Frontier of Inter-firm Network Analysis: Power of network and geographical friction

Handout

Robert DEKLE

Professor of Economics, University of Southern California

March 8, 2016

The Implications of Agglomeration and Regional Spillover Effects

Robert Dekle

Department of Economics

USC

What are Agglomeration Effects

- Agglomeration Effects Refer to Forces External to the Firm that Promotes the Geographical Concentration of Firms and the Factors of Production, such as Labor.

- One of the most basic facts of economics is the geographic concentration of economic activity, which has fascinated urban economists for decades and more recently trade economists and macroeconomists.

- Literature with fruitful interaction between urban economists, trade economists, macroeconomists, and economic historians.

# Concentration of Economic Activity and Population in Japan

- If Agglomeration Effects or Spillovers are Prevalent, then Output and Factors of Production will Tend to Concentrate.

- In Japan, output and population are heavily concentrated.

- One of the peculiar characteristics of Japan is the enormous concentration of economic activity and population in Tokyo.

Concentration of Output, 2010

GDP per Prefecture

gdp

4
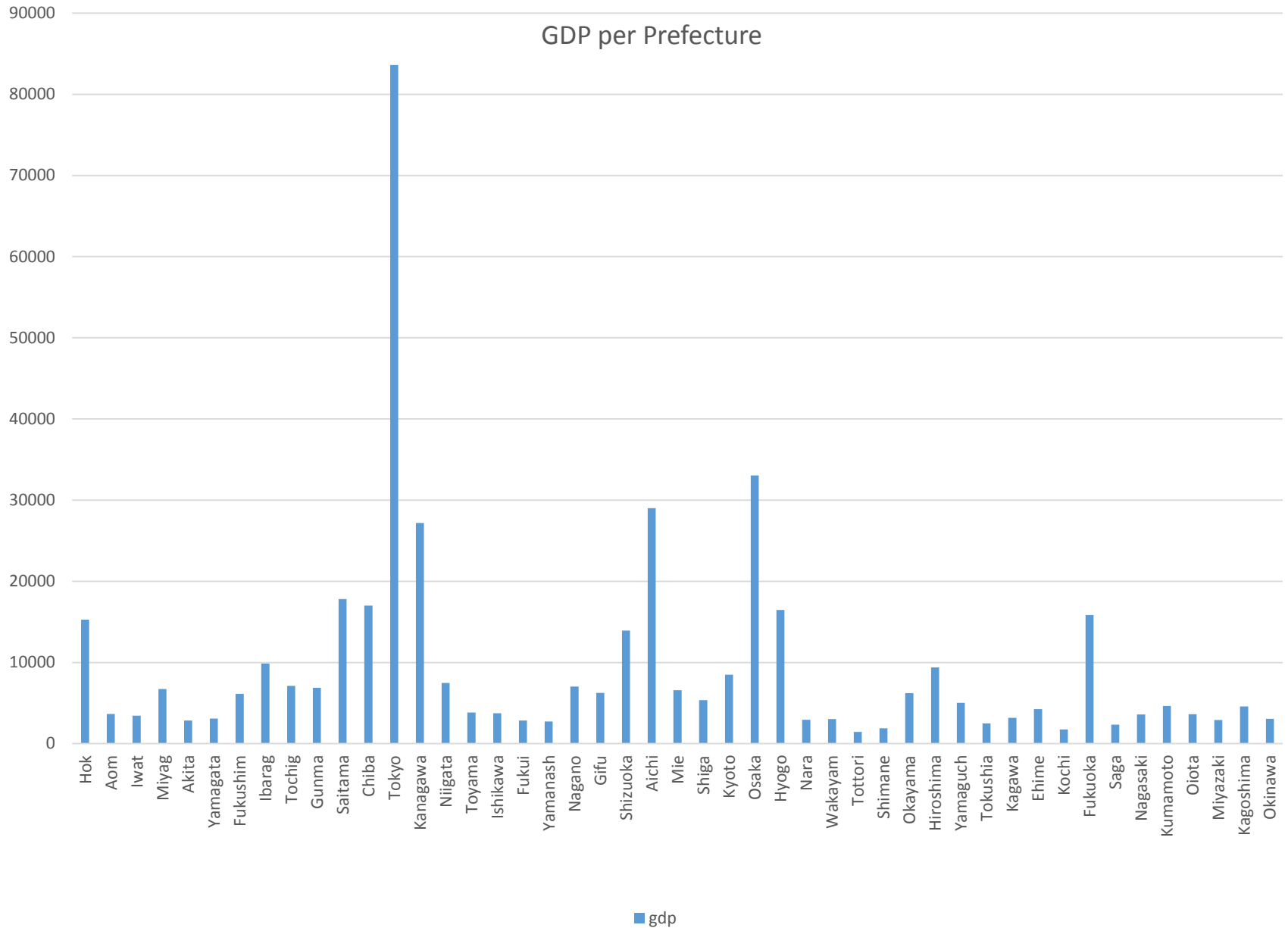
Concentration of Population

Population by Prefecture
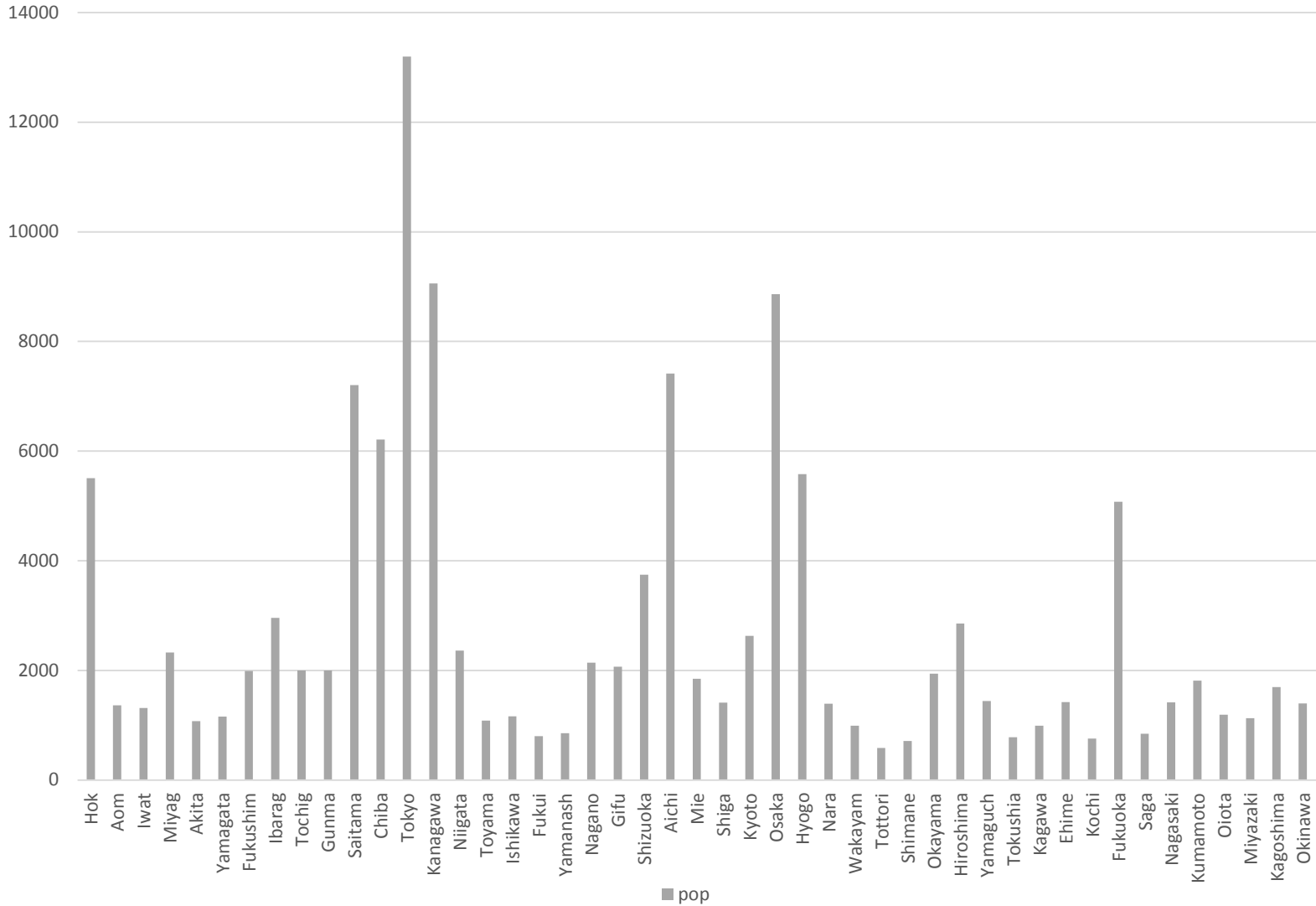
Does all this Regional Concentration of GDP and People Increase "Productivity"?

Two Measures of "Productivity":
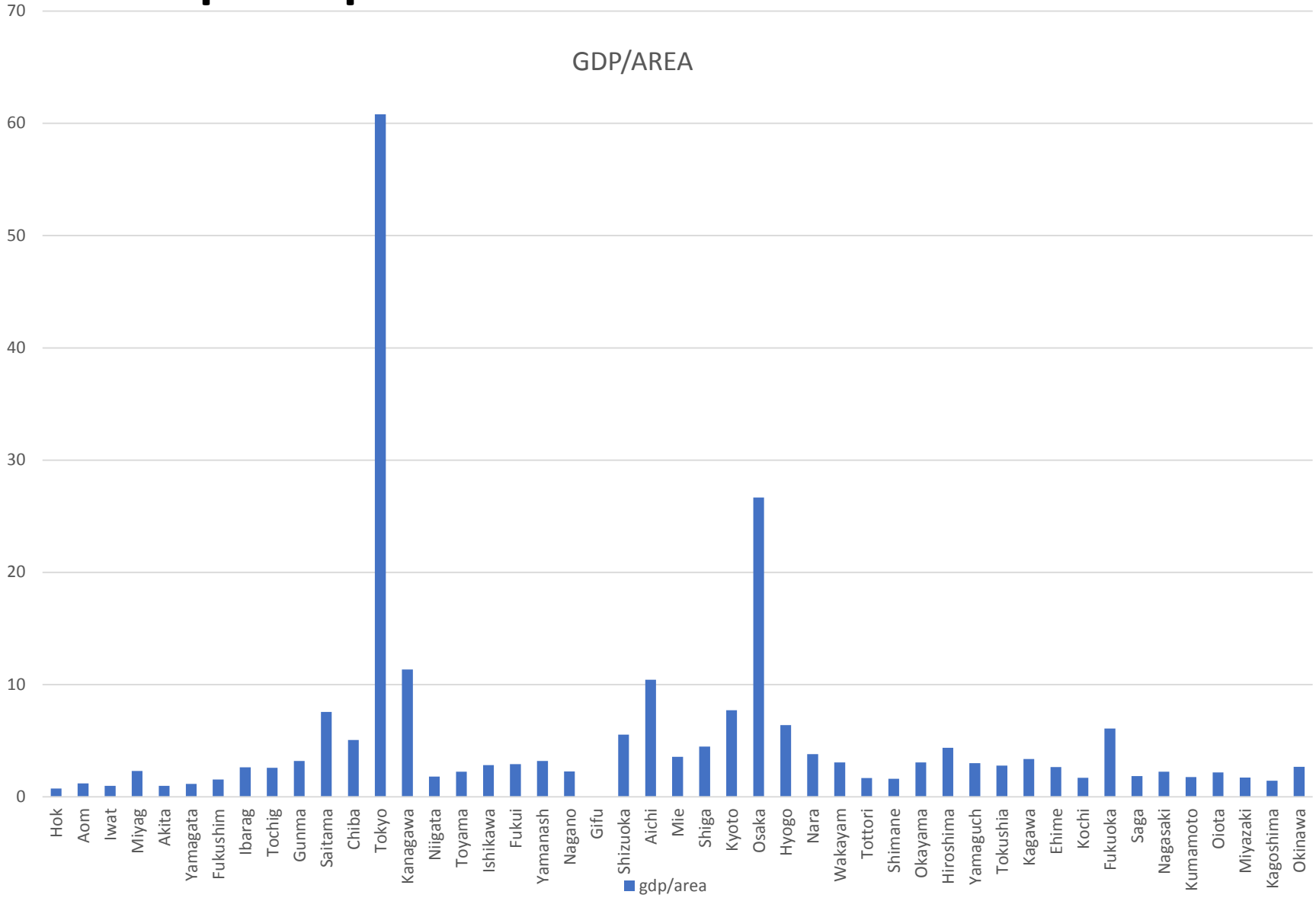Output per Area and Output per Person

Output per Area is increasing with Concentration, even without Tokyo.

The relationship between Concentration on Output per Person is less clear, especially without Tokyo.
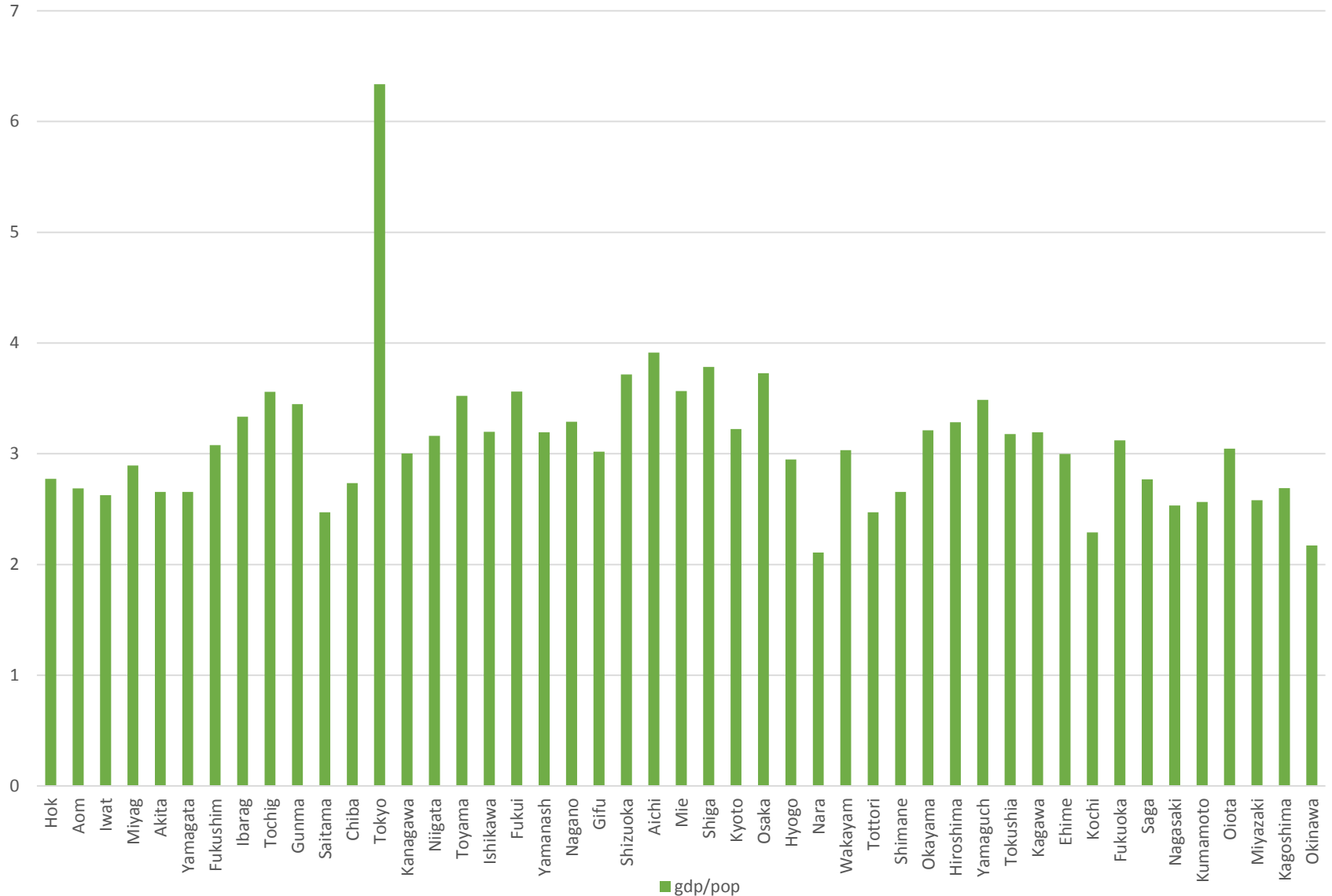
Output per Area

GDP/AREA

Labor Productivity by Region

GDP/Population

gdp/pop

9

GDP/AREA by Population

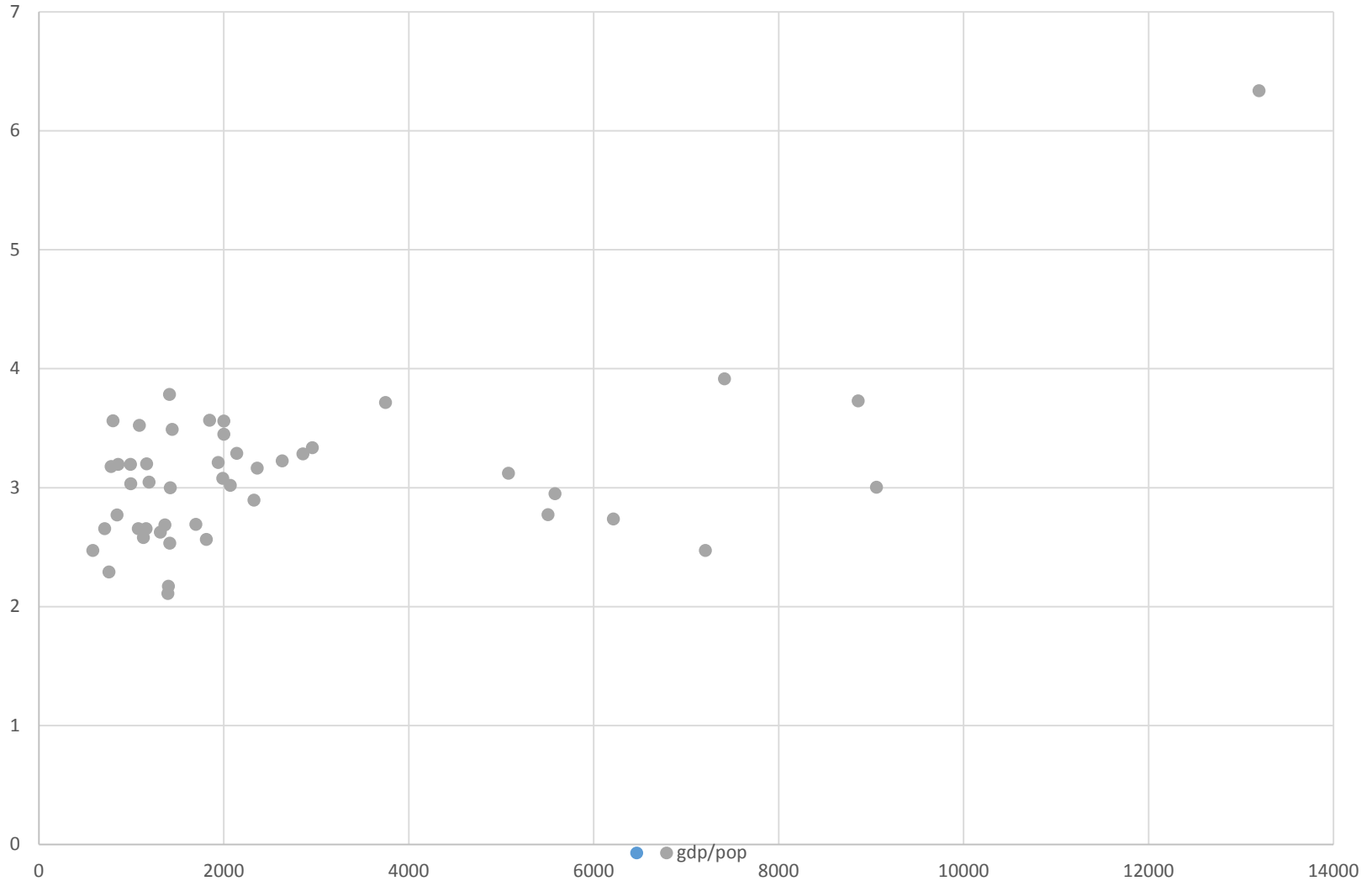GDP/AREA by Population
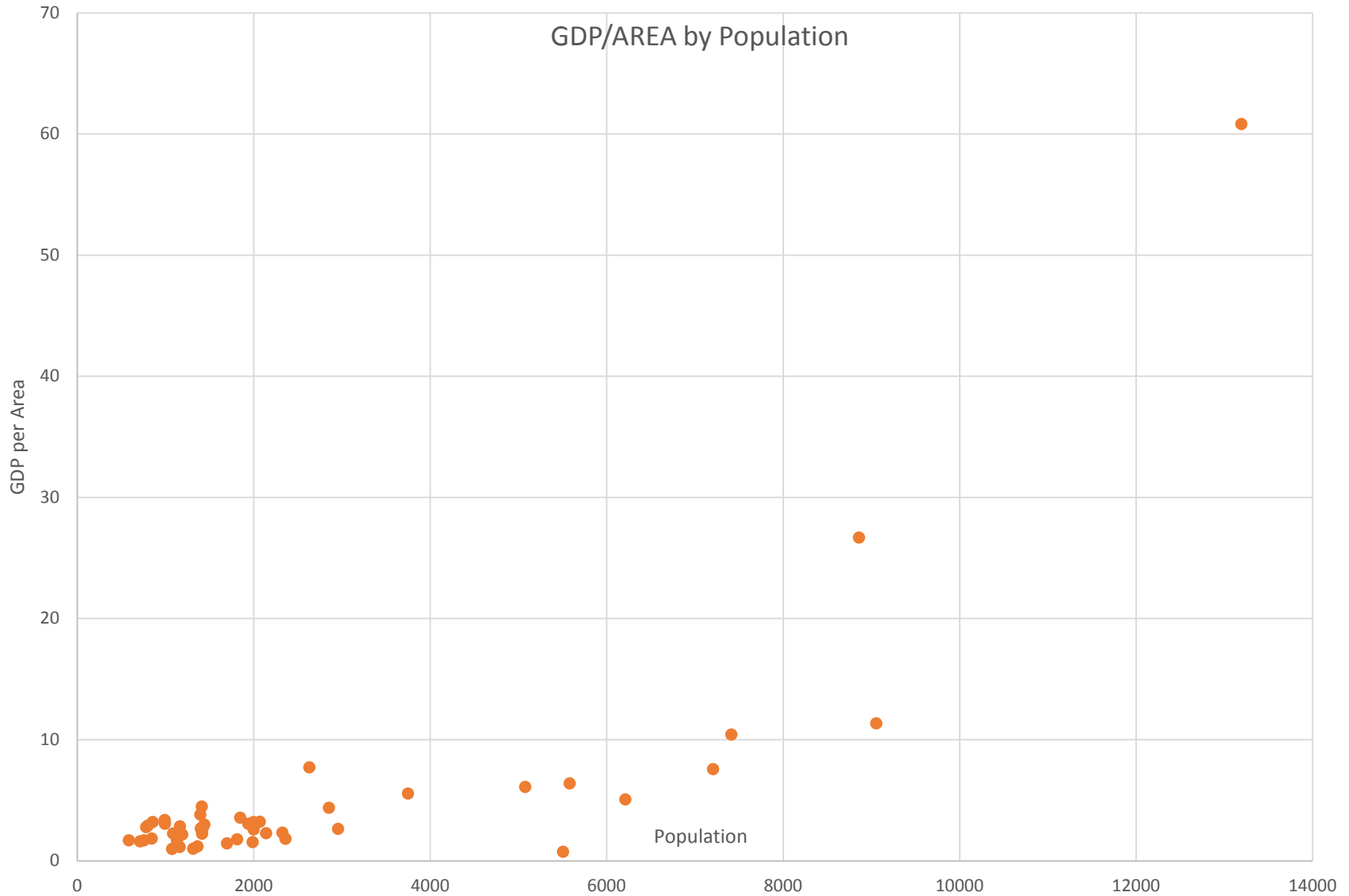
Output per Person by Population

Output per Person by Population

In sum, these simple plots suggest that more concentration of economic activity leads to higher productivity, both over areas (per squared kilometer) and per person.

These productivity effects are external to the firm. Most prefectures are too vast to be dominated by one increasing returns to scale firm.

Reasons for Agglomeration

- As just seen in the graphs, one of the most important reasons for agglomeration is the increase in productivity that occurs when factors of production concentrate, lowering the costs of production. (Increasing Returns to Scale.)

- One can imagine that when R and D workers concentrate, they can exchange ideas, improving the productivity of all firms employing these workers (Silicon Valley).

- With a large market, specialized inputs can develop, such as venture capital and specialized law firms that are beneficial to R and D intensive and Hi-tech firms.

Increasing Returns, Congestion, and Agglomeration

If Increasing Returns external to the firm is the main force for agglomeration, then at the extreme, all firms, capital, and workers will concentrate at one point or city. That is, all economic activity will concentrate in the center of Tokyo.

They do not, because there are forces of dispersion, such as congestion and the increase in the price of fixed factors such as land.

Dekle and Eaton (1999).

- Model the forces of agglomeration and dispersion in attempt to explain the geographic concentration of activity among Japanese prefectures by industry.

- In particular, finance is highly concentrated in Tokyo. Increasing Returns to Scale pushes firms and people to locate in Tokyo but high Tokyo land prices pushes firms and people to locate outside of Tokyo, in a spatial equilibrium.

Heavy Concentration of Finance compared to Manufacturing.
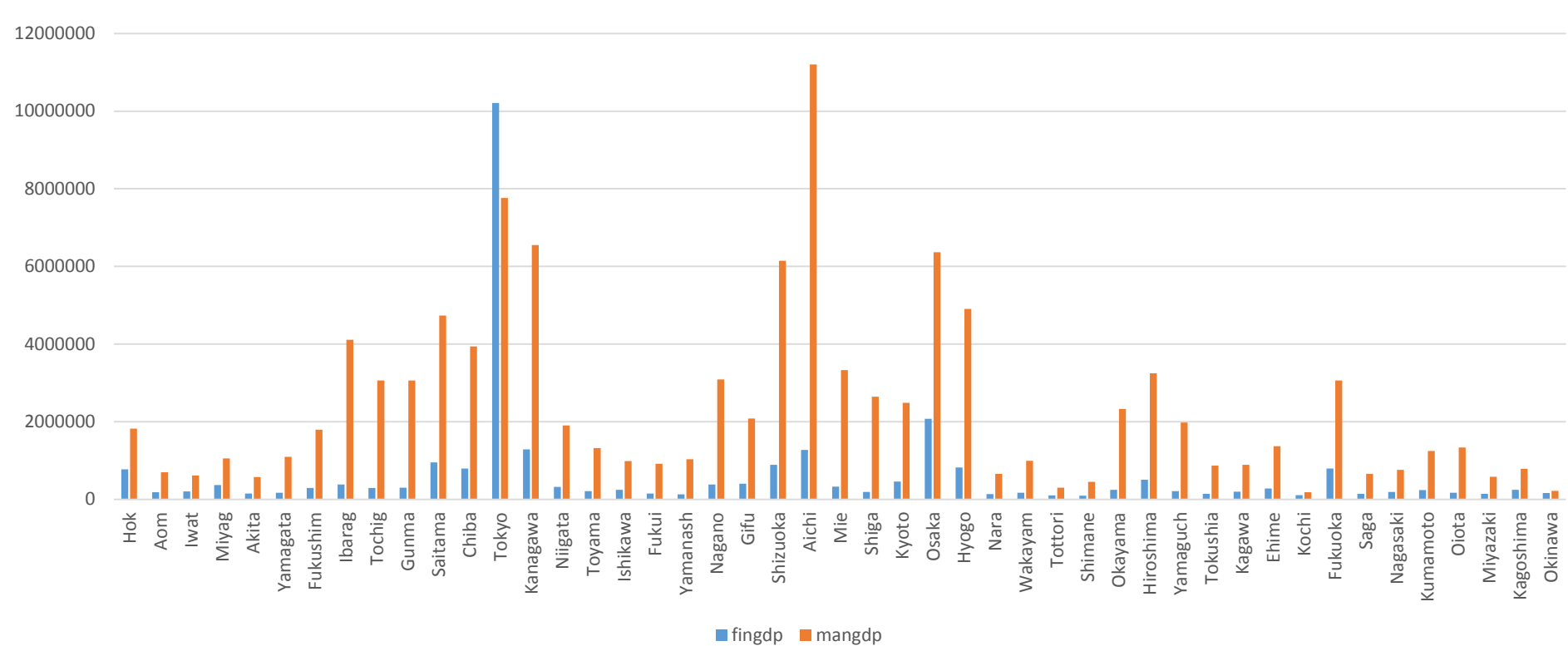
Dekle and Eaton (1999) Model and Estimation

- Urban literature (see for example, Fujita, M., 1989, book): competition for scarce land provides a centrifugal (dispersion) force to offset the centripetal agglomeration effects. Congestion effects explain the existence of multiple cities and economic activity in nonurban locations.

- If agglomeration effects are never offset by scarce land, then all economic activity in Japan will concentrate in a "black hole" and concentrate, in say, Chuo-ku ("Central-ward," Tokyo).

- Dekle and Eaton (1999) focus on using regional wages to land rents to infer increasing returns external to the firm, or "production externalites."

- They are concerned with both regional and aggregate agglomeration spillovers, how externalities decline with distance and how they spill over from one region to another.

- Look at both the manufacturing and financial industries. They use data on graphs such as above on Japanese land, wages, and output by prefecture to infer the scope and distance of agglomeration externalities.

Dekle and Eaton find that a 1 percent increase in prefectures value added (or concentration) will increase TFP by an average 0.010 percent in manufacturing and 0.012 percent in financial services.

Agglomeration spillovers are more localized in finance. A 1 percent increase in value added in all prefectures increased finance TFP by 0.016 percent, but manufacturing TFP by 0.046 percent.

Other reasons for Agglomeration (not based on increasing returns external to firm).

Krugman (1991). Firms may want to locate at locations where there is strong demand for their products. In locations with good "market access," firms can save on transportation costs and have more money to pay their workers, thereby attracting more workers.

Also, if manufacturing activity is concentrated, manufacturing supply higher and prices will be lower in such locations, attracting workers.

Immobile factor is agricultural labor, which serves as a centrifugal or dispersion force. Because of transport costs, some firms cannot be too far from this agricultural labor.

Empirical Work Estimating the Krugman model.

Huge empirical literature. Main implication they test is that in locations with good "market access," there is more value added after paying transport costs to remunerate factors factors of production, raising wages.

Much work has found a positive correlation between measures of "market access" and wages (Head and Mayer, 2006; Amiti and Camerson, 2007). They find a positive relationship.

Effect of Decline in Transport Costs on Agglomeration.

Krugman (1991) model predicts **that a fall in transport costs will lead to more agglomeration** of industries as firms can agglomerate and export goods to the agricultural sector.

Although they have no transport costs in their story, the Dekle and Eaton(1998) story suggests that a fall in transport costs will have ambiguous effects. While a fall in transport costs will tend to lead to concentration because of increasing returns, it will **also raise land prices and drive out people and industries.** High spillovers in finance in Tokyo drove out manufacturing to Tochigi.

Yet another paper, Helpman (1998) **predicts that a fall in transport costs will promote dispersion.** Like Dekle and Eaton, Helpman has a fixed factor, land, and perfectly mobile labor. However, Helpman has a limited role for increasing returns. A fall in transport costs will mean firms and workers will spread out to take advantage of low land costs, and export to each other.

Eg. Toyota, U.S.A.'s move from Torrance, CA to Texas to take advantage of cheaper housing and wages.

Contributions of Recent Quantitative Agglomeration Models Ahlenfeld, et. al. (2015) and Faber and Gaubert (2015).

Ideas are related from the earlier urban economics literature of localization spillovers, but rather than estimation, borrows tools from macroeconomics, such as calibration and indirect inference. Once parameters of these general equilibrium models are calibrated, performs counterfactual experiments.

Faber and Gaubert (2015).

Estimate a reduced form model of tourism for Mexico and finds that local tourism GDP has significant long-term positive effects on local population and wages.

Uses the reduced form estimates to calibrate by indirect inference (a GE spatial equilibrium model)
with two goods and production spillovers.

Finds classic market integration effects (by comparing counterfactuals between imposing prohibitive tourism trade and current situation) and also finds that tourism leads to sizable positive spillovers on the production of local traded goods.

Decline in Transport Costs and Agglomeration: the Case of the Japanese Silk Industry

In Feudal Tokugawa Japan, the Japanese Silk Industry was concentrated in present day Fukushima, Nagano, and Gunma prefectures, because of the abundant mulberry plants (that silk worms fed on) growing in the river banks. The industry did not spread in Japan because the transmission of sericulture farming and silk filature technology among the feudal regions was minimal.

After the Meiji Restoration (1868), rapid exogenous decline in transport costs, both domestic (abolishing of feudal system) and internationally (opening to trade).
Raw silk became a major export industry, accounting for up 60-80 percent Japanese exports in the late 19th century.

How did the location of the raw silk industry change?

However, silk never moved to the major population centers of the coastal areas, despite the importance of being close to ports and trading companies. "Market Access" was not key.

Access to mulberry plants and cocoons and a location familiar with the silk industry was key.

Eg. An attempt by the government to start a silk industry in the early 1880s in Tsukiji failed, because of rapidly disappearing land in Tokyo needed to raise mulberry trees and cocoons.

The government started the first modern silk weaving industry in Tomioka (1871), in Gunma, near the cocoons, and where there was a long tradition of silk weaving.

Silk Industry stayed in the countryside, at first mainly in Gunma and Nagano where access to mulberry trees, cocoons were key. **Did not move near to large cities or port cities like Yokohama.**

For example, to standardize quality, the Japanese government picked the first modern raw silk filature to be in Tomioka, Gunma prefecture, in 1871, where there was a long local tradition of sericulture farming and filature (taking the silk thread off the dry cocoon by wetting and respooling). The government's attempt to start a filature in Tsukiji failed--lack of mulberry trees.

Labor was first procured locally, but soon, the factory girls came from all over Japan and lived in the dormitories of Tomioka.

Access to labor, factory girls, was not important, as many girls moved to the silk factories (some silk factories employed 400-800 or more factory girls; they lived in dormitories).

Eventually, private silk factories spread throughout

Japan, as information and technology of modern silk weaving machinery and techniques spread from Tomioka and others to around the country.

Fall in transport costs—dispersion of silk industry; not concentration for "market access". Fixed factors—land nearby for growing mulberry trees important.

Tomioka Filature, 1871.

Implications of Empirical Work on Agglomeration and Growth

Romer (1986) and Lucas (1988) increasing returns external to the firm as a source of increasing productivity and growth.

These effects should be most pronounced if agents are in close physical proximity.

Dekle (1999) examines which type of concentration promotes TFP growth.

Use data by prefecture on 9 one digit industries: mining, manufacturing, mining, real estate, finance, etc.

Finds that industry concentration helps Japanese TFP growth in nonmanufacturing, but does not help in manufacturing.

Cross-fertilization of ideas (Jacobs) also helps growth in nonmanufacturers.

Conclusion: manufacturing is characterized by no or low dynamic externalities, and should continue to disperse geographically and internationally.

Hanlon, et. al. (2015)

Does similar panel data analysis on British cities, 1851-1911.

Finds strong cross-industry effects on city-employment growth, no "market access effects"—local buyers don't matter; and small own industry concentration effects don't affect city employment.