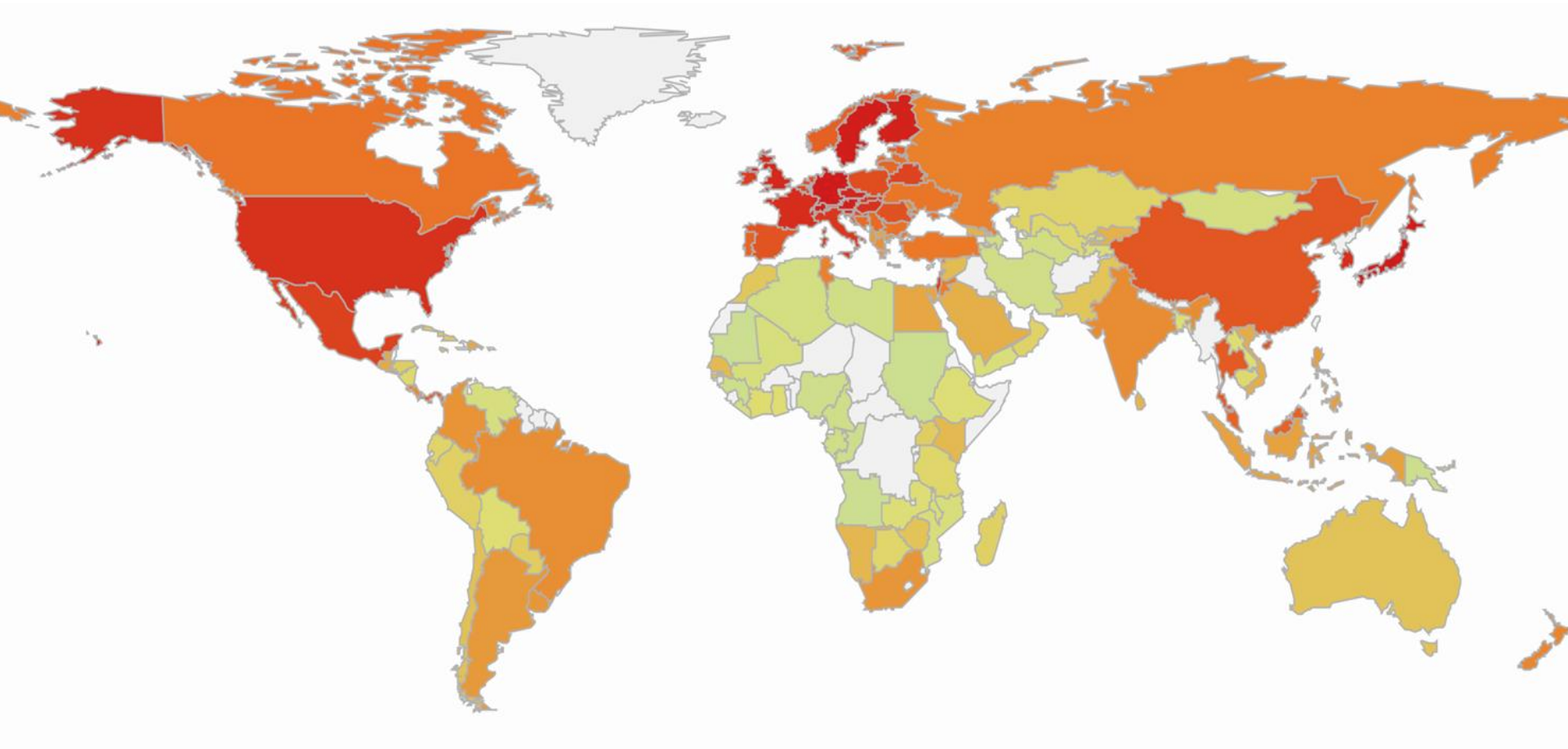
And Districts in Sri Lanka

Diversification vs. Ubiquity

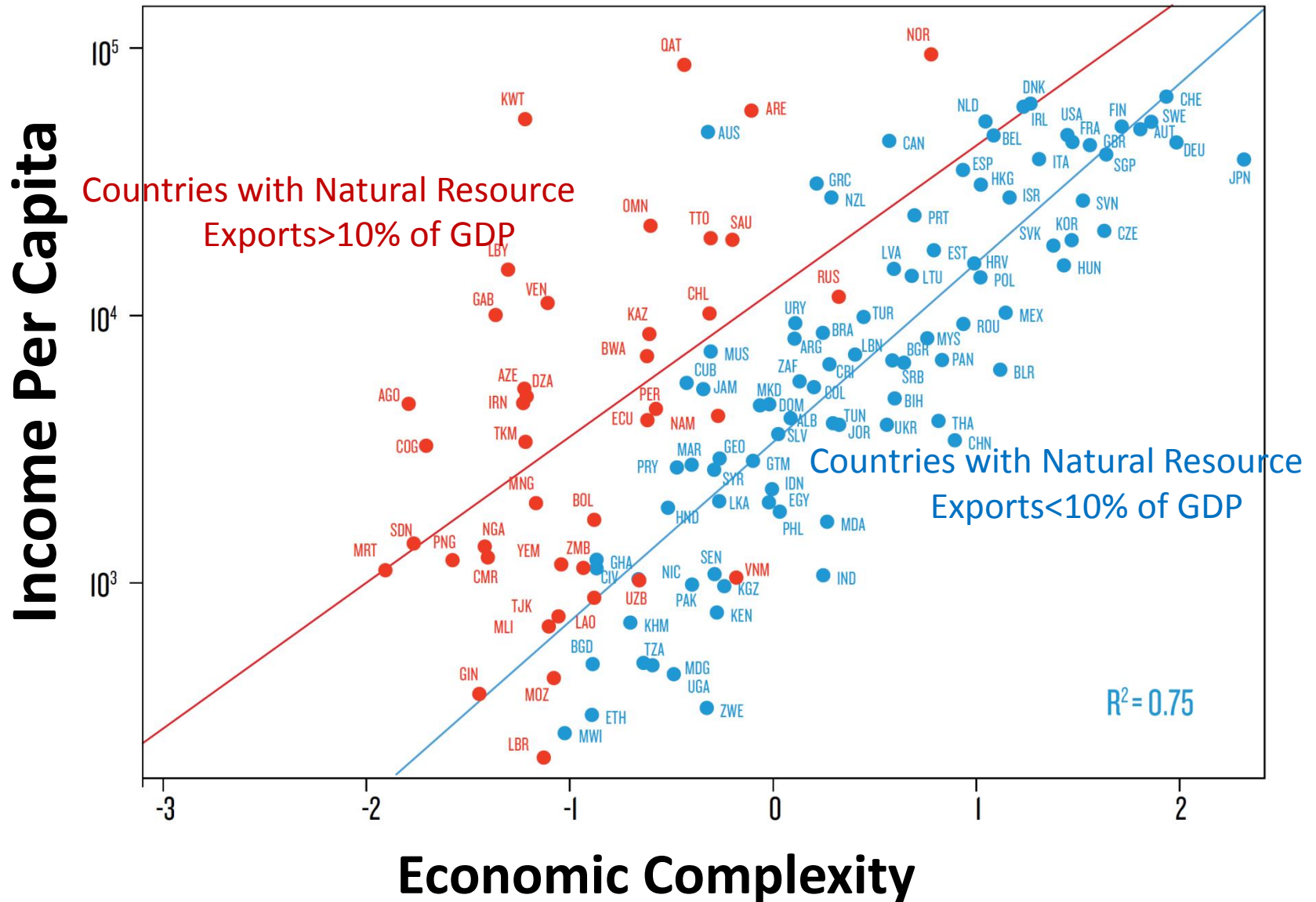


How do we
measure a
country's
personbytes?

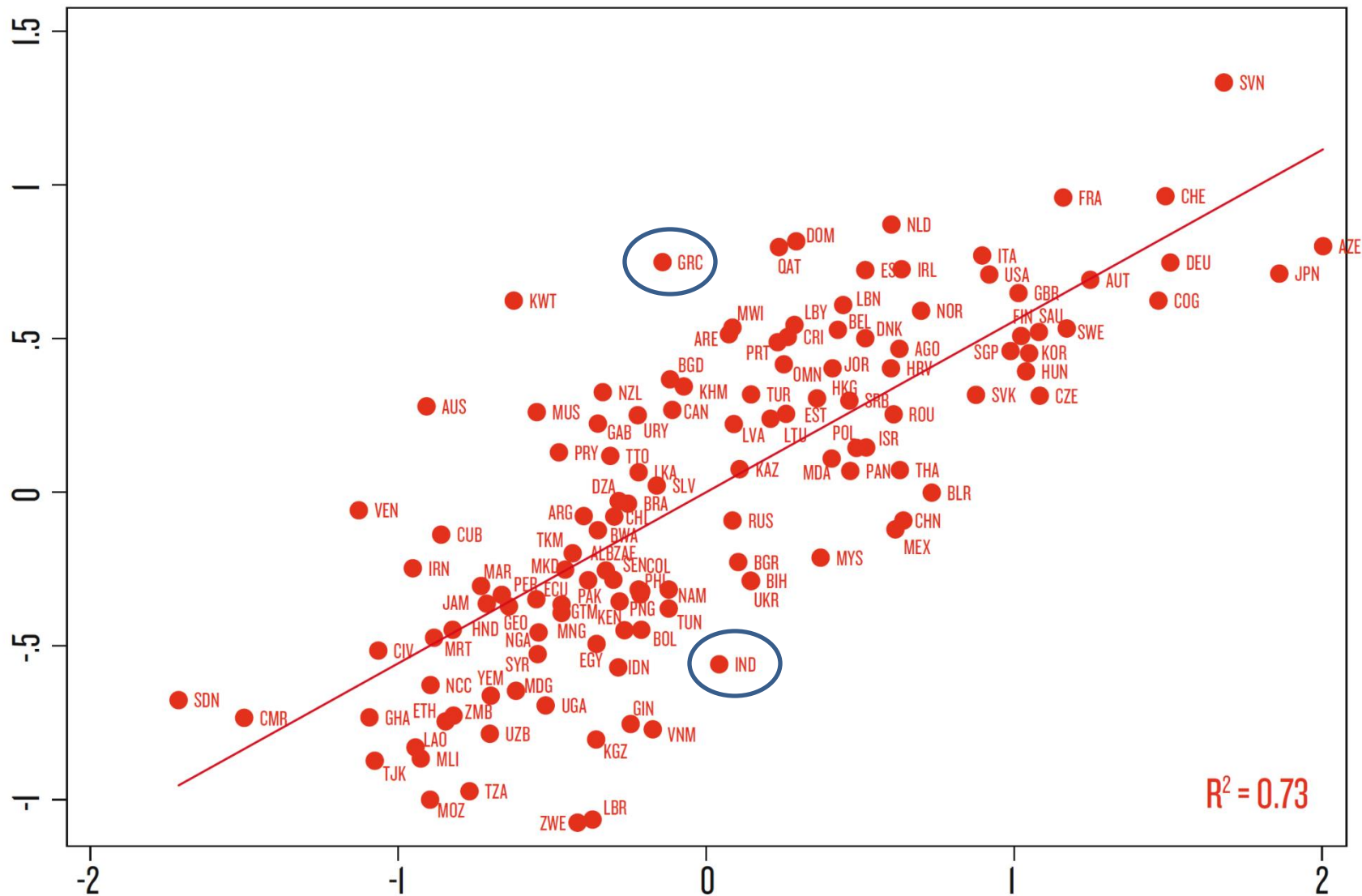
Economic Complexity Index



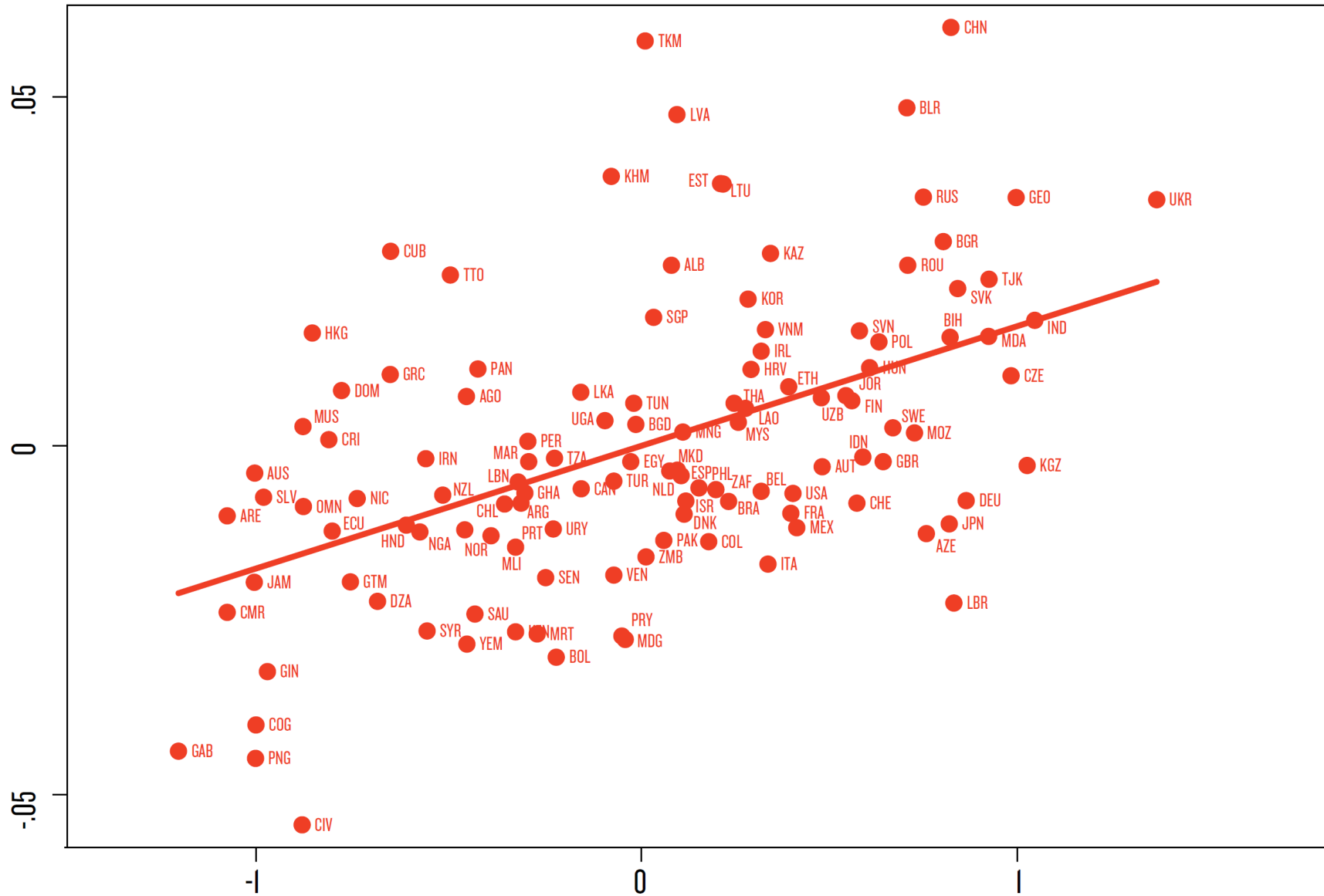
ECI correlates with GDP per capita



Income per capita controlling for initial income and proportion
of natural resource exports per capita in logs [2008]



Growth in per capita GDP, controlling for initial income and growth
in natural resource exports [1998-2008]



Economic Complexity Index controlling for initial income and growth in natural resource export [1998]

How to get more
letters?

The chicken and
egg problem







BEAR



LION



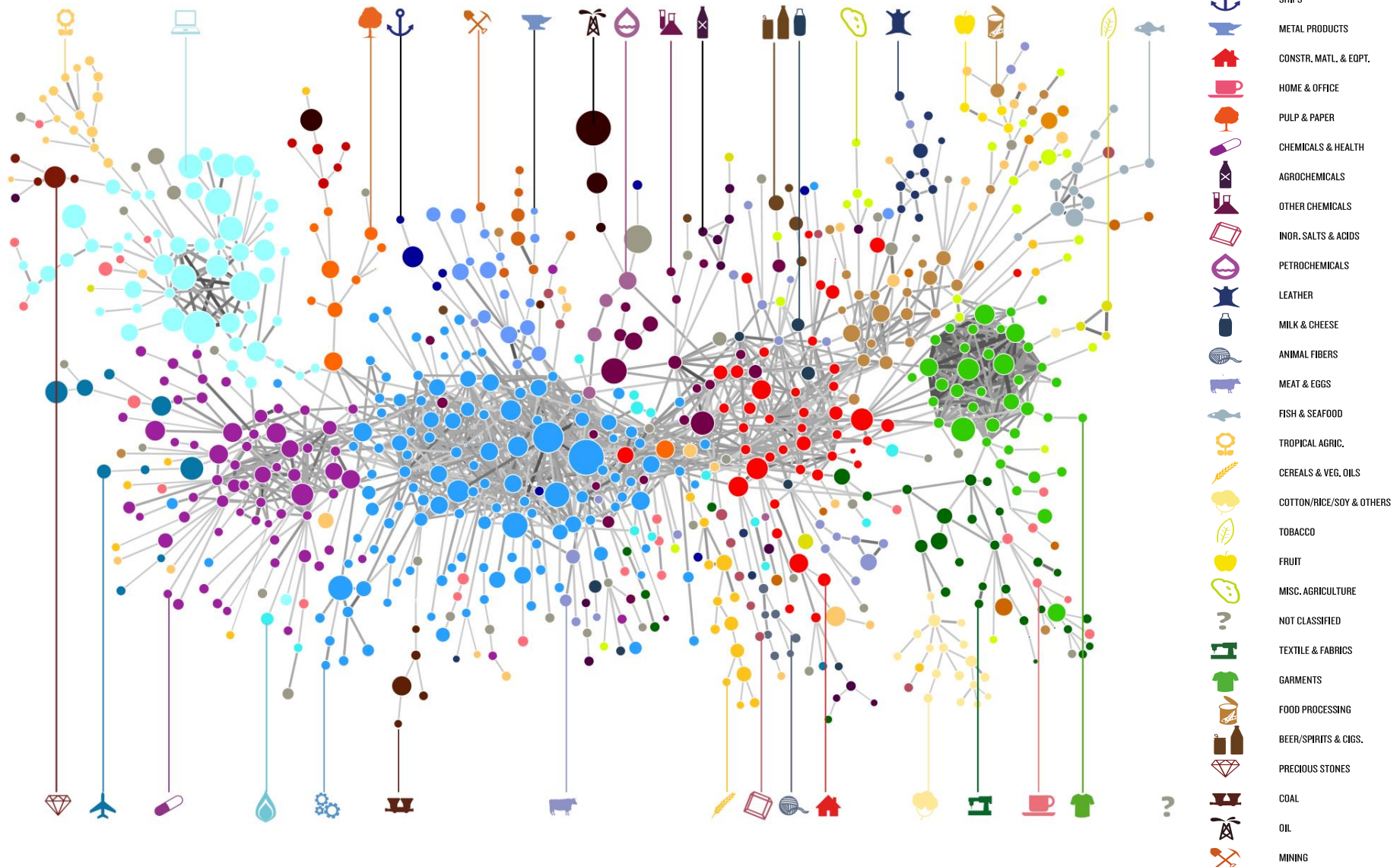
ZEBRA



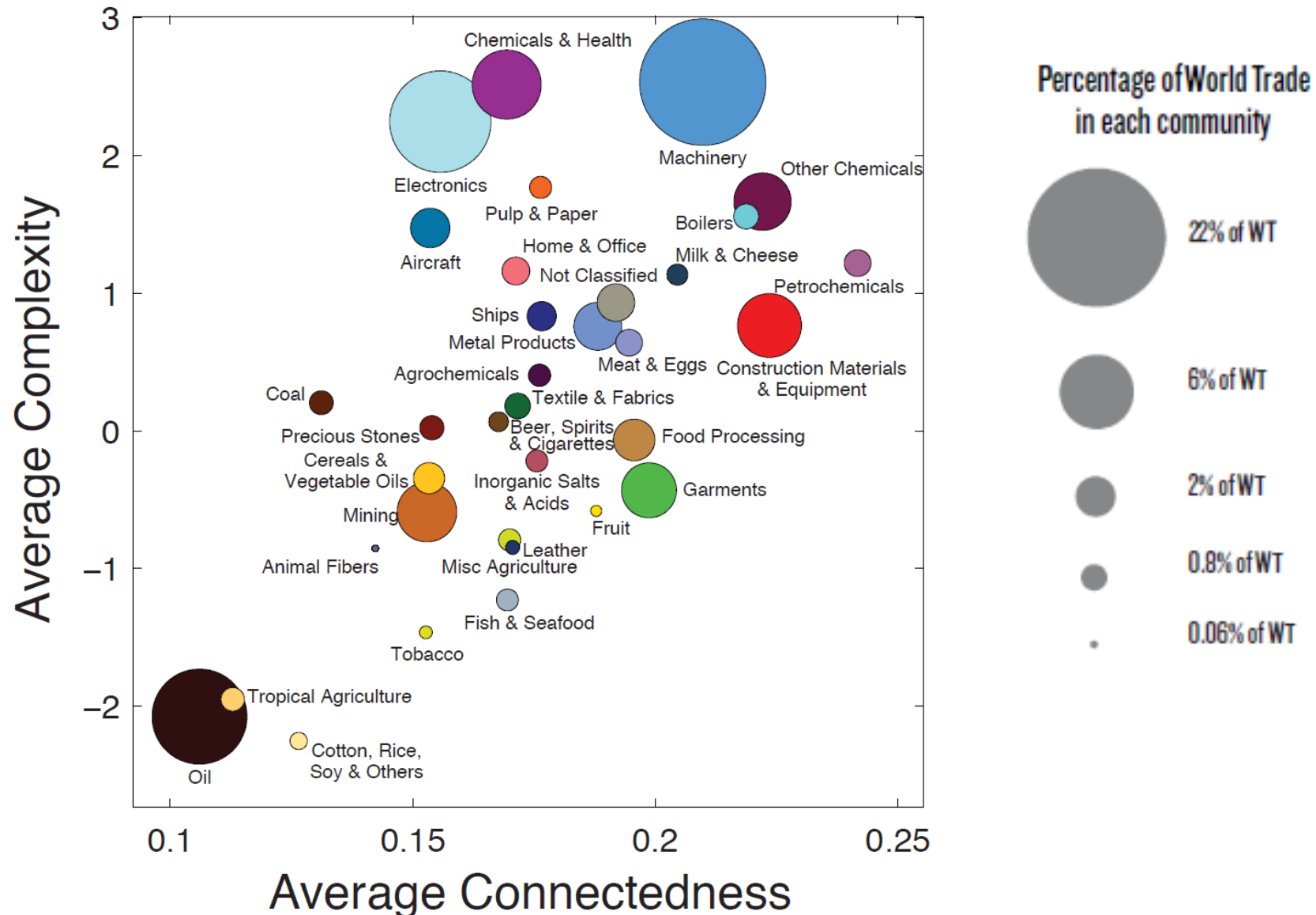
Mapping out the Forest



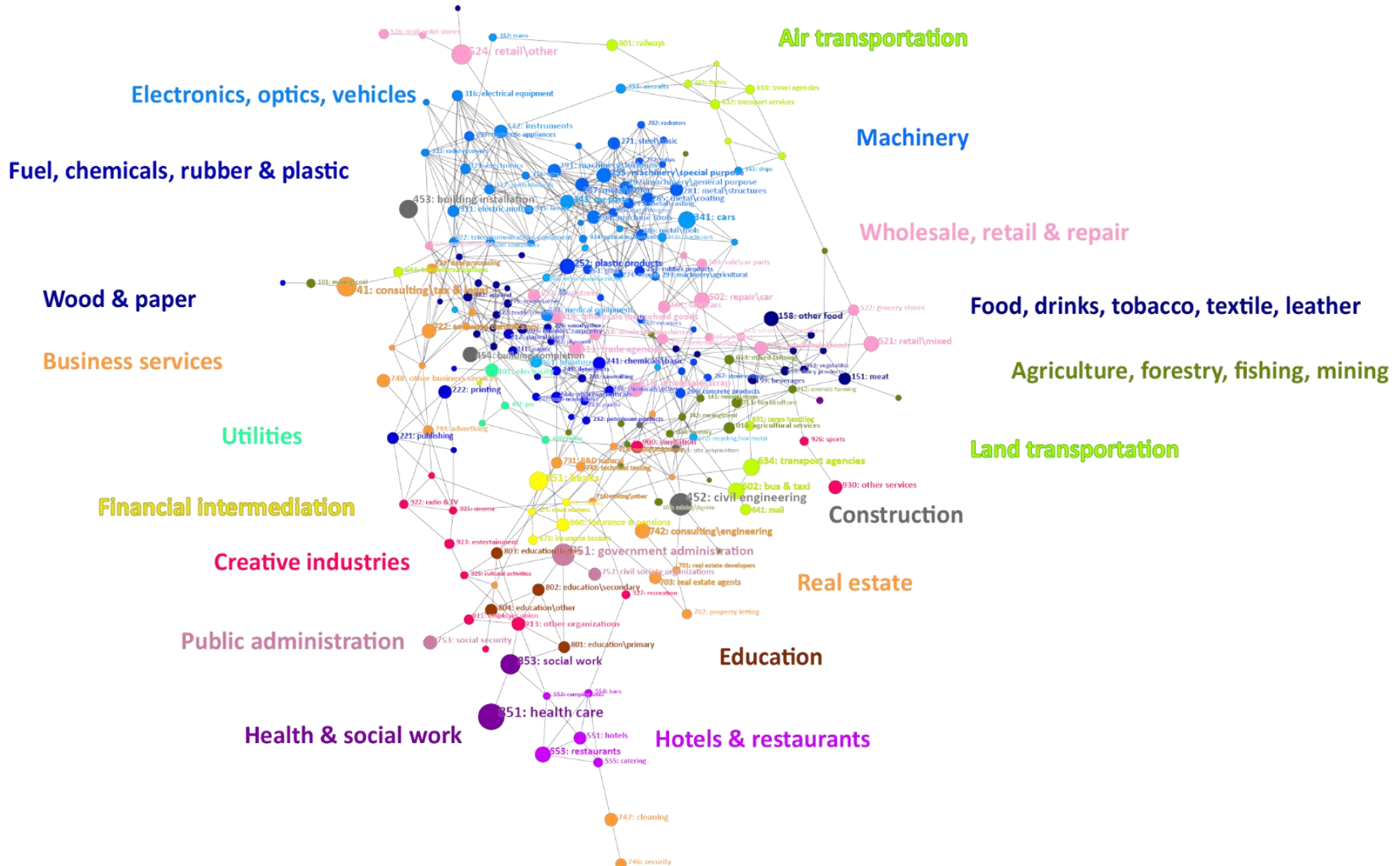
The Product Space



What makes manufacturing different? Complexity, Connectedness and Market Size

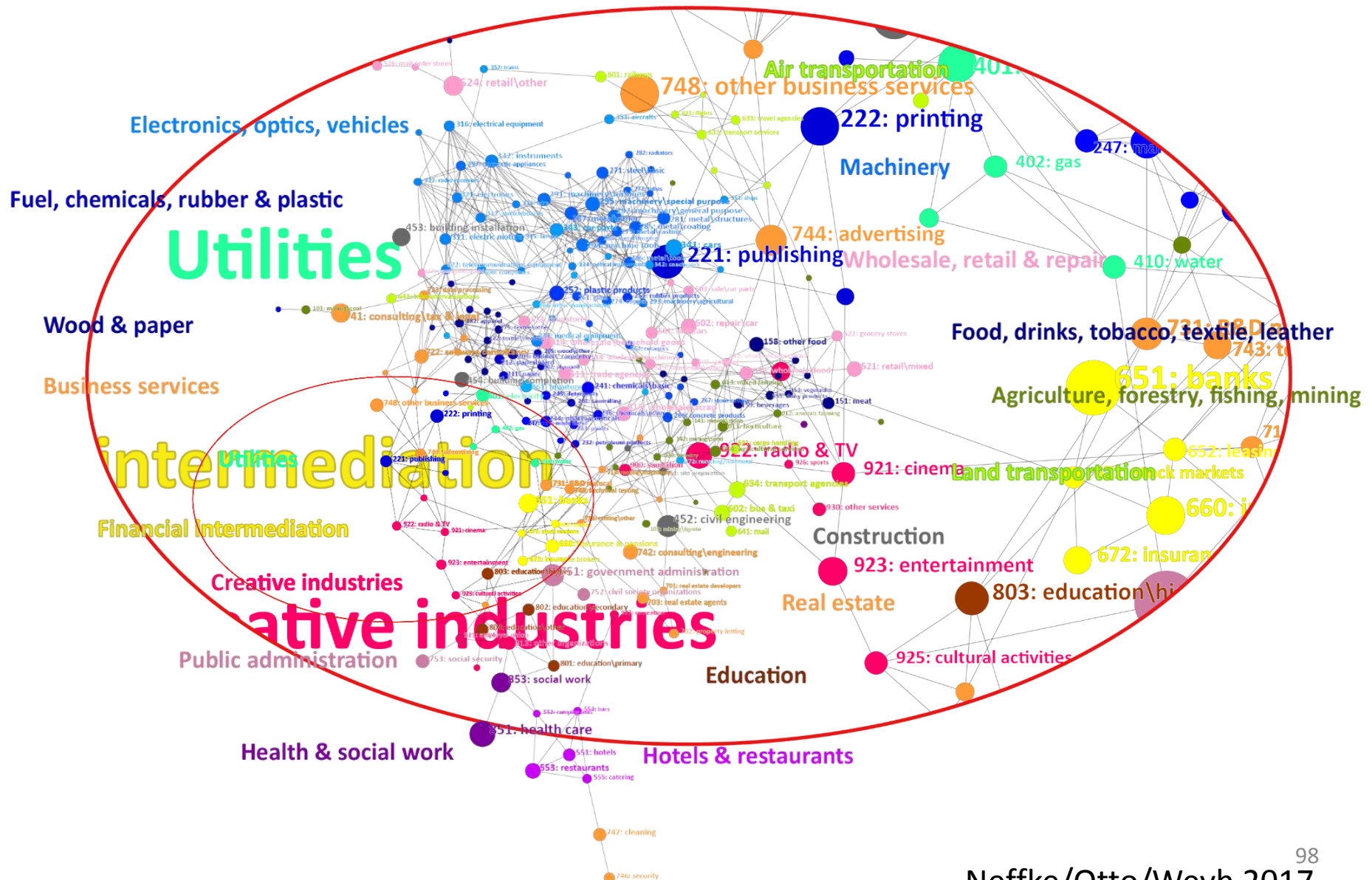


Industry Space



Industry space

Labor market as a network of human capital linkages



An aerial night photograph of a densely packed urban area, likely Tokyo. A prominent elevated highway with multiple lanes runs diagonally from the upper left towards the center. The city is filled with numerous high-rise buildings, many of which are brightly lit with yellow and white lights. Some buildings feature colorful neon signs, including a prominent blue and red one on the right. The overall scene is a vibrant, illuminated mosaic of city lights and structures.

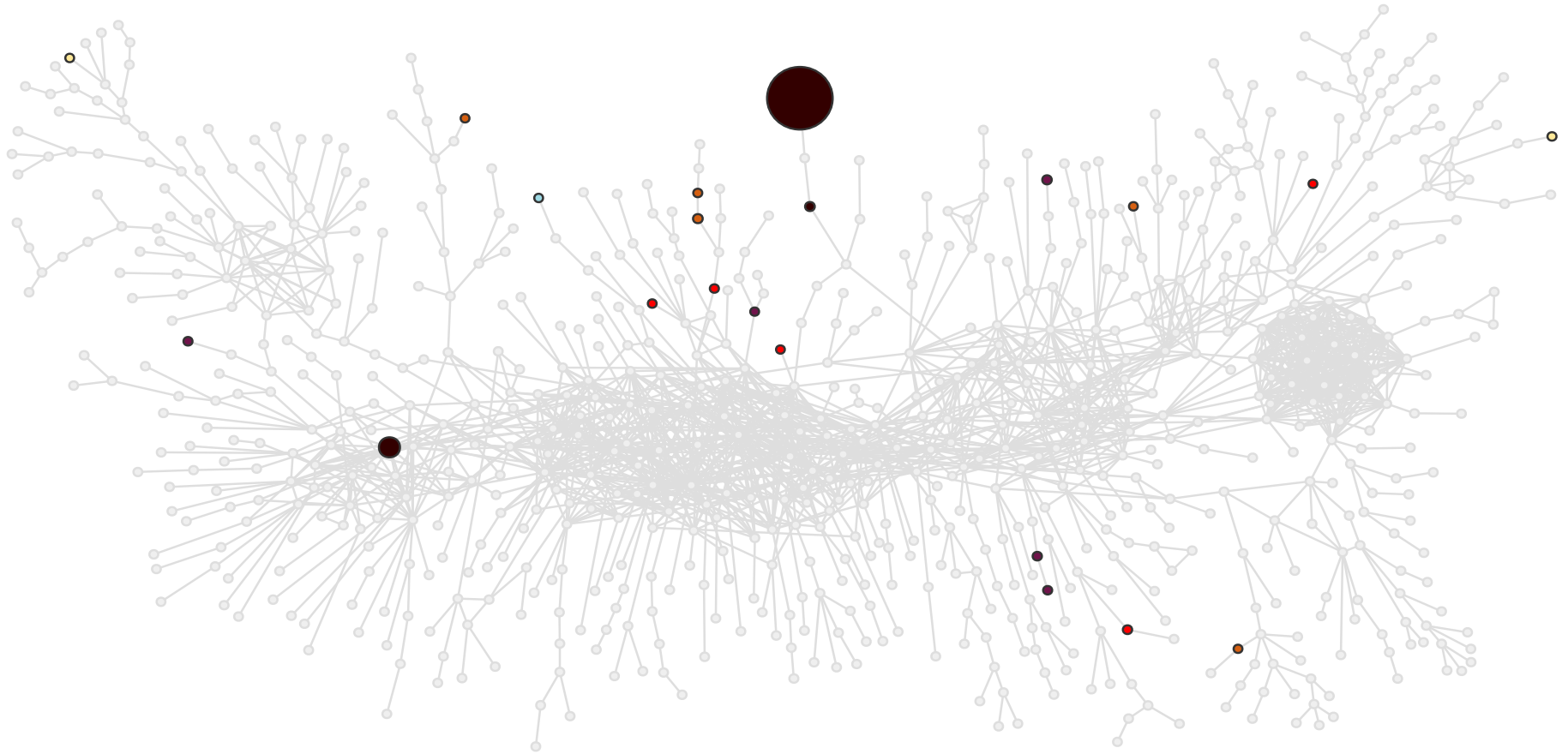
What is a country, a city
or a region?

Where are the monkeys?



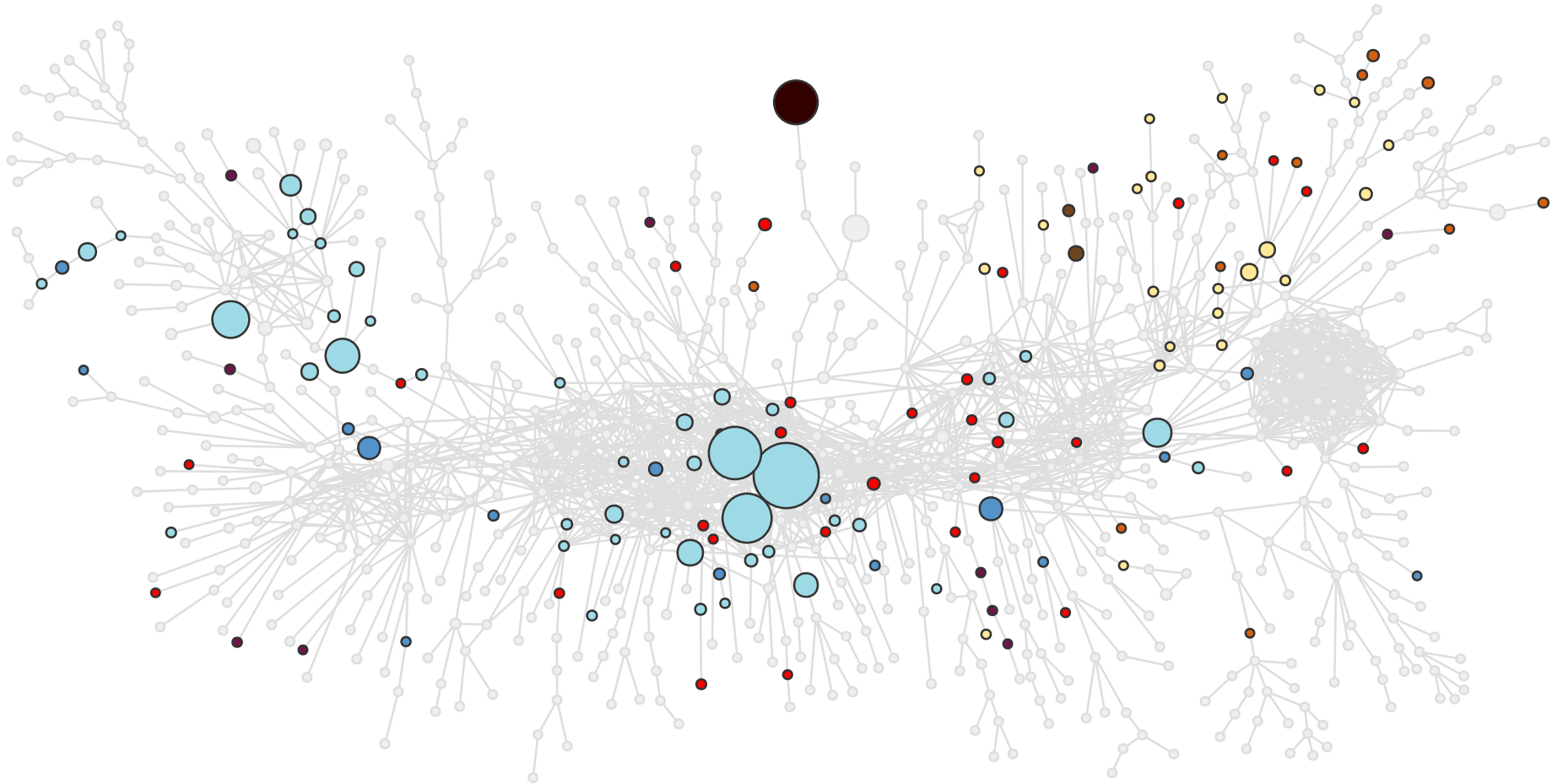
\$33.3B USD

Venezuela 2015

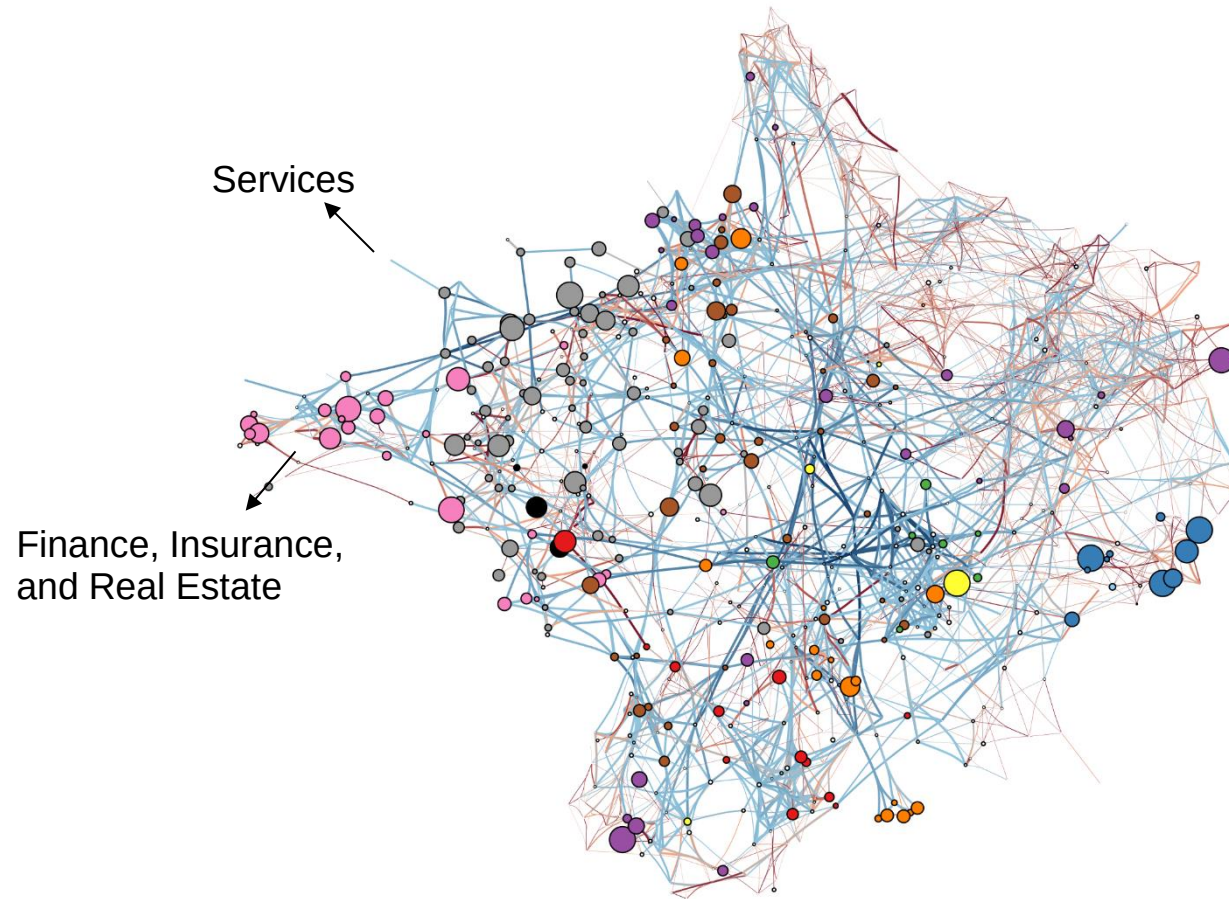


\$382B USD

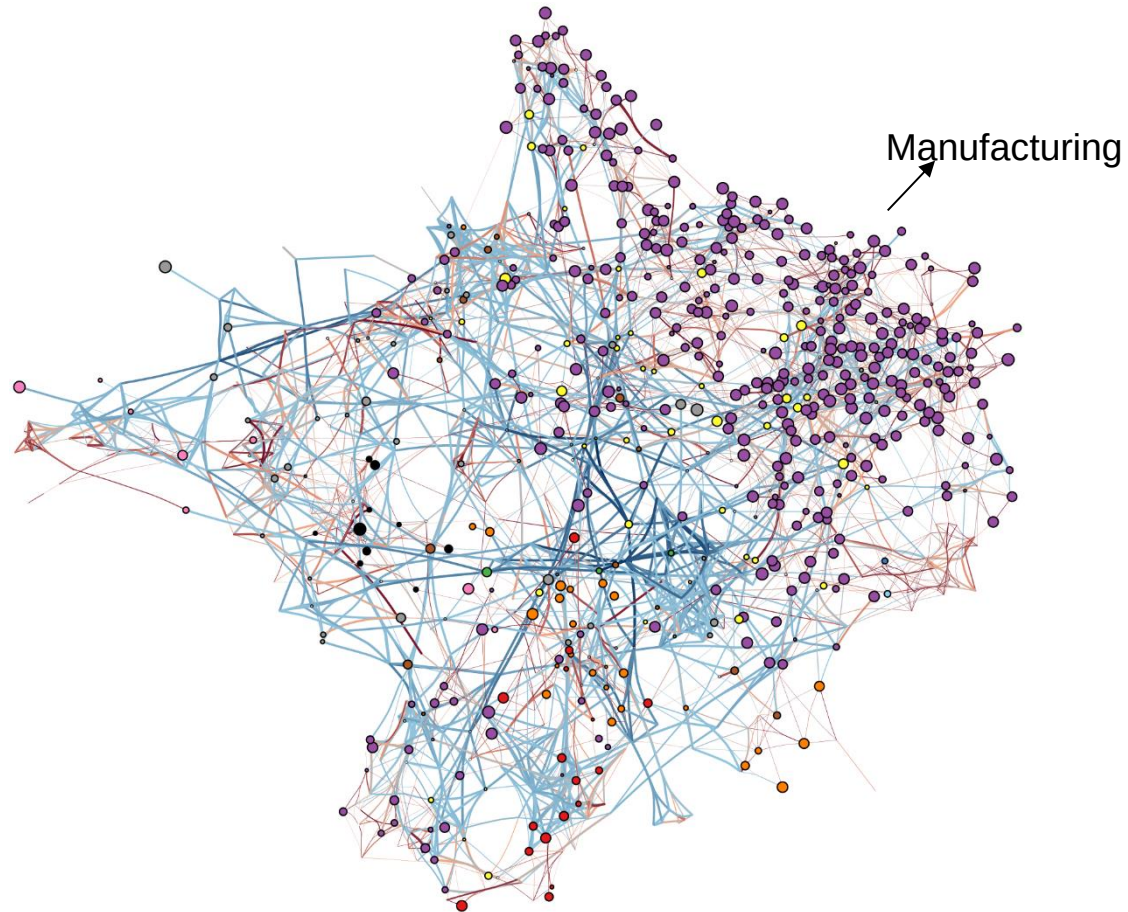
Mexico 2015



London



Shanghai



How do monkeys jump?



A tale of two countries

GHANA



THAILAND



1962: Roughly equal income

GHANA



\$295

THAILAND

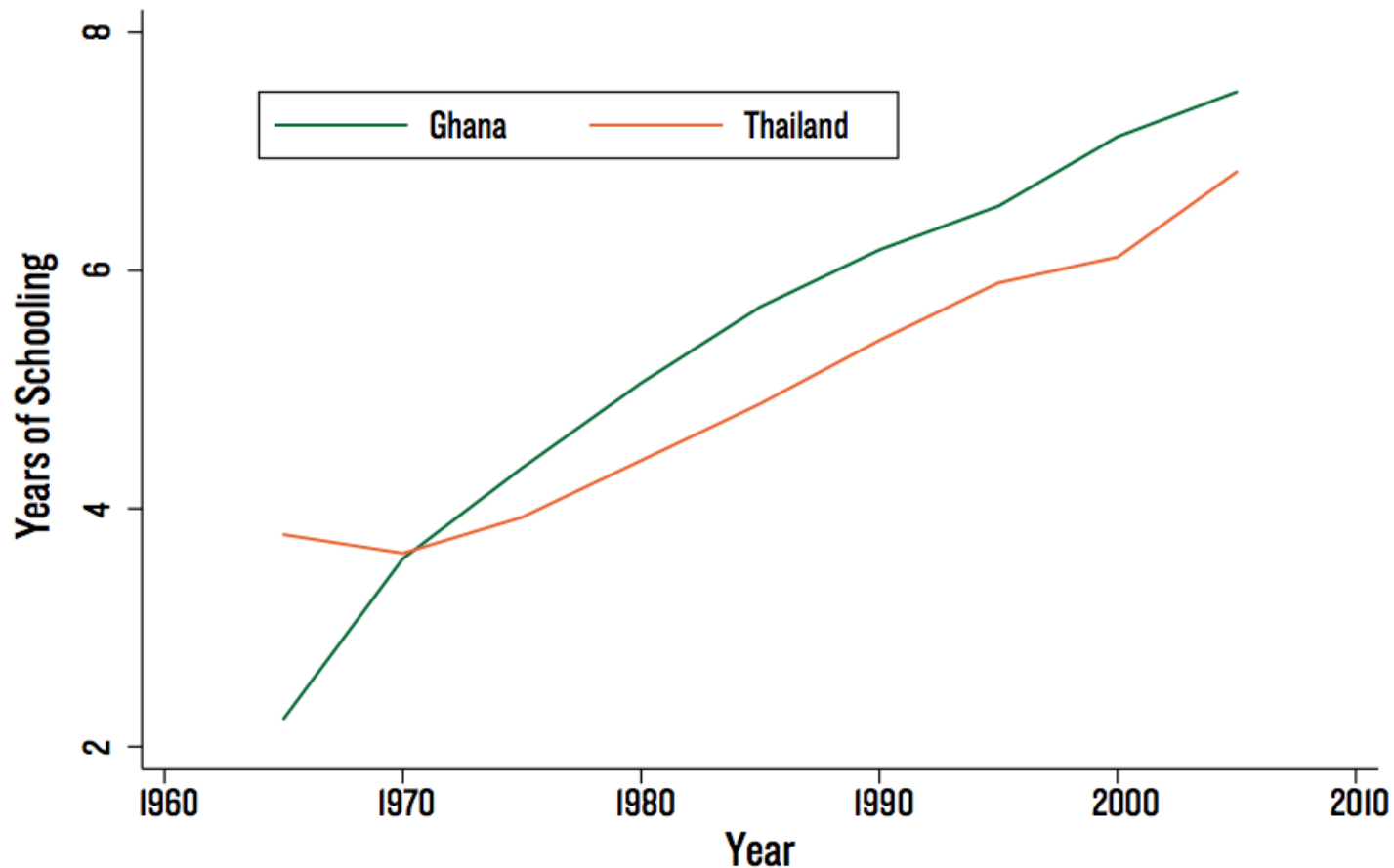


\$363

GDP per capita (constant 2000 US\$)

Human capital story:

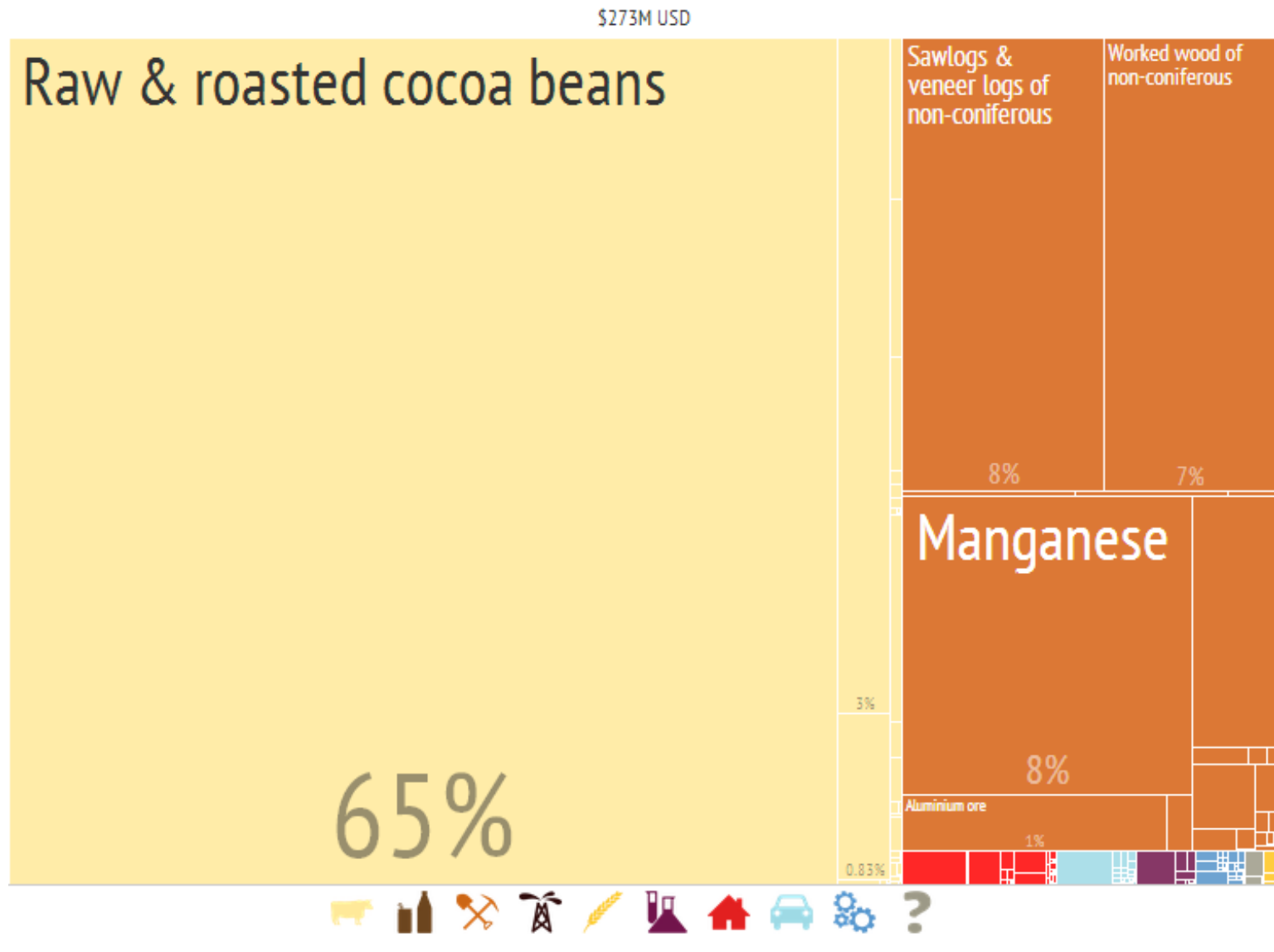
- Years of schooling of Thailand and Ghana as a function of time.



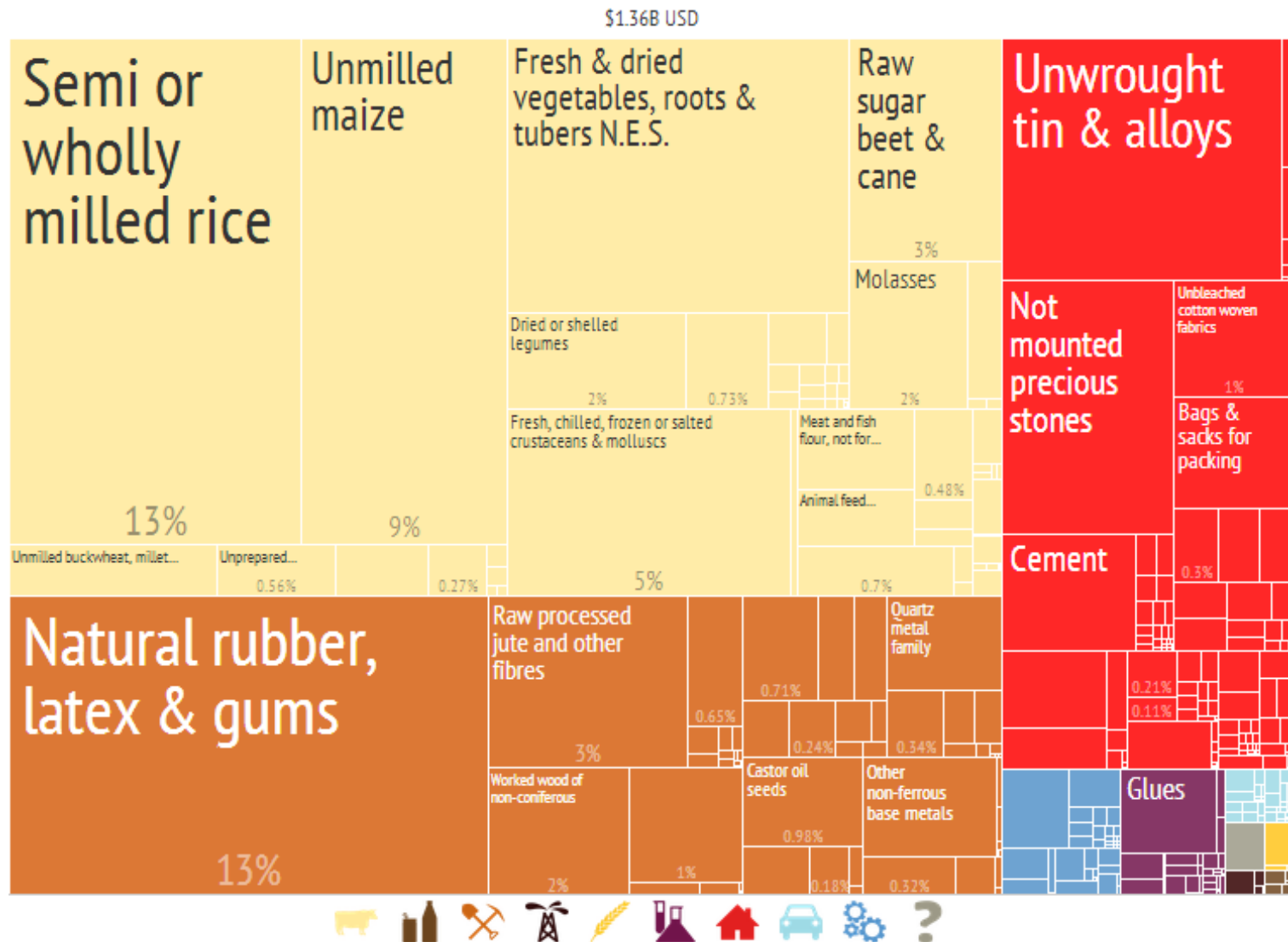


GHANA

Ghana's exports in 1962

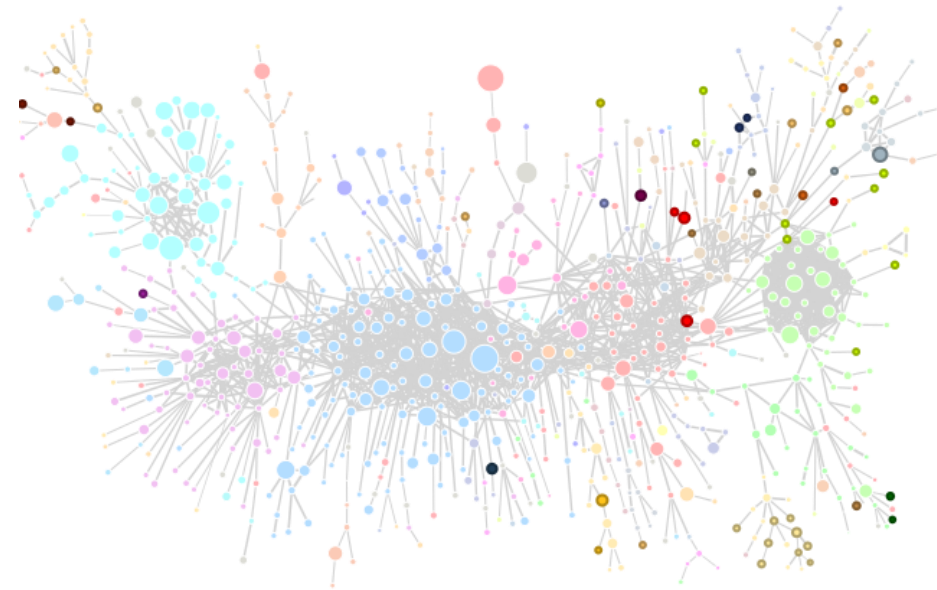


Thailand's exports in 1962



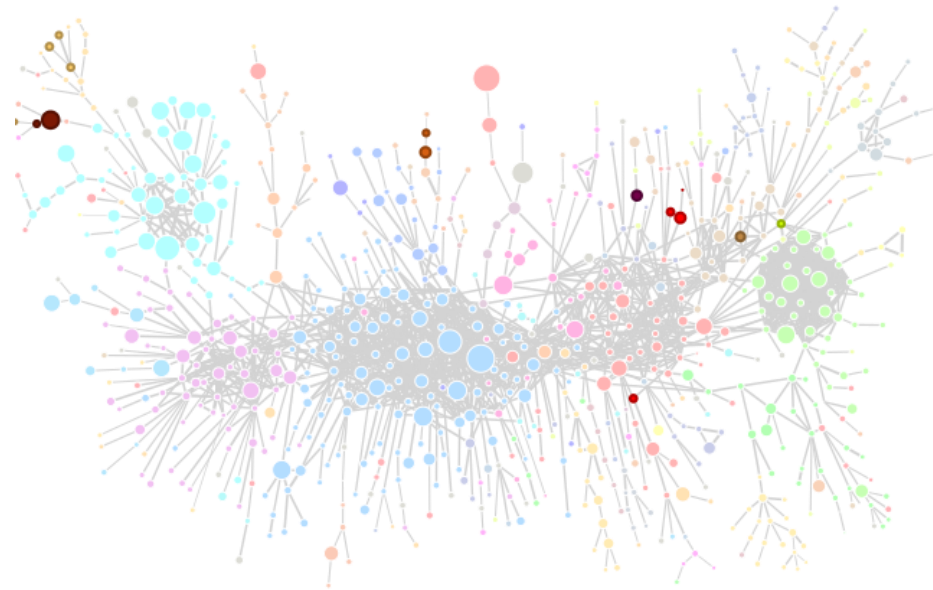
Thailand vs. Ghana in the Product Space 1965

Total Value: \$615,728,000



Thailand

Total Value: \$294,604,000

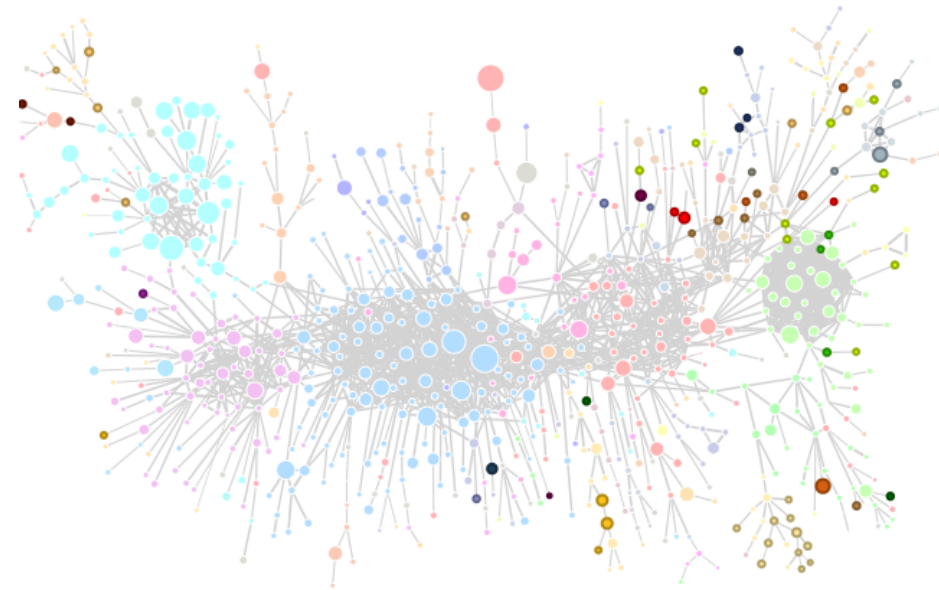


Ghana

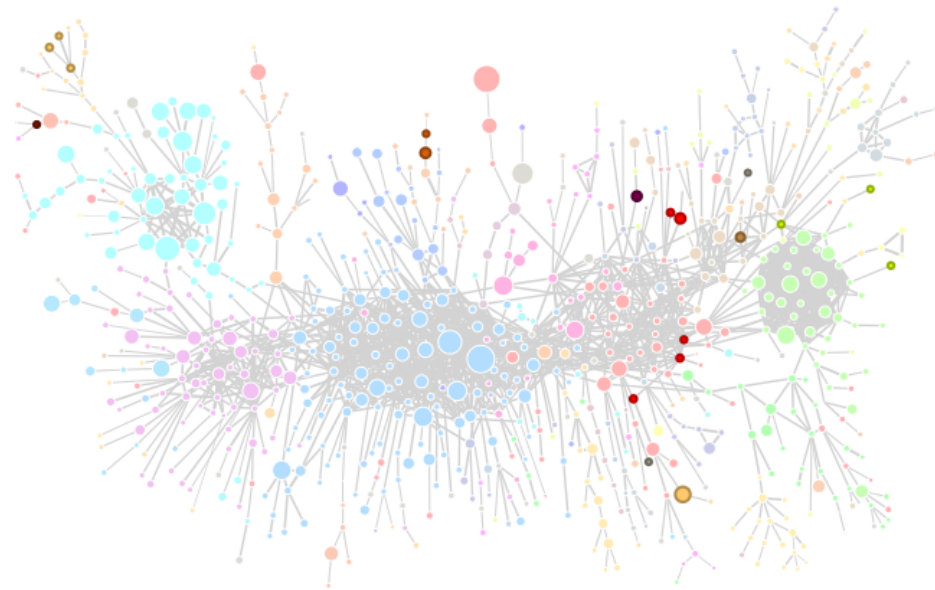
1970

Total Value: \$721,421,000

Total Value: \$432,140,000



Thailand

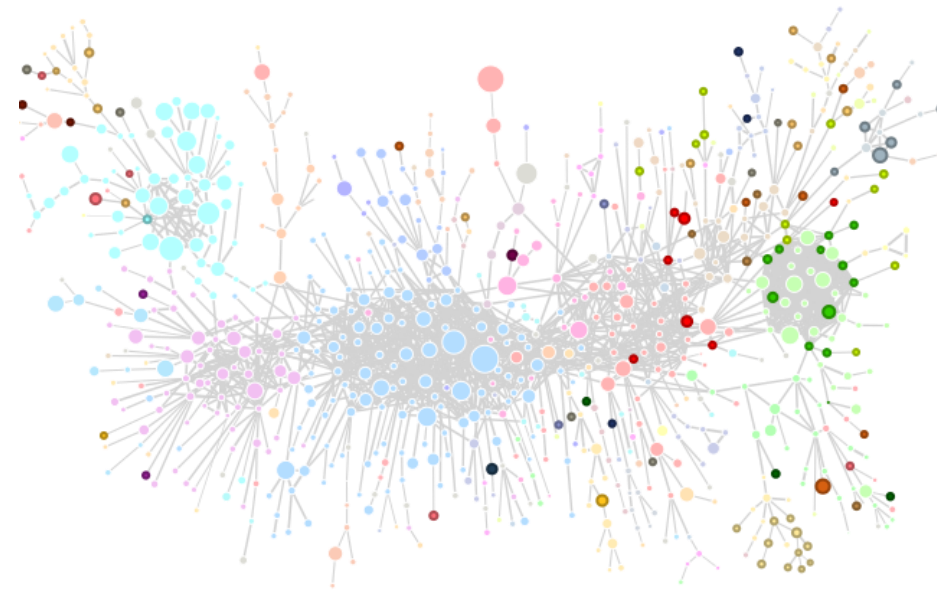


Ghana

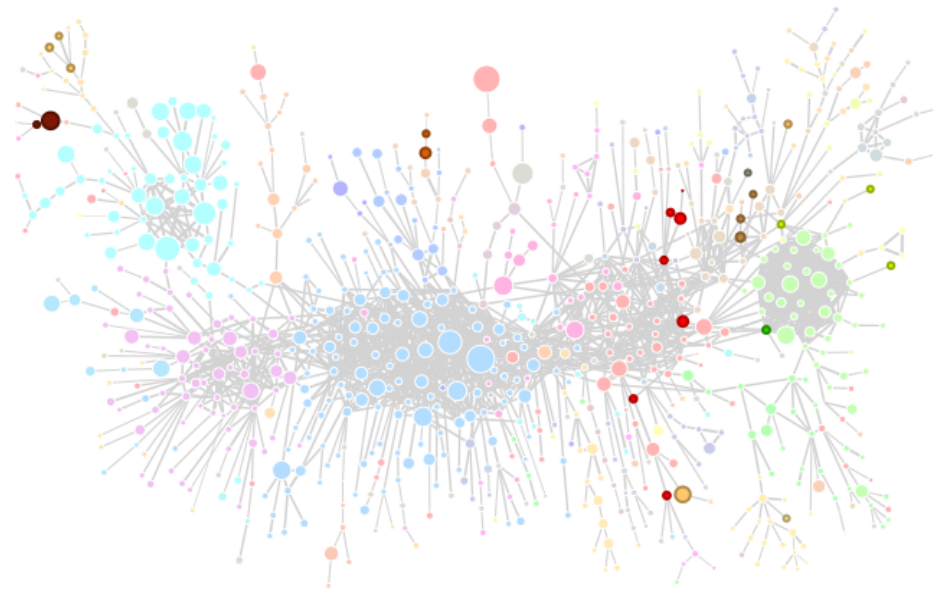
1975

Total Value: \$2,238,988,000

Total Value: \$818,766,000



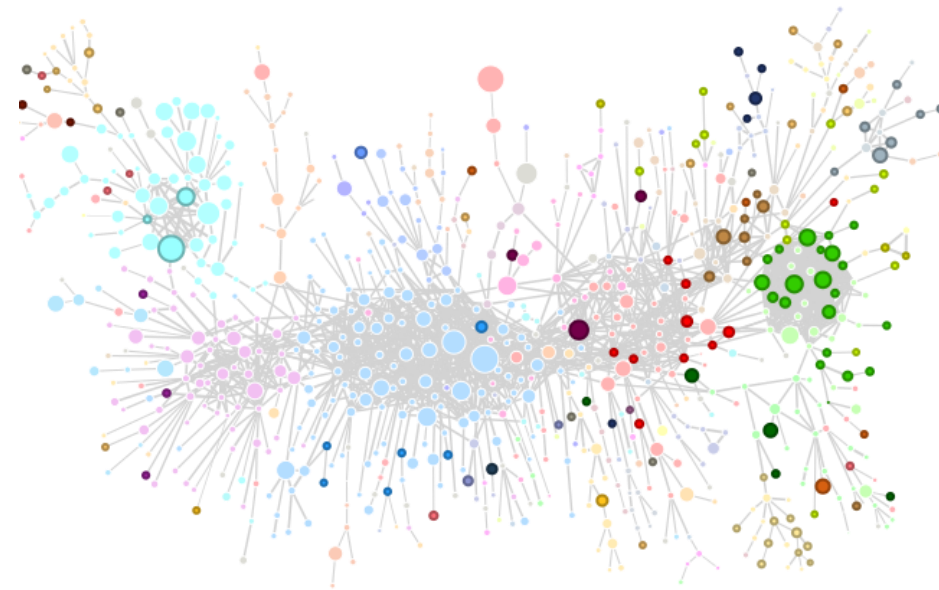
Thailand



Ghana

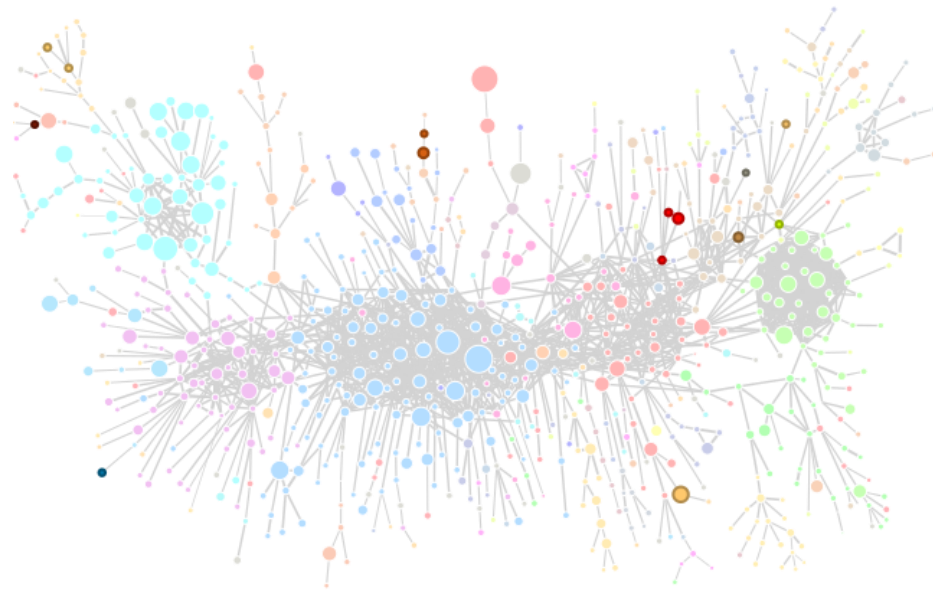
1980

Total Value: \$5,980,038,000



Thailand

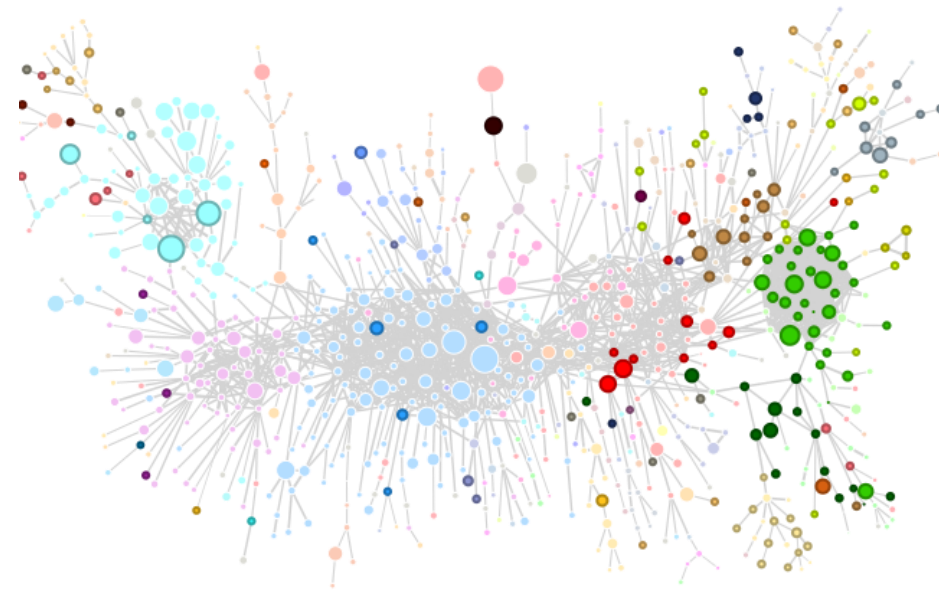
Total Value: \$1,017,767,000



Ghana

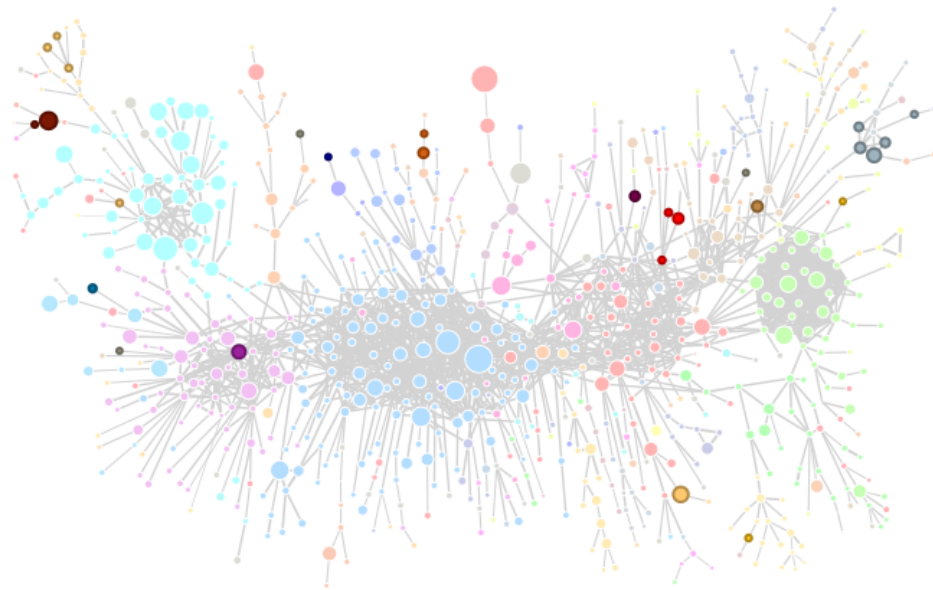
1985

Total Value: \$7,354,613,137



Thailand

Total Value: \$462,524,204

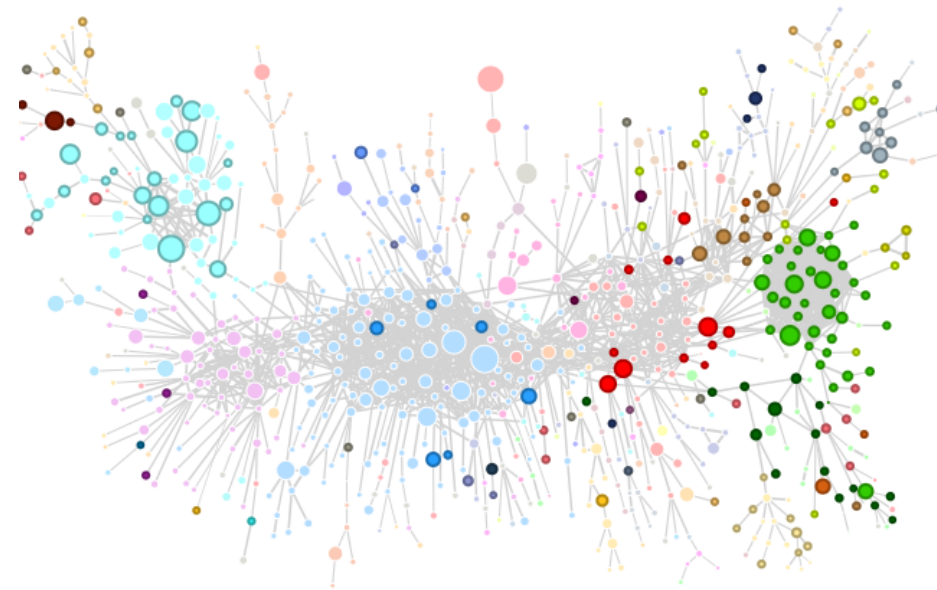


Ghana

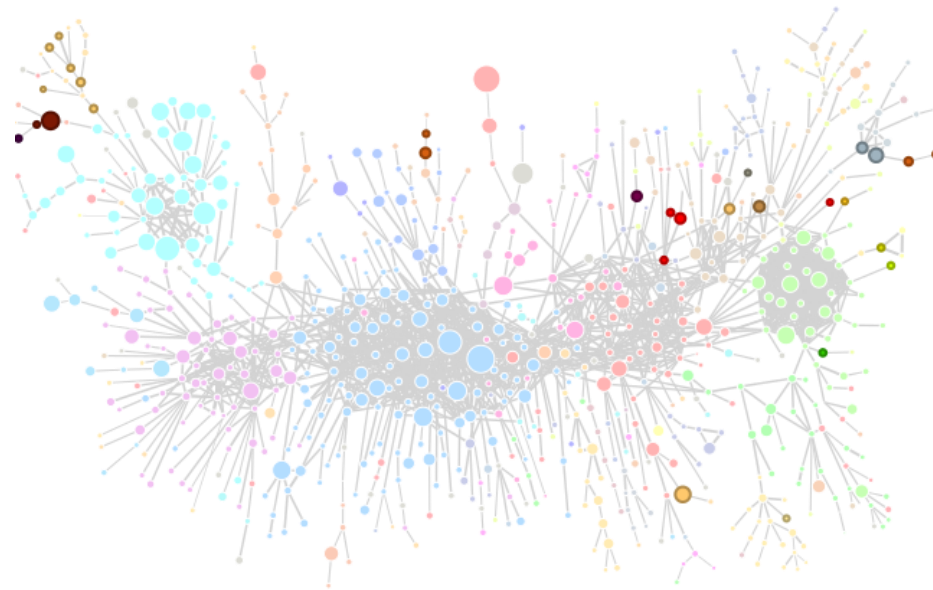
1990

Total Value: \$21,914,013,991

Total Value: \$1,086,328,204



Thailand

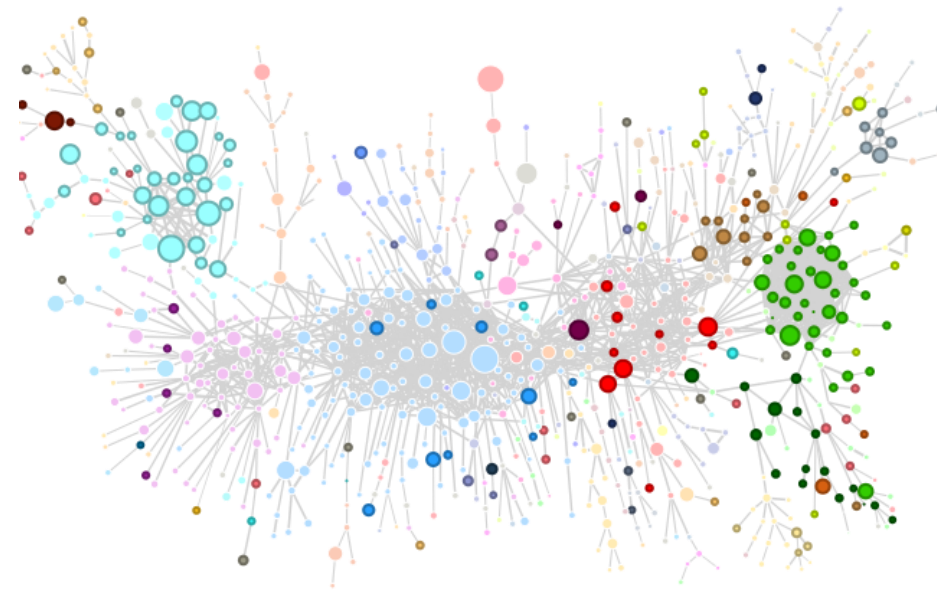


Ghana

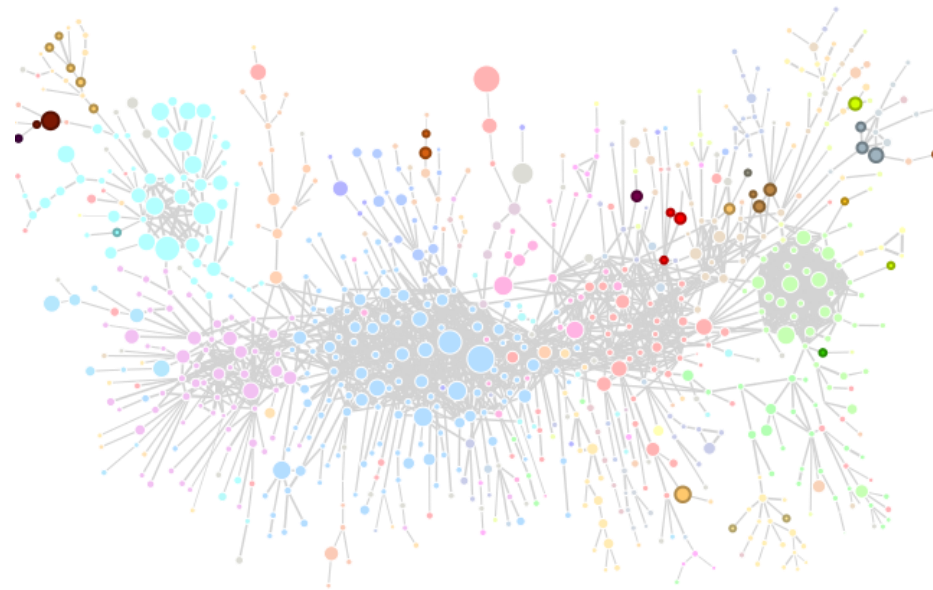
1995

Total Value: \$50,644,730,628

Total Value: \$1,294,057,269



Thailand

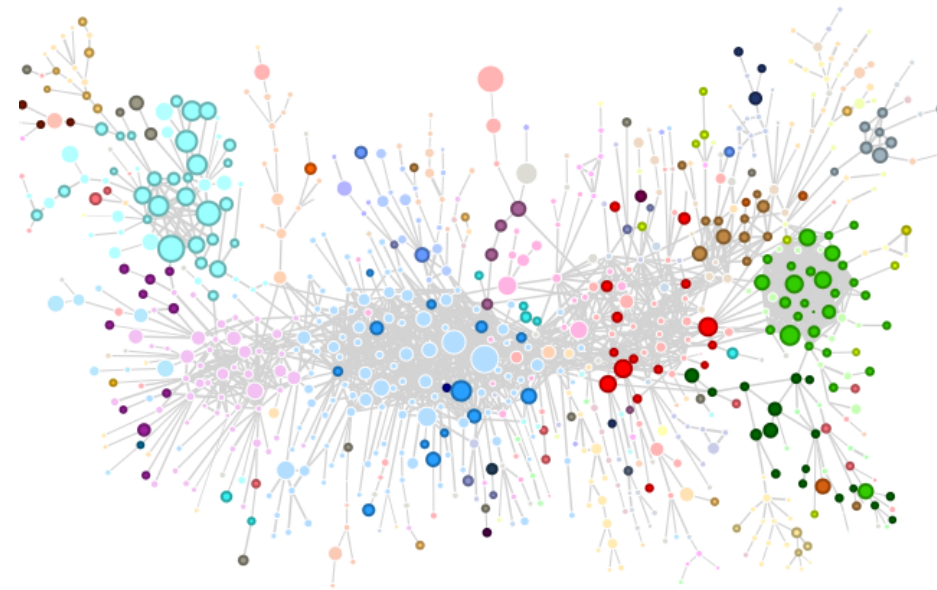


Ghana

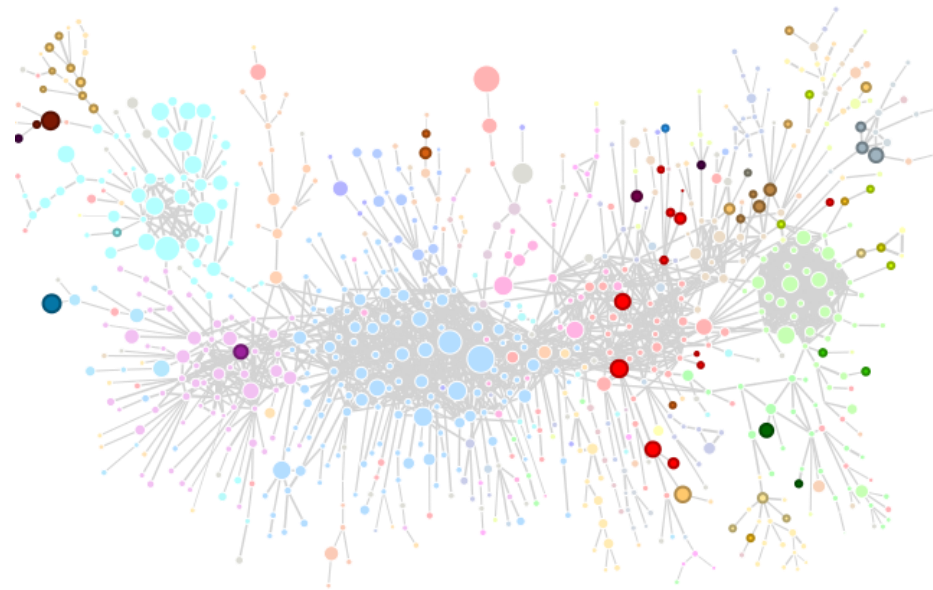
2000

Total Value: \$67,126,271,442

Total Value: \$1,206,161,694



Thailand

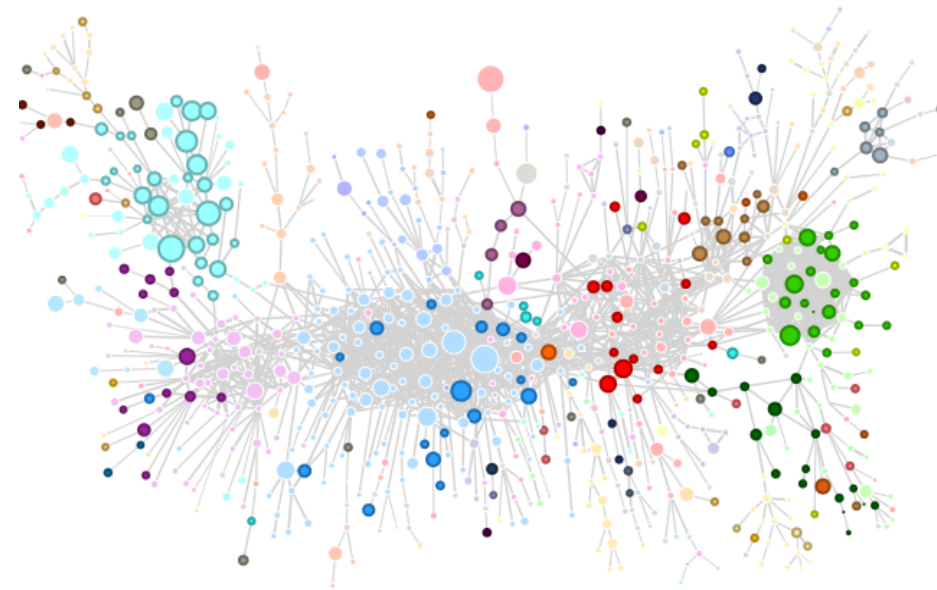


Ghana

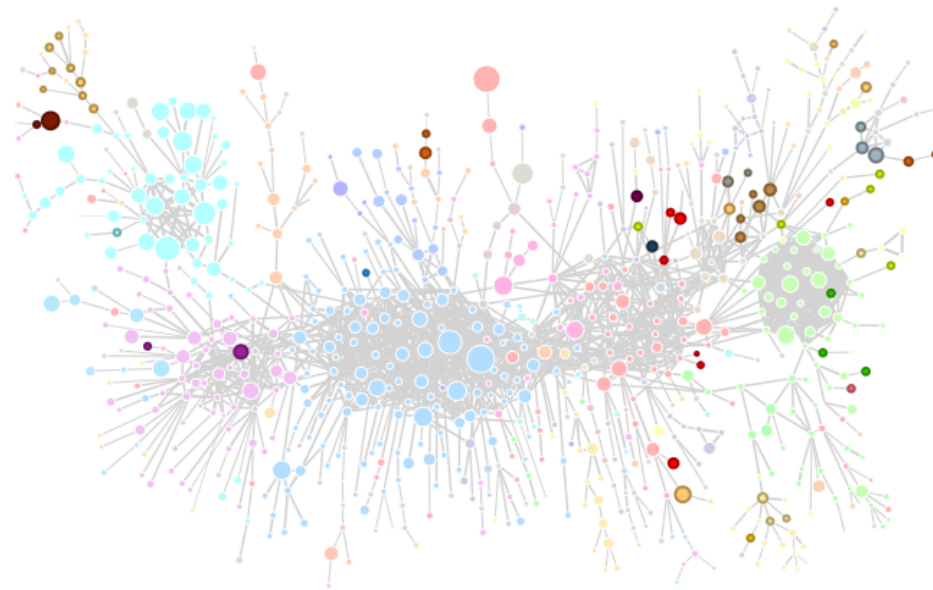
2005

Total Value: \$111,099,204,052

Total Value: \$1,871,625,725



Thailand

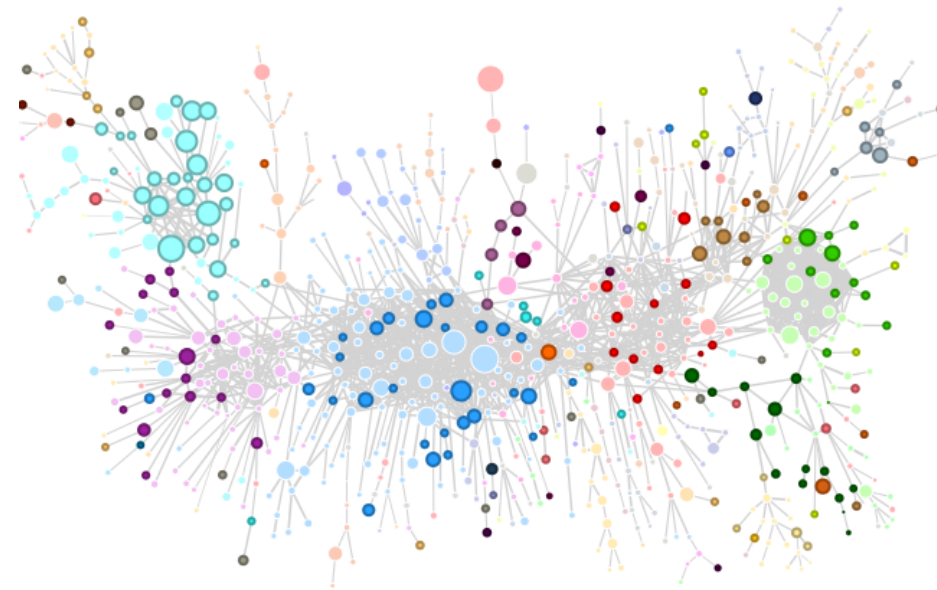


Ghana

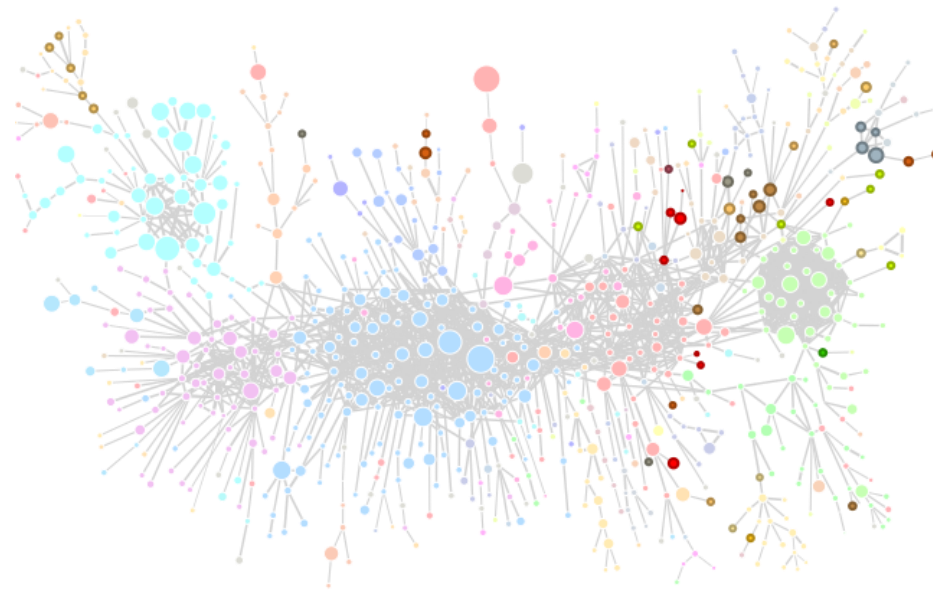
2010

Total Value: \$186,564,165,927

Total Value: \$4,052,850,523

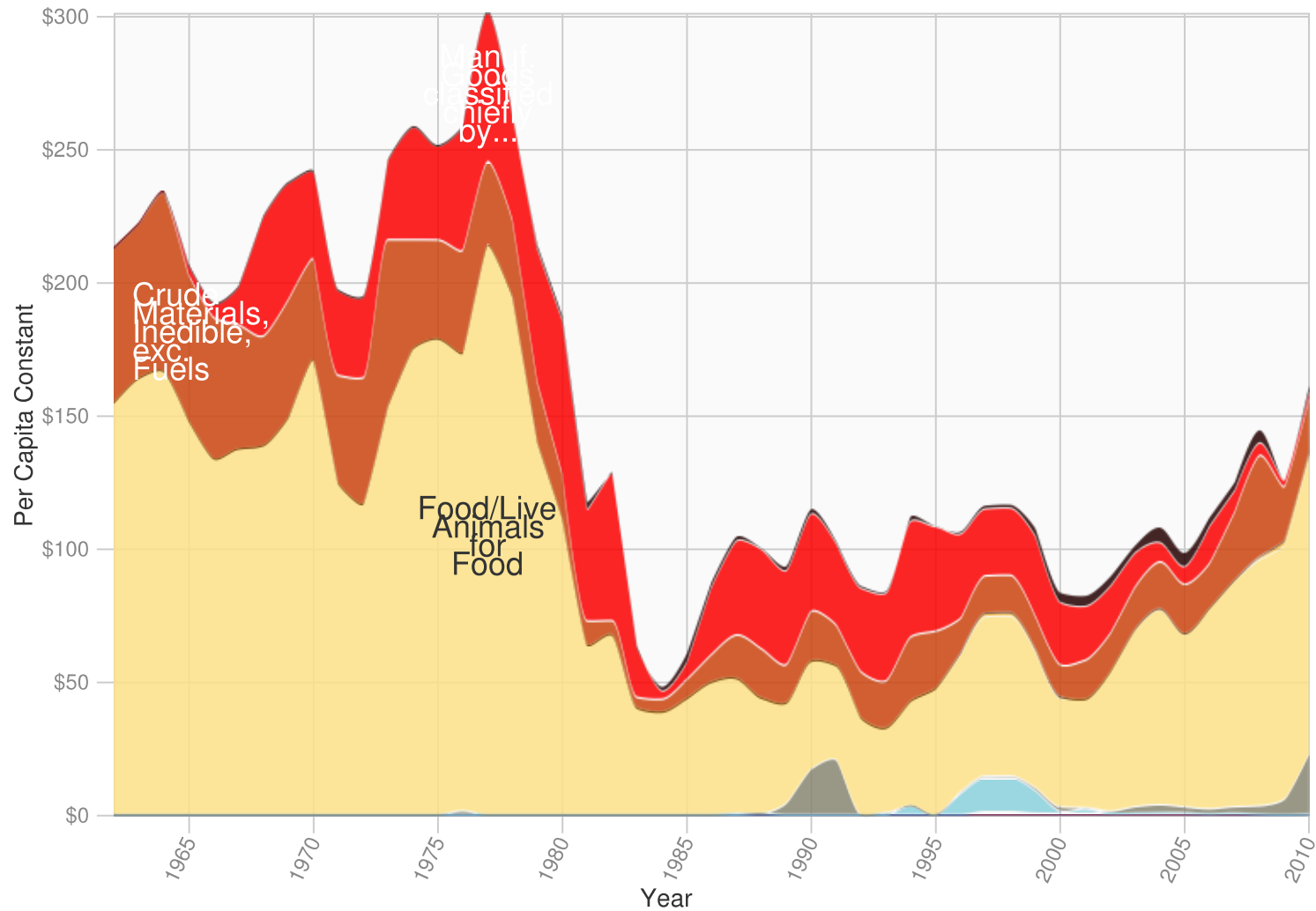


Thailand

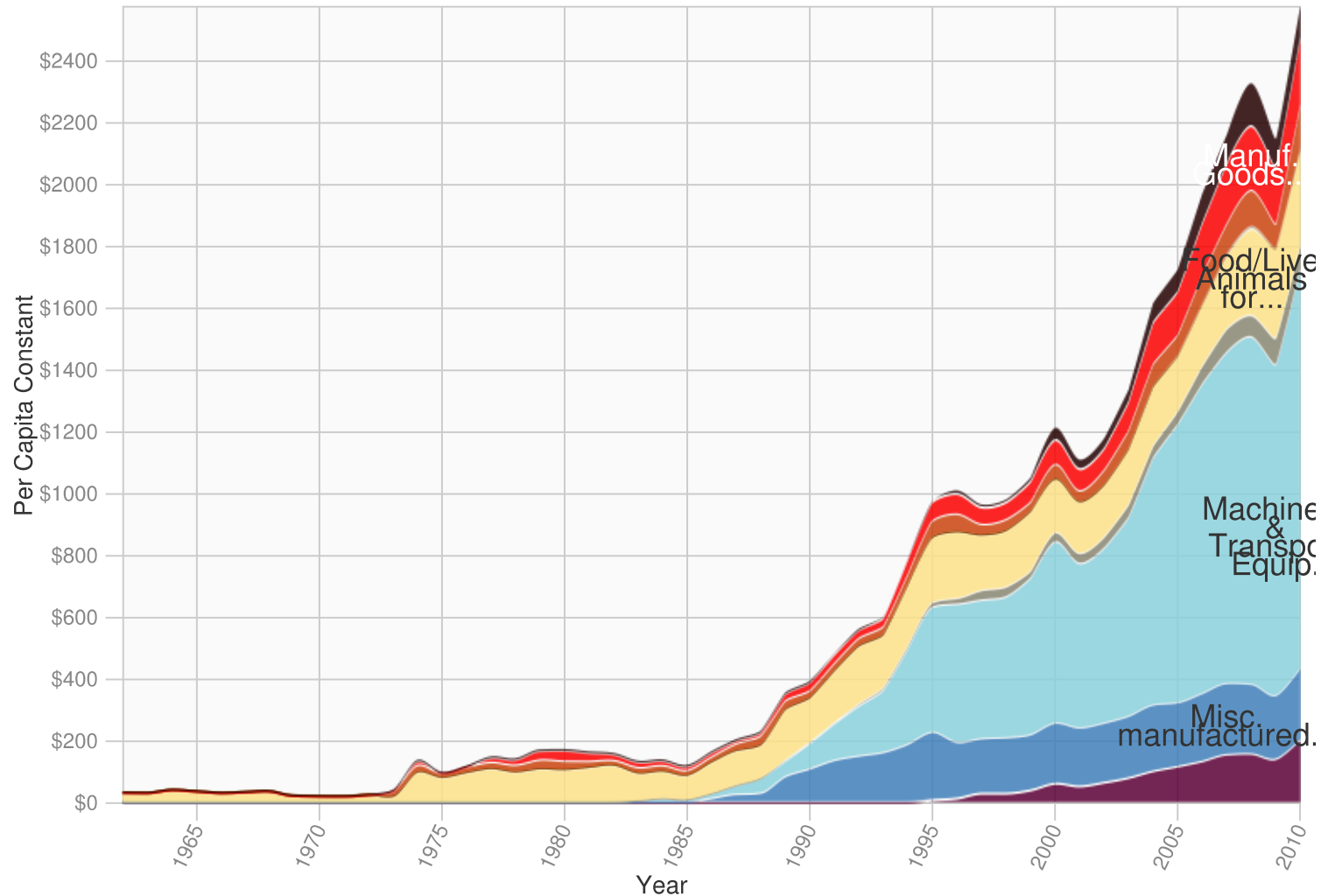


Ghana

Ghana's exports per capita at constant 2005 prices

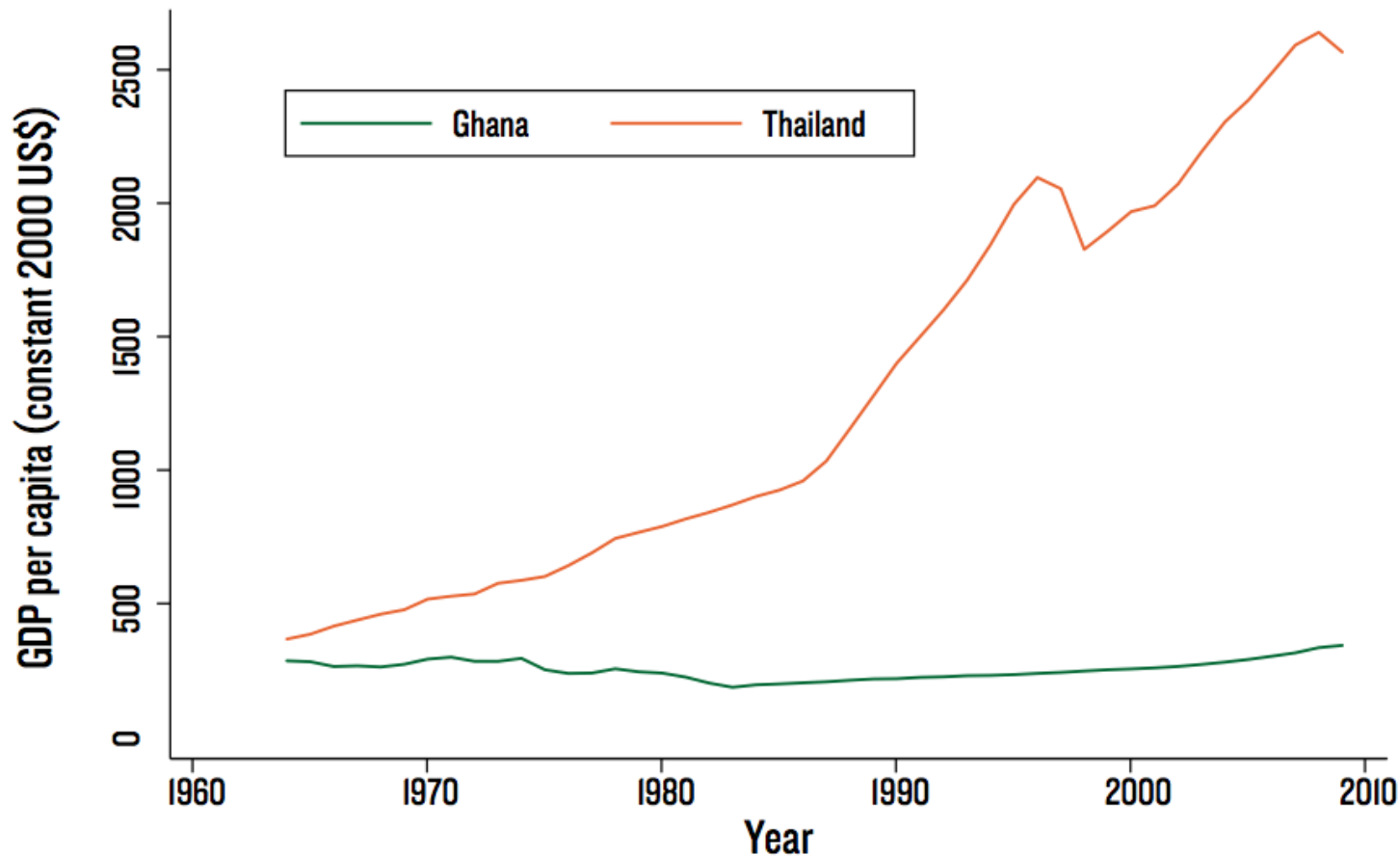


Thailand's exports per capita at constant 2005 prices



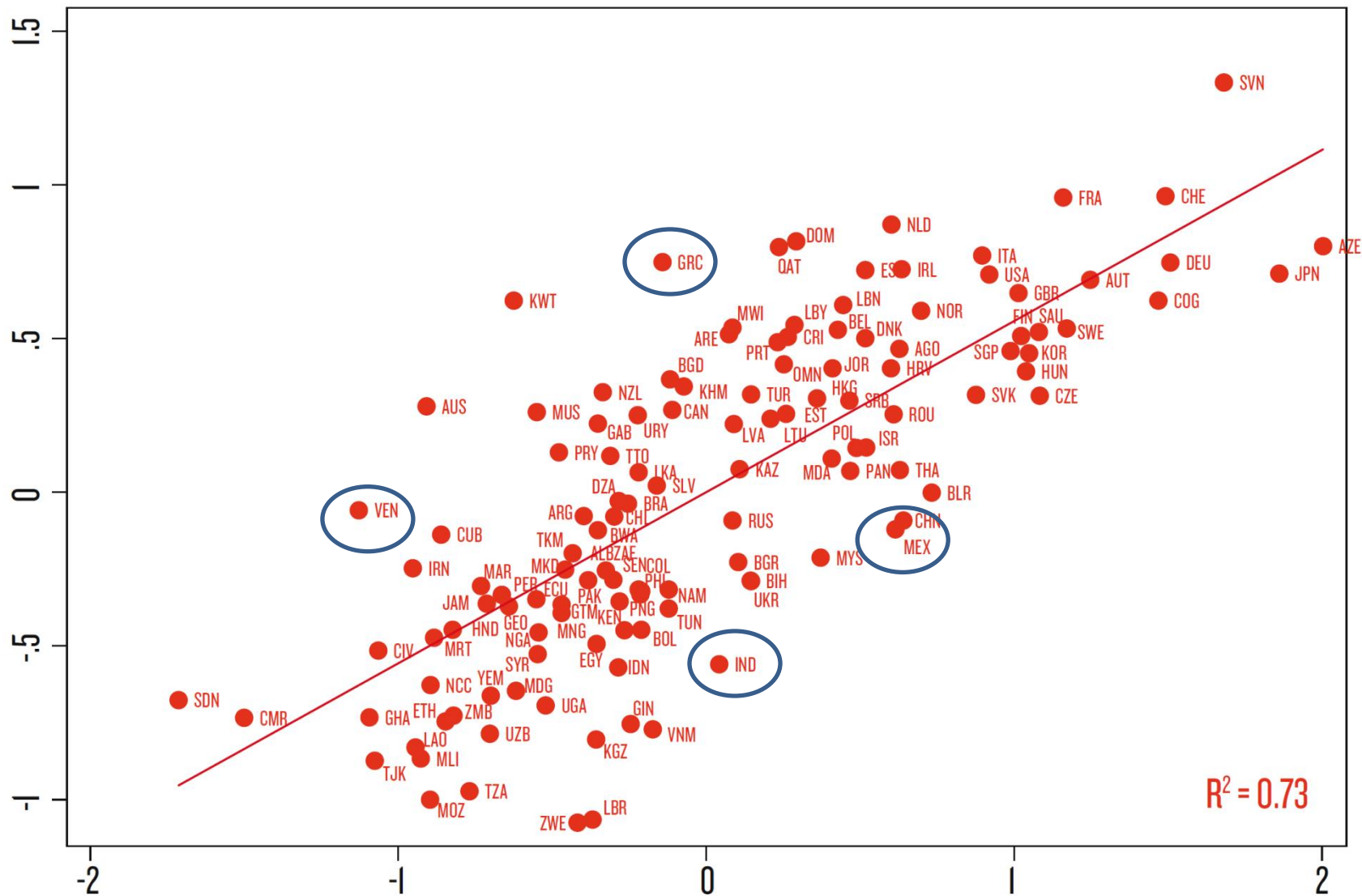
Divergence, big time

- Evolution of the GDP per capita of Thailand and Ghana as a function of time.



Explaining growth

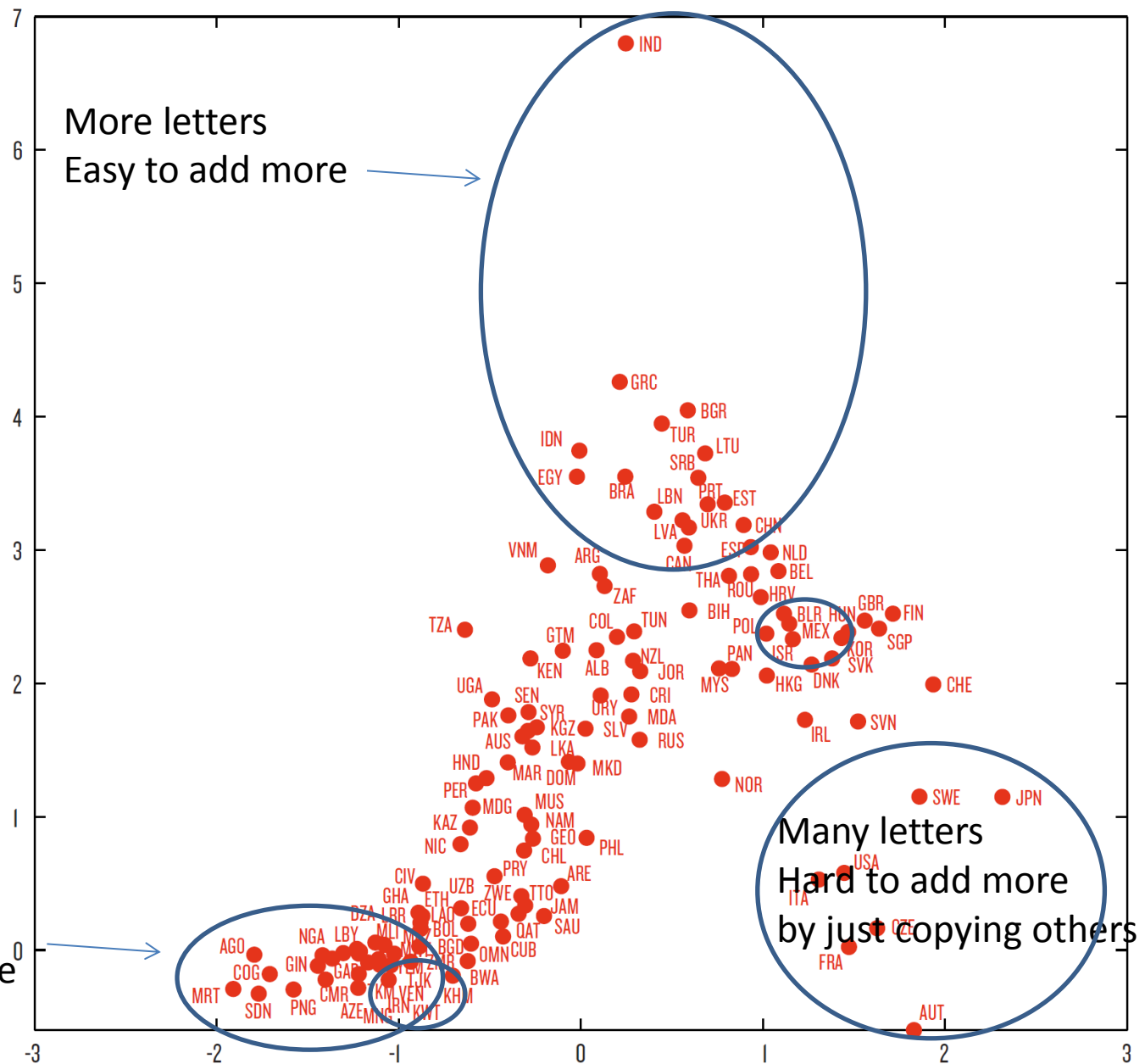
Income per capita controlling for initial income and proportion
of natural resource exports per capita in logs [2008]



Economic Complexity Index controlling for initial income and proportion
of natural resource exports per capita in logs [2008]

How close are
you to other
good products?

Few letters
Hard to add more

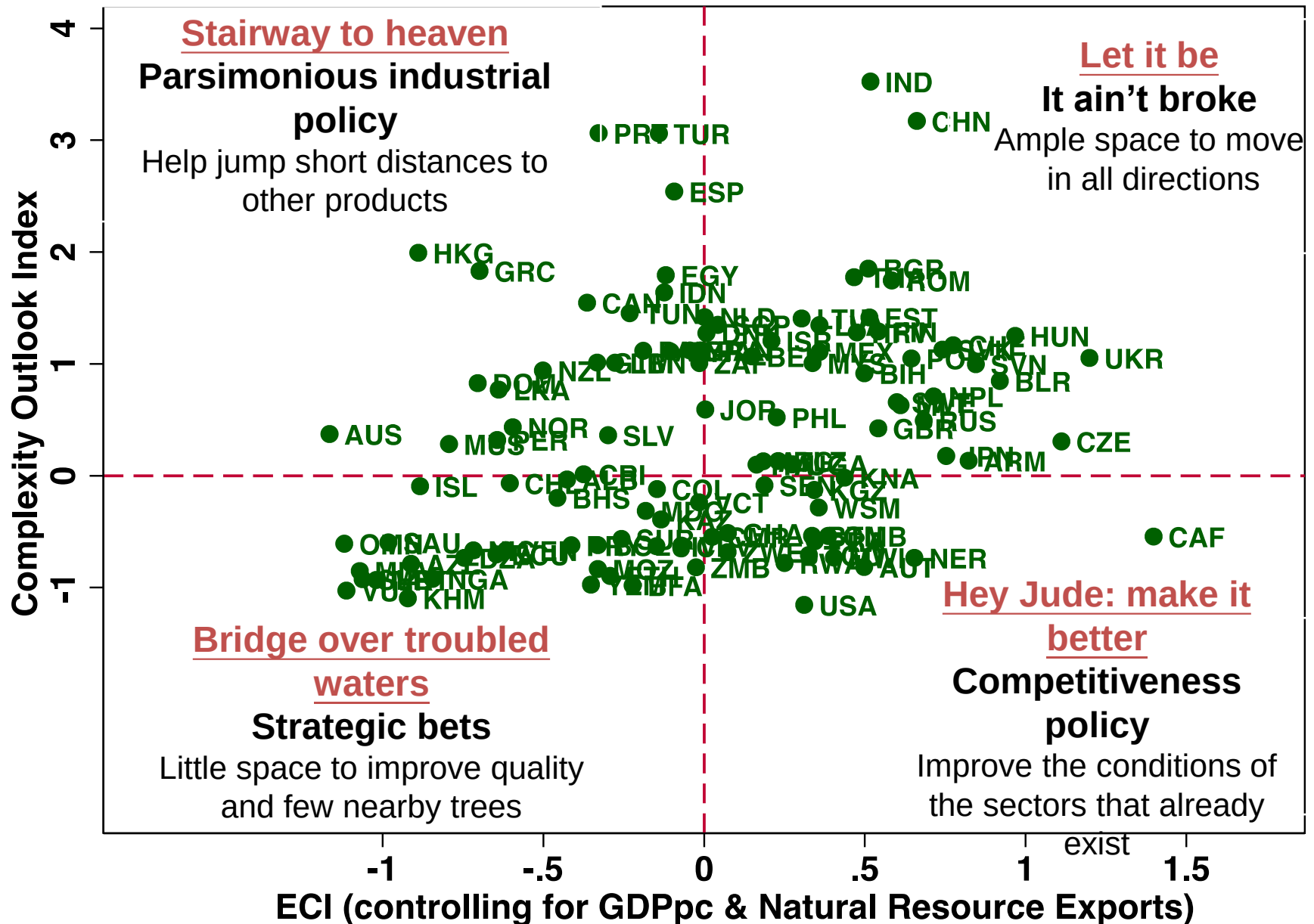


How many letters you have?

The Strategic Setting



The Strategic Setting: intensive vs. extensive



How to get new
letters?

The infection
problem

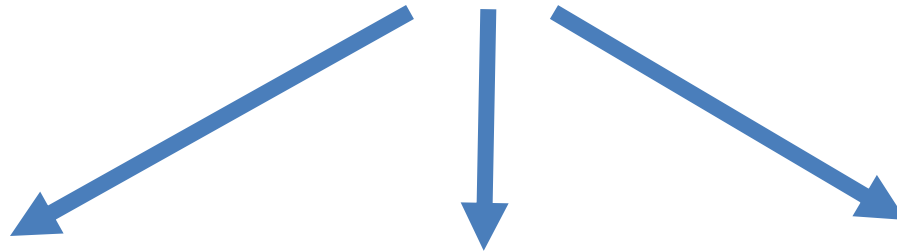




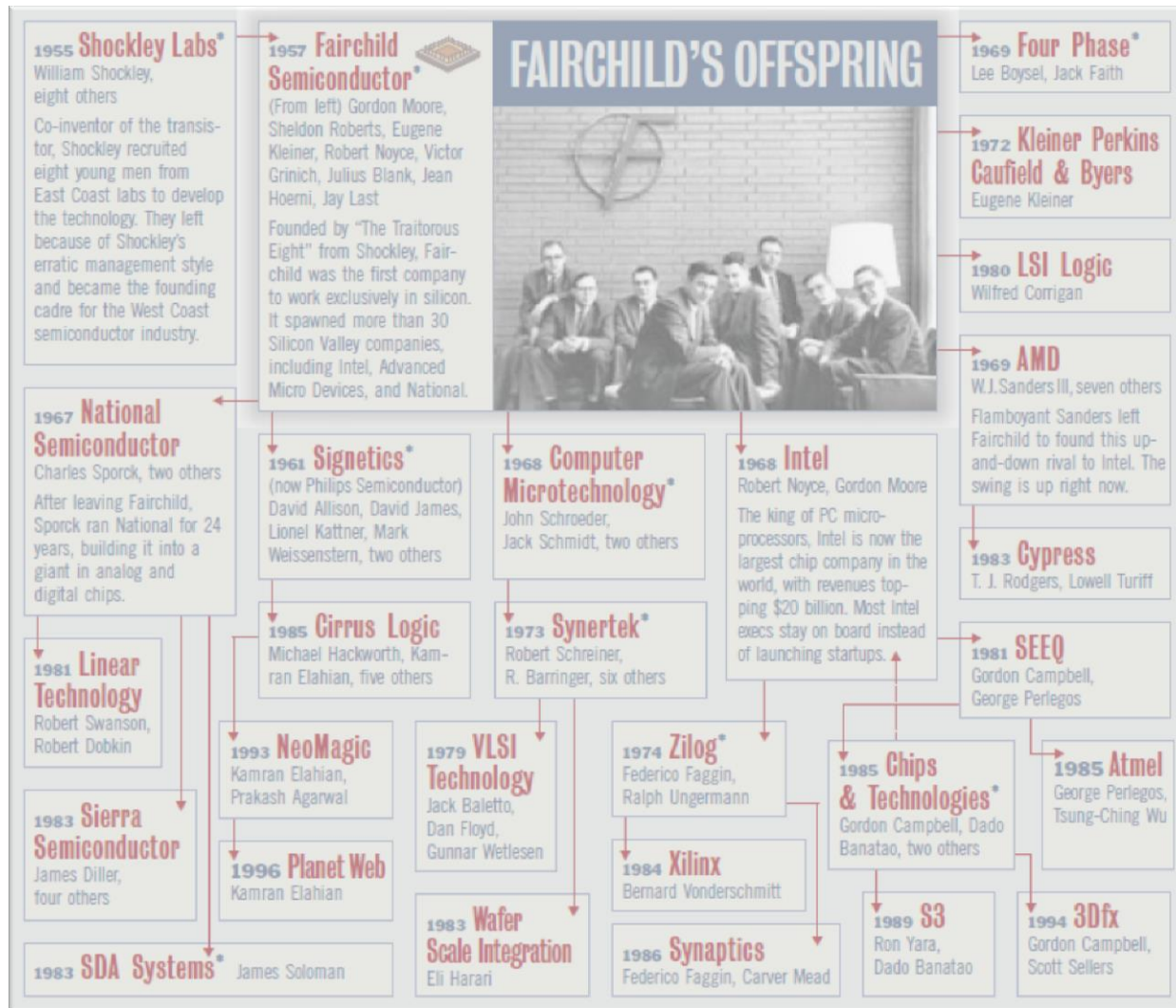
Example 1: DETROIT



All successful car firms in Detroit came out of Olds Motor Works



Example 2: SILICON VALLEY



Silicon Valley consists almost exclusively of Fairchild Semiconductor renegades

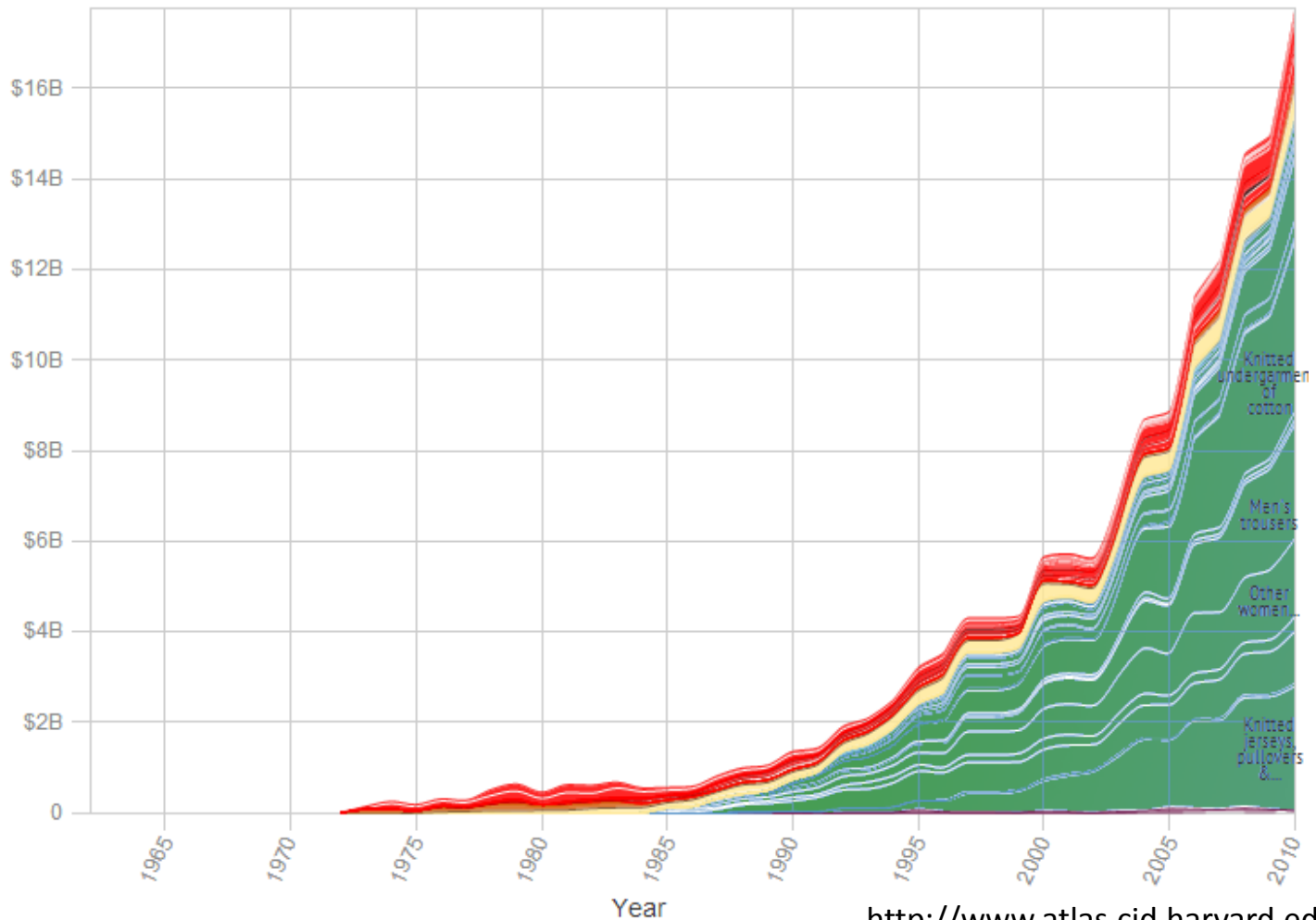
II. Diffusion of knowhow between firms across countries

Example 3: The garment exports of Bangladesh
(Klepper and Mostafa, 2011)



Bangladesh

What did Bangladesh export between 1962 and 2010?



Naer weg vlugten der Gereformeerde uit Frankryk.

Diffusion of Knowhow across Countries via Migrants



Huguenots fleeing France – engraving by Jan Luyken, 1696. <http://migrationmuseum.org>



EDIT⁴ DU ROY, PORTANT SUPPRESSION DES EDITS DE NANTES ET DE NISMES;

Revocation generale de tous les Privileges cy-devant
accordez à ceux de la Religion pretendue reformée:
Et qui ordonne la Demolition de tous les Temples,
& l'Interdiction de l'exercice de ladite Religion dans
tout le Royaume, Pais & Terres de l'Obeissance de
Sa Majesté.

Vérifié en Parlement le 22. Octobre 1685.



A METZ,
Par JEAN & BRIER les ANTOINE, Imprimeurs jurez du Roy, &
de Nosseigneurs de Parlement, demeurans dessous le Tillon
à la Place de Chambre.

Huguenots on the run





Chur = Brandenburgisches EDICT,

Betreffend
Diejenige Rechte / PRIVILEGIA
und andere Wohlthaten / welche Se. Churfürstl.
Durchl. zu Brandenburg denen Evangelisch = Refor-
mirten Franckösischer Nation, so sich in Ihren Landen
niederlassen werden / daselbst zu verstatten gnädigst
entschlossen seyn.

Geben zu Potsdam / den 29. Octob. 1685.

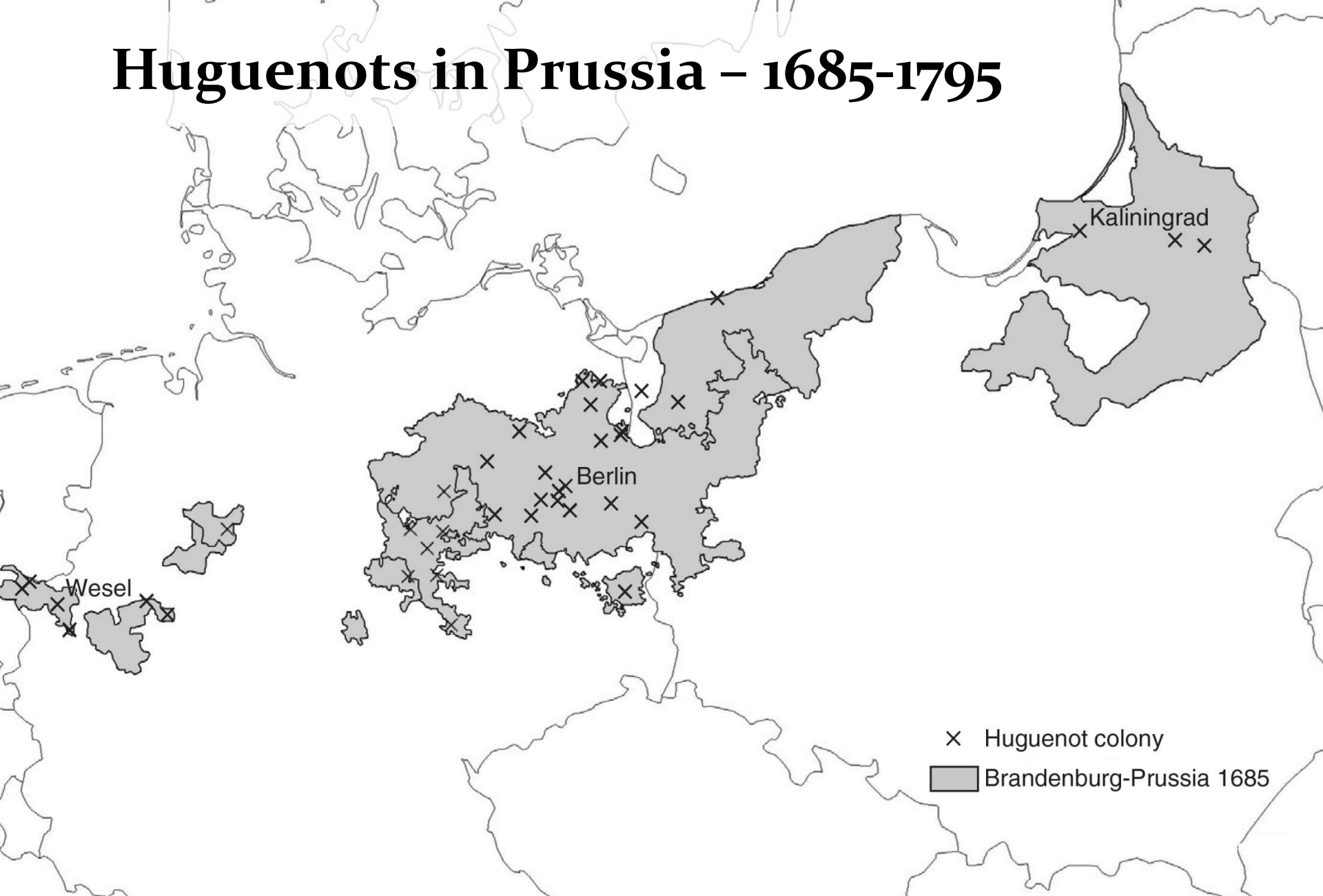
EDIT

De Sa Serenite Electorale de
Brandebourg,

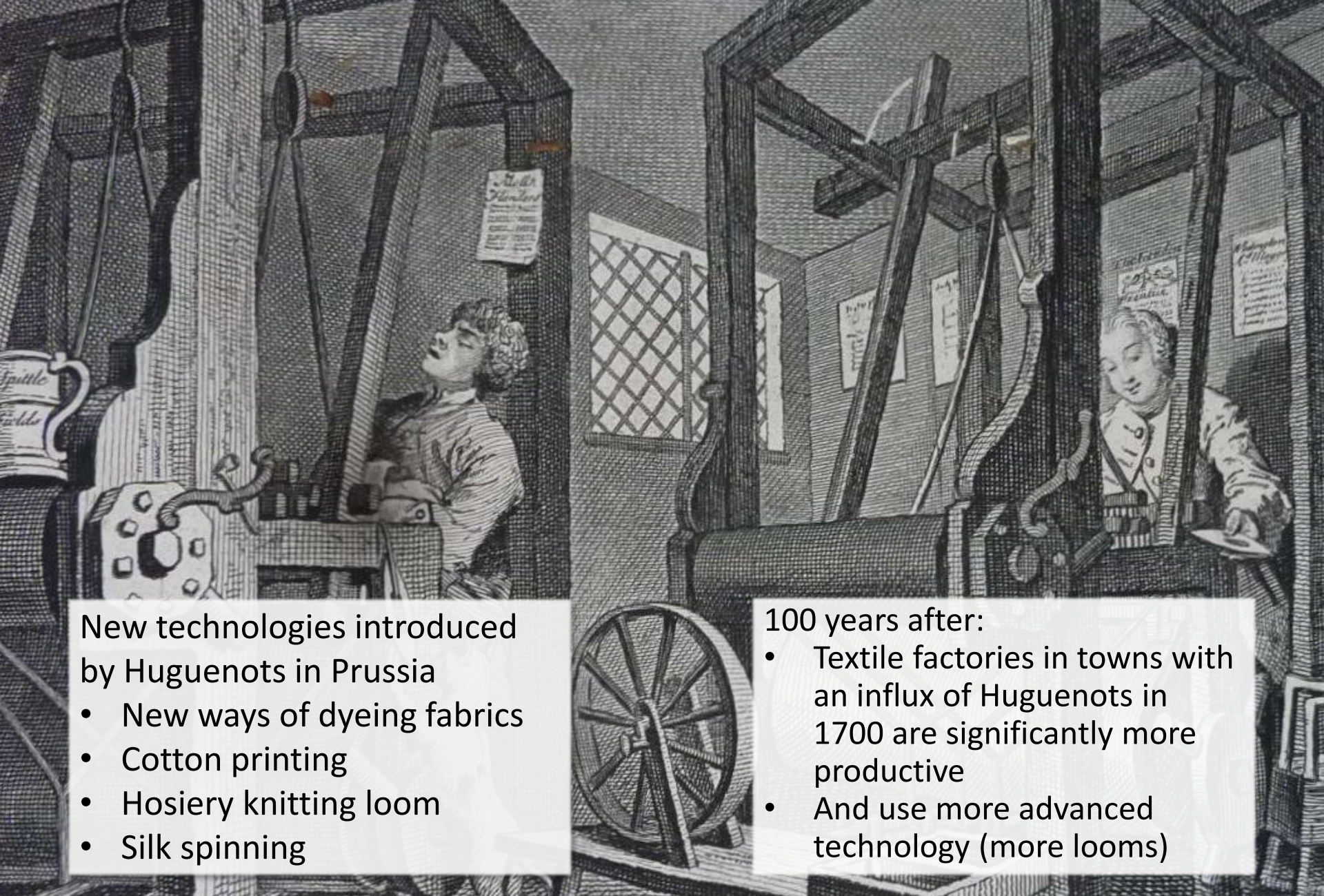
Qui expose
Tous les Droits, Franchises & Privi-
leges que Sa dite Serenite Electorale accordera
aux François de la religion Reformee, qui
viendront s'establir dans ses Etats.

donne à Potsdam le 29. d'Octobr. 1685.

Huguenots in Prussia – 1685-1795



Source: Hornung, E. (2014). Immigration and the diffusion of technology: The Huguenot diaspora in Prussia. *The American Economic Review*, 104(1), 84-122.



New technologies introduced by Huguenots in Prussia

- New ways of dyeing fabrics
- Cotton printing
- Hosiery knitting loom
- Silk spinning

100 years after:

- Textile factories in towns with an influx of Huguenots in 1700 are significantly more productive
- And use more advanced technology (more looms)

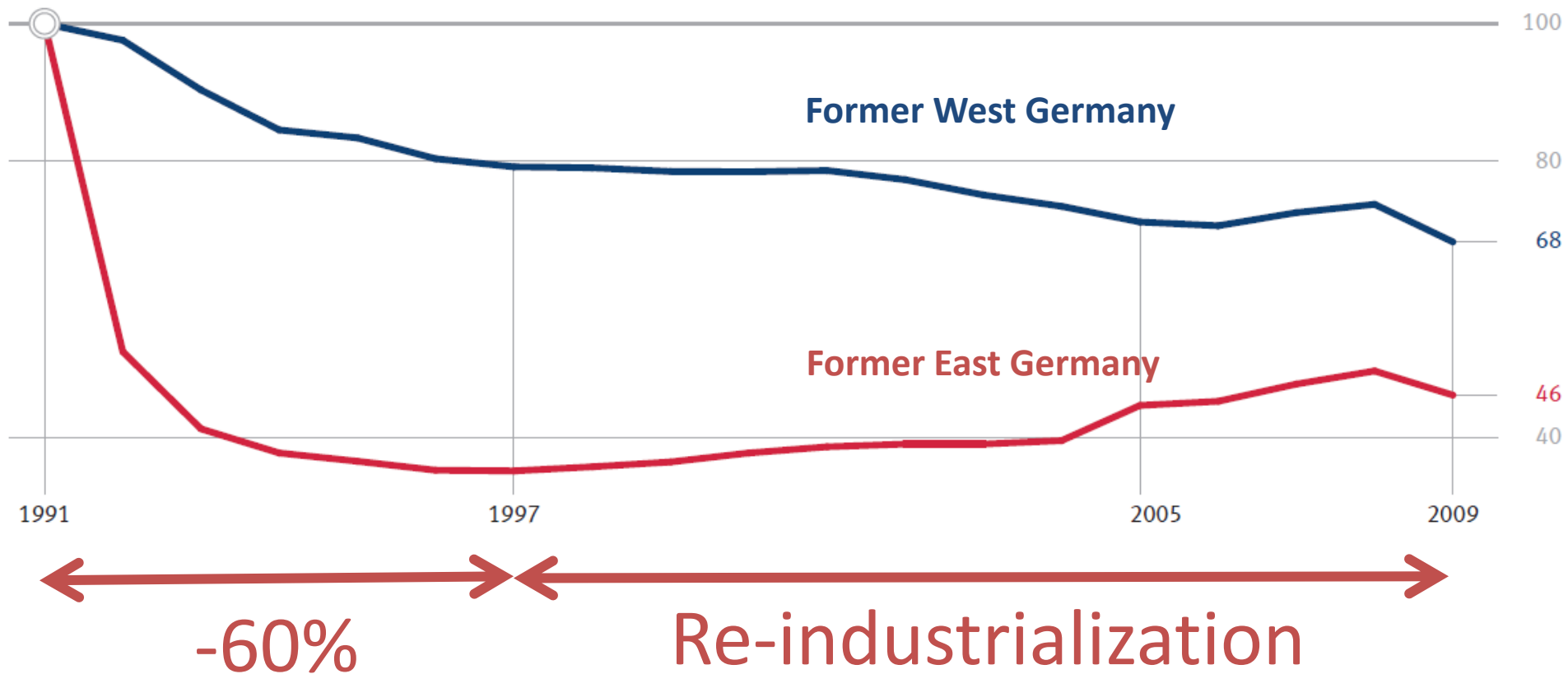
Source: Hornung, E. (2014). Immigration and the diffusion of technology: The Huguenot diaspora in Prussia. *The American Economic Review*, 104(1), 84-122.

How to start a new industry?

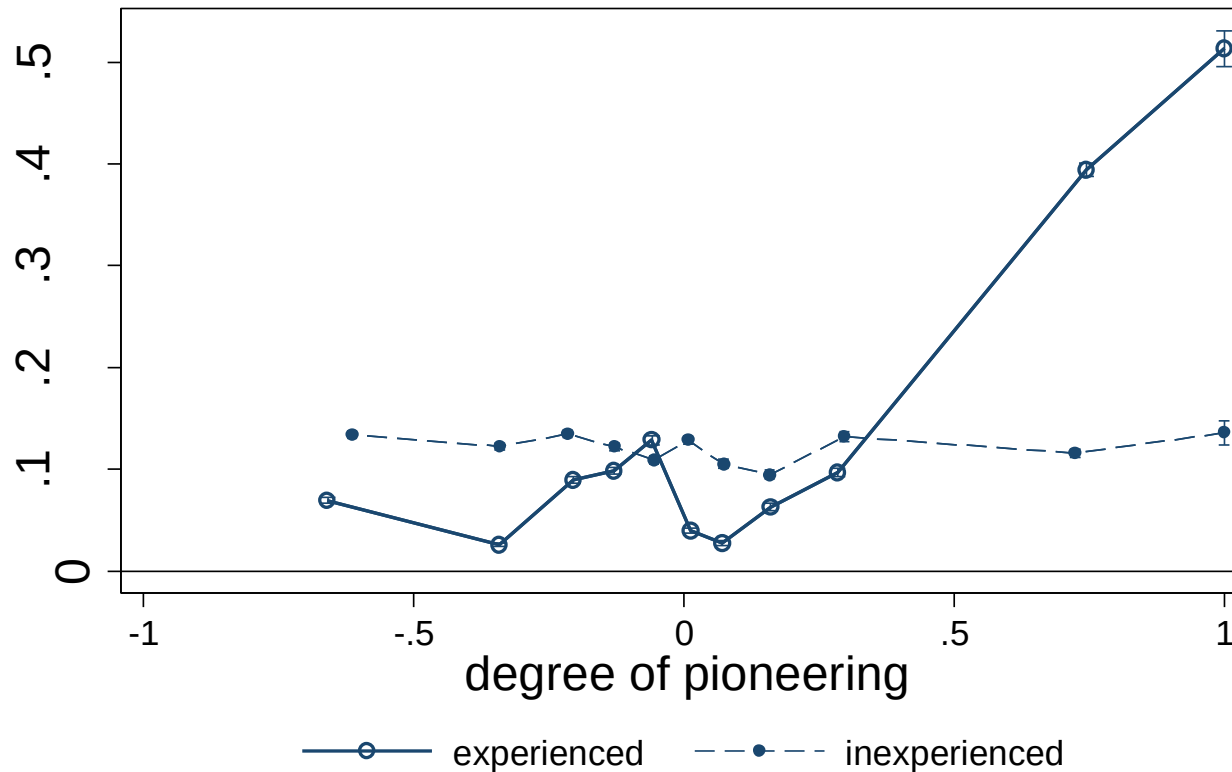




Collapse of East German manufacturing



East German pioneers manufacturing vs nonmanufacturing



51% of experienced
manufacturing
workers were hired
from West Germany

Return Migration: Moving letters

Welcome home in a crisis:
The effect of return migration on wages and
employment on nonmigrants

Hausmann & Nedelkoska (2017)





Albanian unemployment and wages after 5% of expansion of labor force





Photo Credit: Clare Masson, USAID Albania, <https://blog.usaid.gov/>



Dario Diodato: Mexican return migration

Photo Credit: <http://www.cbp.gov/newsroom>



Catalysts of Regional Innovation

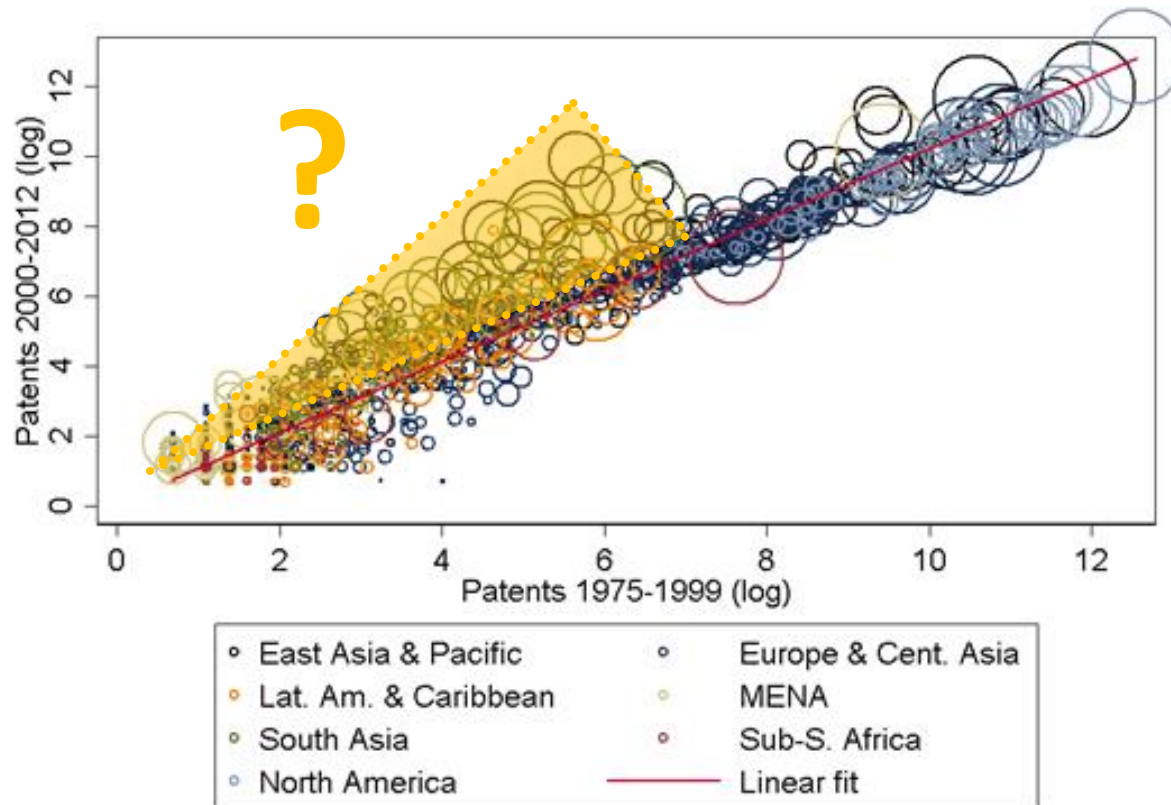
How foreign firms allow new places to
join the global innovation contest

Arnaud Dyeve (LSE), Riccardo Crescenzi (LSE),
Frank Neffke (HKS)

Inventive activity around the world

Stable over time

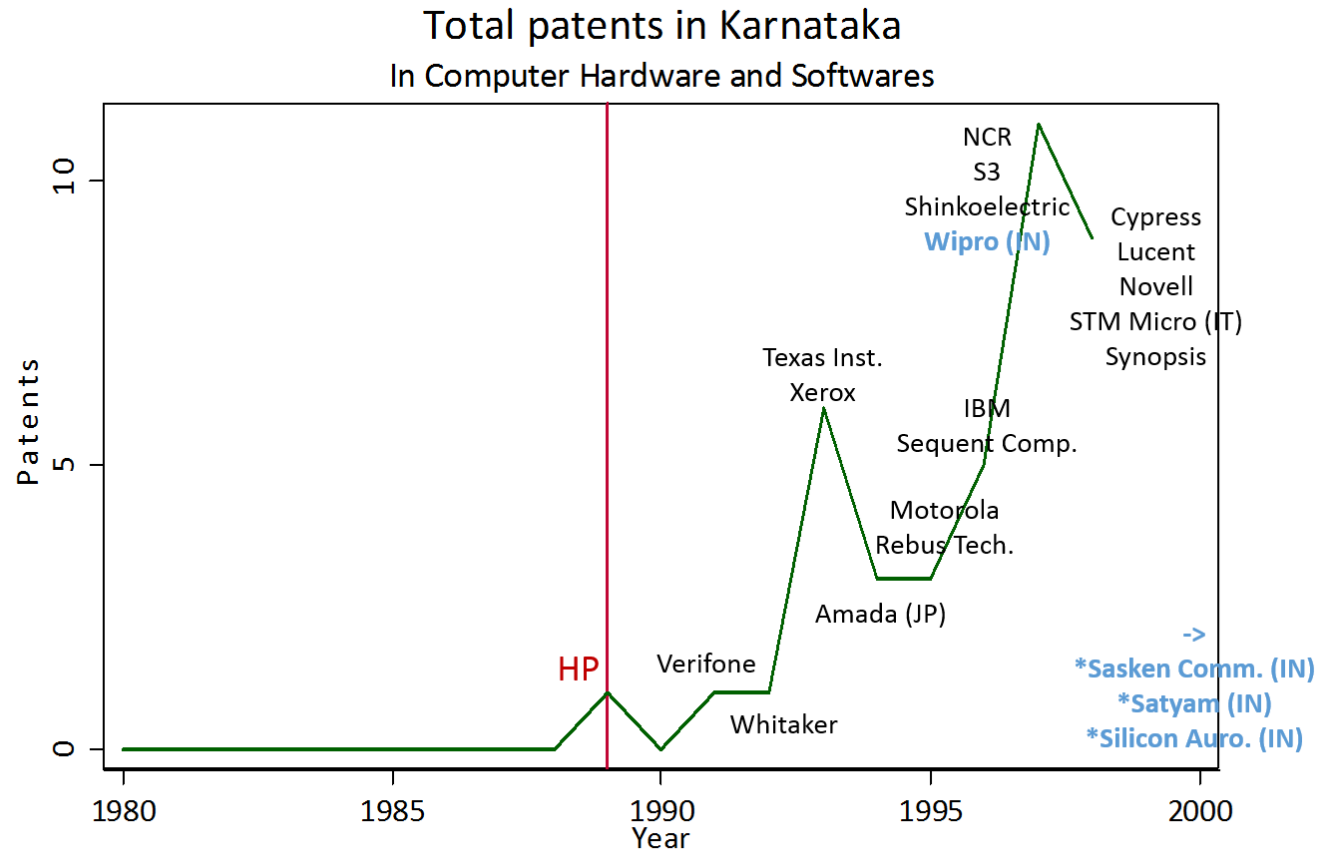
Patents in region before and after 2000



Note: circles are proportional to regional GDP in 2000

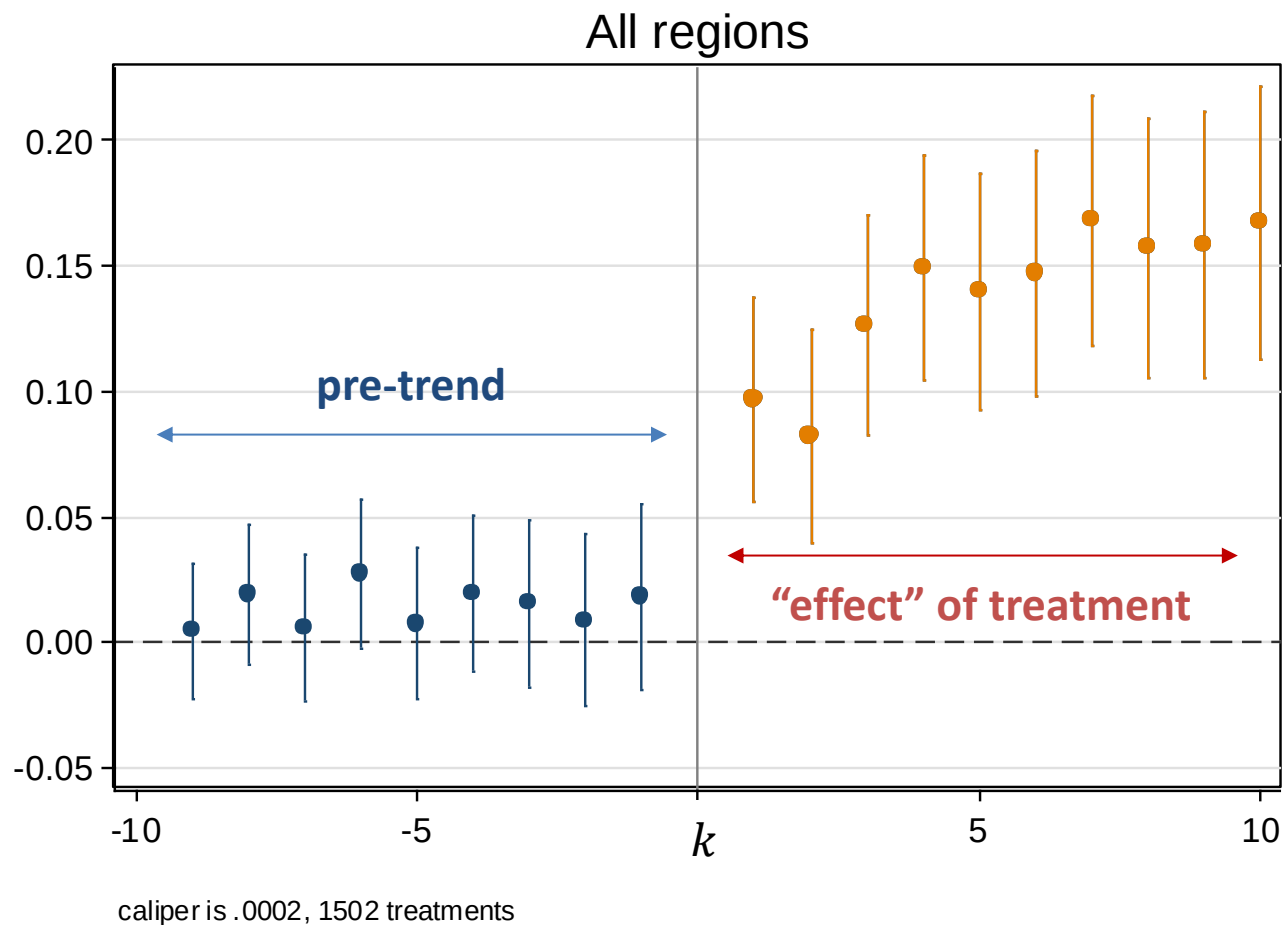
USPTO data

HP in Bangalore



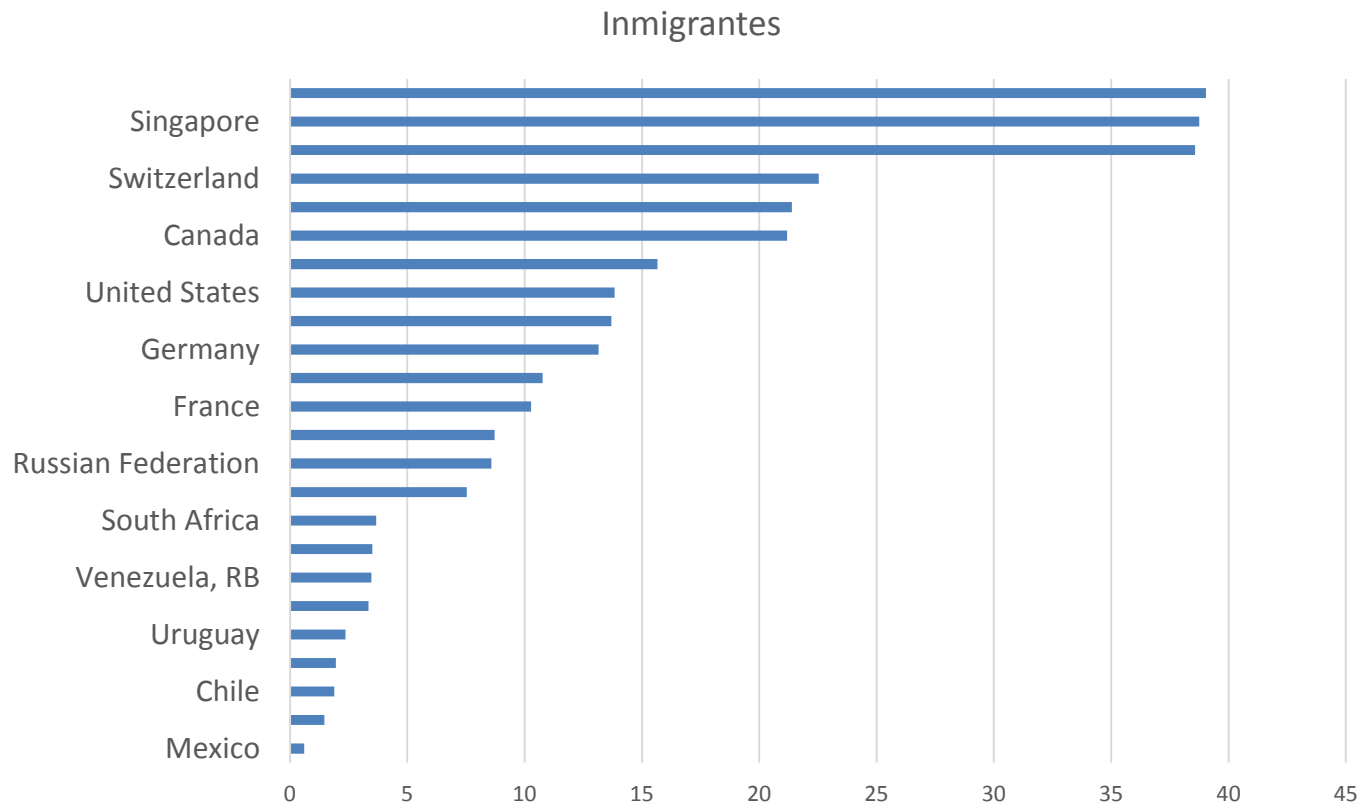
Difference-in-Differences

Patents by all firms



Enormous heterogeneity in the
number and diversity of migrants
in the developing world

The percentage of immigrants varies enormously across the world



The developing world is very closed to immigration

Singapore	1 in 2.4
Panama	1 in 24
Mexico	1 in 240
Sri Lanka	1 in 534



But is it push or pull?

Quotas on foreign skilled workers are very common

- Ireland: maximum 50% non-EU citizens
- Kazakhstan: maximum 30% foreign
- Egypt, Guatemala, Panama: maximum 10% foreign
- Cambodia: maximum 6% foreign
- Dem. Rep. Congo: maximum 4% foreign
- Ghana, Mozambique, Nigeria, Thailand: 1 or 2 per firm

Summing up

- The secret of development is technology adoption
- A major obstacle to technology adoption is the spread of collective knowhow
- Technology adoption moves preferentially (and inefficiently) towards the “adjacent possible”
 - From BEAR to ZEBRA rather than LION
- Human mobility is key to accelerate technology diffusion
- Human mobility is highly constrained, especially in developing countries where it is most needed

Epilogue

- We don't let "them" in because this country is for "us"
 - An "imagined community" (B. Anderson)
- The state is supposed to act on behalf of "us"
- The sense of us is constrained by the need to paper over existing diversity (race, language, religion)
- If development is to happen, the sense of us must be:
- ...deep enough to agree on complex public goods
- ...broad enough to allow for economies of scale
- ...and the mixing of new forms of knowhow
- Many countries are paying a hefty price for not wanting to be more open to others





Development Collective Know-how and Us

#LSEHausmann

Professor Ricardo Hausmann

Director of Harvard's Center for International Development and Professor of the Practice of Economic Development at the Kennedy School of Government. Former Chief Economist of the Inter-American Development Bank.

Chair: Professor Riccardo Crescenzi

Professor of Economic Geography at LSE.

Hosted by the Department of Geography and Environment.