

### **Development Collective Know-how and Us**

#### #LSEHausmann

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Hosted by the Department of Geography and Environment.

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# Development, Knowhow and Us

Ricardo Hausmann Harvard University Lecture at LSE, January 2018



Presenter to the If leastell Public Library STAUSTELT 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,

VIEW OF THE DOCTRINE OF SMITH, COMPARED WITH THAT OF THE SRENCH 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

a over Boy Shan

### Haiti

# \$819 per capita

## Morocco

# \$3,108 per capita

## Poland

AND COM

# \$13,431 per capita

## Singapore

# \$55,182 per capita











# 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



GDP per capita, logs

### Years of schooling and income per capita



# Why does technology not diffuse

Die.



### The two Nogales



### Guerrero

# \$5,281 per capita

### Sinaloa

# \$10,945 per capita

44444

# Guanjuato

## \$20,827 per capita

# Nuevo Leon \$42,281 per capita

3.3 33-2

# 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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WIKIPEDIA The Free Lacyclopedia	Lift (force)						
Main page Contents Featured content Current events Rendem activity	For integration, the the unsysteptida 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 force parallel to the flow direction. If the fluid is air, the force is called an aerodynamic force. In water, it is called a hydrod	te oncoming flow direction $[1^{1}]$ is contrasts with the drag force, which is the component of the surface synamic force.					1
Parton ance Donas to Wikedia Wikineda Shop Interaction Help Acout Wikipedia Connunity potal Recent charges Contact page	Contents (hide) 1 Overview 2 Simplified physical explanations of lift on an airfoil 2.1 Flow deflection and Newton's laws 2.1.1 Limitations of deflection/turing 2.2 Increased flow speed and Bernoutli's principle 2.2.1 Conservation of mass 2.2.2 Limitations of explanations based on Bernoutli's principle 2.2.2 Limitations of explanations based on Bernoutli's principle		Boeing 74	17-OF landing	it y	-	9
Tools What links here Related changes Upload file Special pages Permanent link Page information Wikidina item Cite this page Protilespot Create a book Download ite PDF Protable version	3 Basic attributes of lift  3.1 Pressure differences  3.2 Angle of attack  3.3 Aniol shape  3.4 Air speed and density  3.5 Lift coefficient  3.6 Pressure integration  4.4 more comprehensive physical explanation  4.1 Lift involves ection and reaction at the airtoi surface and is fet as a pressure difference  4.2 The airtoi affacts the flow over a wide area around it  4.3 The pressure differences and the changes in flow speed and direction support each other in a mutual interaction  5 The understanding of lift as a physical phenomenon  5 The understanding of lift as a physical phenomenon						
Languages C Atrivaans Supel Bith-Ittim gib Sistragoon Català Cettima Dansk Deutech Espanol Espanol U-//4 Français Galago Bit-Pol	6 Mathematical theories of Int     6.1 Navier-Stokes (NS) equations     6.2 Reynold5-Averaged Navier-Stokes (RANS) equations     6.3 Inviscid-flow equations (Euler or potential)     6.4 Linearized potential flow     6.5 Circulation and the Kutta-Joukowski theorem     6.6 Momentum balance in litting flows     7 Ut of three-dimensional wings     6 Viacous effects: Profile drag and stalling     9 Ut forces on bulk bodies     10 Attamative explanations, misconceptions, and controversies     10.1 False explanation based on equal transit-time     10.2 Controversy regarding the Coand& effect     10.3 Misconception regarding the role of viscosity						

### What do you do when your tooth hurts?





Search the web and fix it yourself?

Q External links

### ...or look for a dentist

### Knowhow needs to be in brains



# Knowhow *≠* 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?



## 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





#### 2 Theory The of Economic Development the design of the distinctive SCRABBLE brand Da

WORD SCORE

x.



#### With **1** letter,



а

You can make 1 word, of 1 letter







You can make 4 words, of up to 3 letters





а	art	act tar	
at	rat		
cat	car	cart	

You can make 9 words, of up to 4 letters

#### With 10 letters,



cilantros contrails gnostical nostalgic triclosan agnostic antilogs calorist cantoris carlings caroling	clangors clarinos clarions clarting coasting coatings congrats contrail cortinas cotingas locating	ratlings roasting saltoing scarting sclating slarting solacing solating starling tonsilar tracings	agnosic agonist alnicos alongst angicos anglist antilog arcings argotic aroints atonics	carlots carotin carting cartons casting cations catling catlins cistron citolas citrals	closing coaling coating coltans colting contras cornist cortina cortins costing cotinga	garcons garlics gastric gastrin girasol gitanos glorias gnostic gratins lacings
caroling carotins castling catlings offering	locating oracling organics organist nake 59	tracings trigonal actings actions <b>5 word</b> s	atonics caligos cantors carling s, of up	citrals citrons clangor clarino to <b>10</b> le	cotinga crating cratons crotals crotals crotals	lacings lasting latigos latinos

# 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)

### This pattern also holds subnationally: Municipalities in Chile

Diversification vs. Ubiquity



# **Industries in Chilean Municipalities** Municipality-Product Pairs



Industries (Sorted by Ubiquity)

#### **Cities in Turkey**

### Diversification vs. Ubiquity





#### **Departments in Colombia**



### 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




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

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 growth in natural resource export [1998]

# How to get more letters? The chicken and egg problem









LION

# Mapping out the Forest



#### What makes manufacturing different? Complexity, Connectedness and Market Size



# **Industry Space**



# Industry space

Labor market as a network of human capital linkages



# What is a country, a city or a region?

# Where are the monkeys?

# Venezuela 2015



\$382B USD Mexico 2015



# London



# Shanghai



## How do monkeys jump?

# A tale of two countries

#### GHANA

#### THAILAND



#### 1962: Roughly equal income







GDP per capita (constant 2000 US\$)

## Human capital story:

Þ

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

Total Value: \$294,604,000



Thailand

Total Value: \$721,421,000

Total Value: \$432,140,000



Thailand

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

Total Value: \$818,766,000



Thailand

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

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



Thailand

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

Total Value: \$462,524,204



Thailand

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

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



#### Thailand

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

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



Thailand

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

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



#### Thailand

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

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



Thailand

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

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



Thailand

#### 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



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

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



# The Strategic Setting



High

Low

#### Stairway to heaven

#### Parsimonious industrial policy Help jump short distances to other products

#### Let it be

It ain't broke

Ample space to move in all directions

Bridge over troubled

waters

Strategic bets

Little space to improve quality and few nearby trees Hey Jude: make it better

#### **Competitiveness policy**

Improve the conditions of the sectors that already exist

#### Low

#### High

**Relative endowment of letters** 

### 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 OIds 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?



http://www.atlas.cid.harvard.edu/

# Diffusion of Knowhow across Countries via Migrants

Her weg sugten der Gereformeerde ugt Vrankryk.

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

Sa Majefte.

#### DU ROY, DORTANT SUPRESSION PORTANT SUPRESSION 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'Obeillance de Sa Majefté.

Verifié en Parlement le 22. Octobre 1685.



A METZ, Par JEAN & BRIER les ANTOINE, Imprimente jurés du Roy, & de Nolfeigneurs de Parlement, demeurans deflous le Tillor à la Place de Chambre.

LXXX



#### http://www.huguenotsociety.org.uk/history.html



# Shur - Brandenburgifches EDICT,

Betreffend Diejenige Rechte /| PRIVILEGIA und andere Bolthaten / welche Se. Shurfürstl. Durchl. zu Brand-nburg denen Evangelijds - Reforunrten Fransdischer Nation, fo fich in Ibren Landen niederlaffen werden/dafelbst zu verstatten gnädigst entschloffen seyn. Geben zu Potstam / den 29. Octob. 1685.

EDIT De Sa Screnite Electorale de Brandebourg,

Di exposé Tous les Droits, Franchifes & Privileges que Sa dite Serenite Electorale accordera auxFrançois de la religion Reformee, qui viendront s'etablir dans fes Etats, donne à Potsdam le 20, d'Octobr, 1 6 8 5.



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?



By Germany,\_Federal\_Republic\_of\_location\_map\_January\_1957\_-\_October\_1990.svg: TUBS Flag\_of\_East\_Germany.svg: derivative work7 Fry1989 (talk) 00:25, 26 January 2011 (UTC) [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons



Photo Credit: Lear 21 at English Wikipedia

# 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)





Ljubica Nedelkoska & Ricardo Hausmann: Albanian return migration in the Greek crisis

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



Photo credit: Lendingmemo (from www.flickr.com)

Hausmann & Nedelkoska (2016)



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 Dyevre (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

# HP in Bangalore



### Difference-in-Differences Patents by all firms



caliper is .0002, 1502 treatments

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

ANY -X



# 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







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