How to Use Big Data in Agricultural Policy Analysis?

Hung-Hao Chang

Oct 14, 2021

Speaker: Hung-Hao Chang

- **Current Position**: Professor, Dept. Agricultural Economics, NTU.
- **Education**: Ph.D, Agricultural Economics, Cornell University, USA.
- **Research Interest**: Agricultural Policy Evaluation, Agribusiness, Food and Consumption Economics, Digitalization in Agriculture.
- **Academic Activities**:

Co-Editor, *Food Policy* (FP)
Managing Editor, *Agricultural Resource and Economics Review*
Associate Editor, *Agricultural Economics*
Associate Editor, *Applied Economics Perspectives and Policy*

- **Website**: http://homepage.ntu.edu.tw/~hunghaochang/

What is Digital Technology ?

- Definition in OECD (2014):

ICTs *[information communication technologies], including the Internet, mobile technologies and devices, as well as* ***data analytics*** *used to improve the generation, collection, exchange, aggregation, combination, analysis, access, searchability and presentation of digital content, including for the development of services and apps.*

- Types of ICTs:

-- Platform, Sensor, The Internet of Things (IoT), Robot, Big Data, Cloud Computing, Artificial Intelligence, Black Chain.

-- **Big Data** is the core and driving engine of the ICTs.

ICT and Rural Development

- ICT affects our life in many aspects.

- ICT can overcome the territory barrier of the rural households, and increase their access to better information and knowledge.

- Education inequality

-- Economic inequality

-- Health inequality

-- Intergenerational inequality

2019 OECD Rural Development Conference

HOME | PROGRAMME | DOCUMENTS | SPEAKERS | BACKGROUND

The Conference

24-26 September 2019 | Seoul, Korea

The 12th OECD Rural Development Conference shared leading practices from across the world on how rural policies can support rural business to embrace new technologies and access global markets, deliver services and amenities in new ways, and mobilise rural assets (renewable energy, natural resources, land and know-how) to create jobs.

The conference took place over two days, followed by an optional field trip to nearby Wanju in Jeonbook Province to demonstrate local approaches to rural development and well-being.

Watch the video of the conference highlights ▶

Main theme: **How to use ICT to improve rural life?**

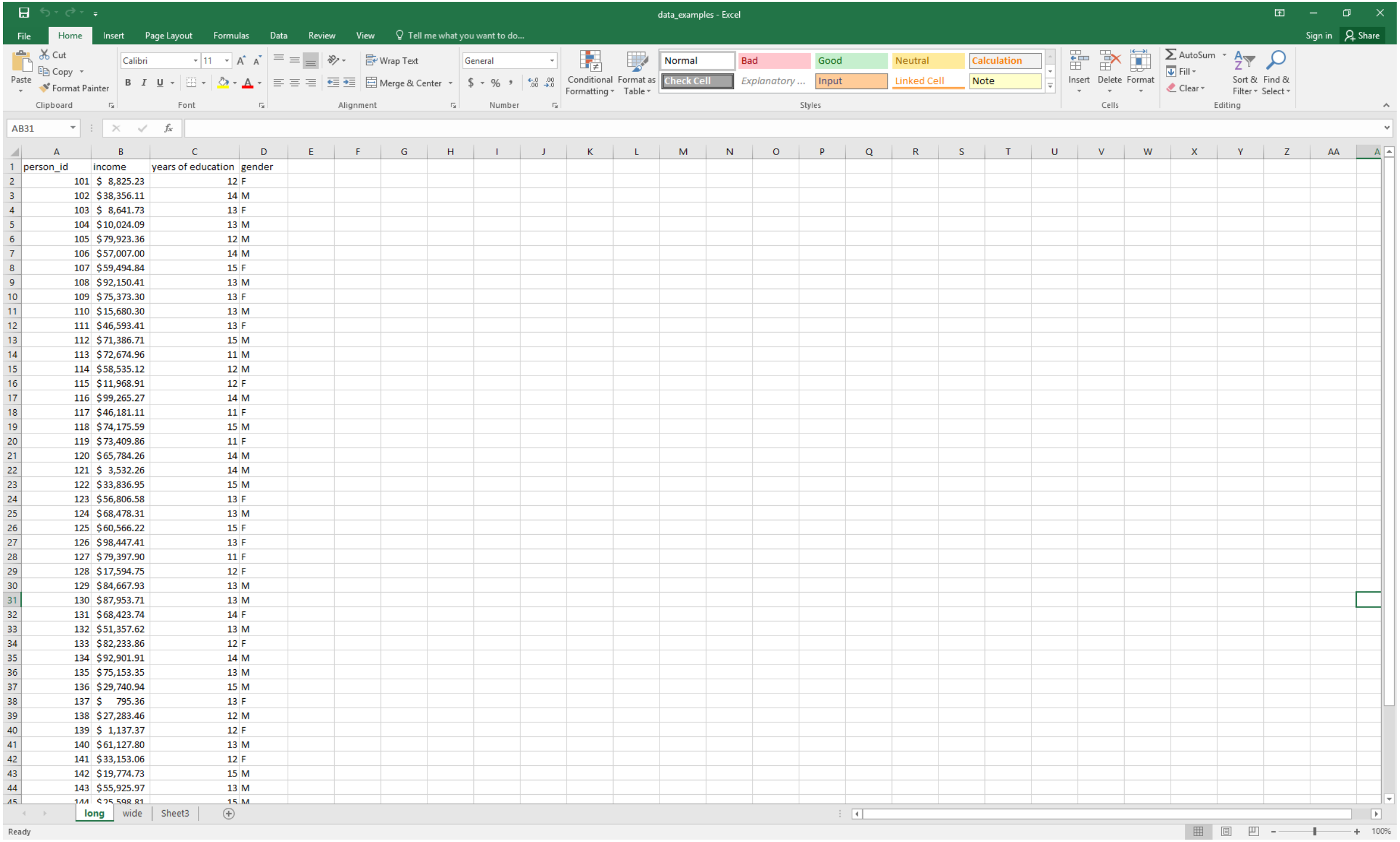
Promoting ICT in Taiwan

Since 2014, the government of Taiwan has implemented new digital technology policies:

- Open Data
- Big Data
- Crowdsourcing

What is Big Data?

- 4V: Volume; Velocity; Variety; Veracity/Reality
- Non-Structural Data
- Population Representative



data_examples - Excel

File Home Insert Page Layout Formulas Data Review View Tell me what you want to do... Sign in Share

Paste Cut Copy Format Painter | Calibri 11 | Wrap Text Merge & Center | General | Conditional Formatting Format as Table | Normal Bad Good Neutral Calculation Check Cell Explanatory ... Input Linked Cell Note | Insert Delete Format | AutoSum Fill Clear | Sort & Filter Find & Select

Clipboard Font Alignment Number Styles Cells Editing

AB31

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	A
1	person_id	income	years of education	gender																								
2	101	$ 8,825.23	12	F																								
3	102	$38,356.11	14	M																								
4	103	$ 8,641.73	13	F																								
5	104	$10,024.09	13	M																								
6	105	$79,923.36	12	M																								
7	106	$57,007.00	14	M																								
8	107	$59,494.84	15	F																								
9	108	$92,150.41	13	M																								
10	109	$75,373.30	13	F																								
11	110	$15,680.30	13	M																								
12	111	$46,593.41	13	F																								
13	112	$71,386.71	15	M																								
14	113	$72,674.96	11	M																								
15	114	$58,535.12	12	M																								
16	115	$11,968.91	12	F																								
17	116	$99,265.27	14	M																								
18	117	$46,181.11	11	F																								
19	118	$74,175.59	15	M																								
20	119	$73,409.86	11	F																								
21	120	$65,784.26	14	M																								
22	121	$ 3,532.26	14	M																								
23	122	$33,836.95	15	M																								
24	123	$56,806.58	13	F																								
25	124	$68,478.31	13	M																								
26	125	$60,566.22	15	F																								
27	126	$98,447.41	13	F																								
28	127	$79,397.90	11	F																								
29	128	$17,594.75	12	F																								
30	129	$84,667.93	13	M																								
31	130	$87,953.71	13	M																								
32	131	$68,423.74	14	F																								
33	132	$51,357.62	13	M																								
34	133	$82,233.86	12	F																								
35	134	$92,901.91	14	M																								
36	135	$75,153.35	13	M																								
37	136	$29,740.94	15	M																								
38	137	$ 795.36	13	F																								
39	138	$27,283.46	12	M																								
40	139	$ 1,137.37	12	F																								
41	140	$61,127.80	13	M																								
42	141	$33,153.06	12	F																								
43	142	$19,774.73	15	M																								
44	143	$55,925.97	13	M																								
45	144	$25,598.81	15	M																								

long wide Sheet3

Ready

100%

絕佳採光景觀雙人床 西門町交誼空間 獨立衛浴 唐吉訶德電影街 I Play Inn 愛玩客

★ 4.64 (28 reviews) · Wanhua District, Taipei, Taiwan

Share Save




Private room in hostel hosted by I Play Inn

2 guests · 1 bedroom · 1 bed · 1 private bathroom

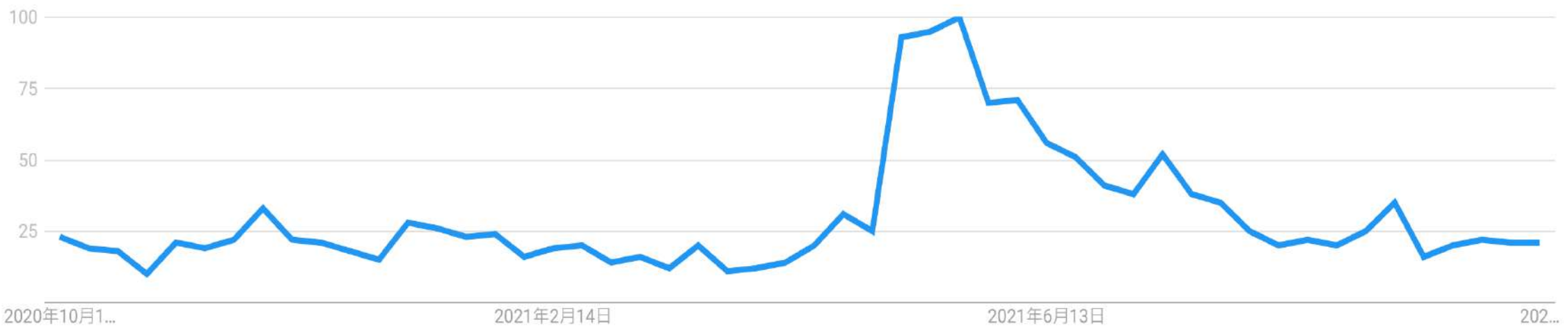
£15 / night ★ 4.64 (28 reviews)

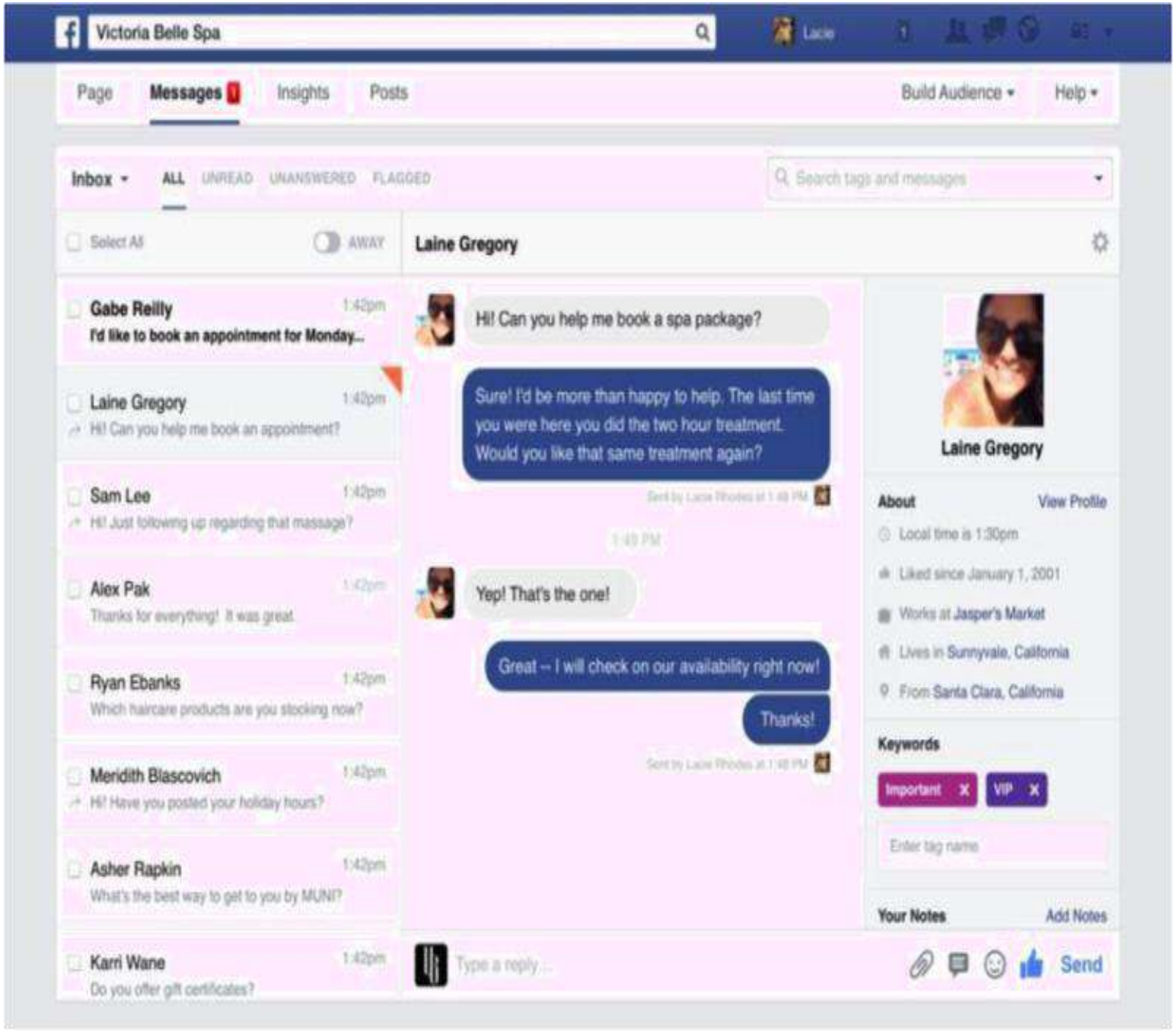
COVID-19
搜尋字詞

＋ 比較

台灣 過去 12 個月 所有類別 Google 網頁搜尋

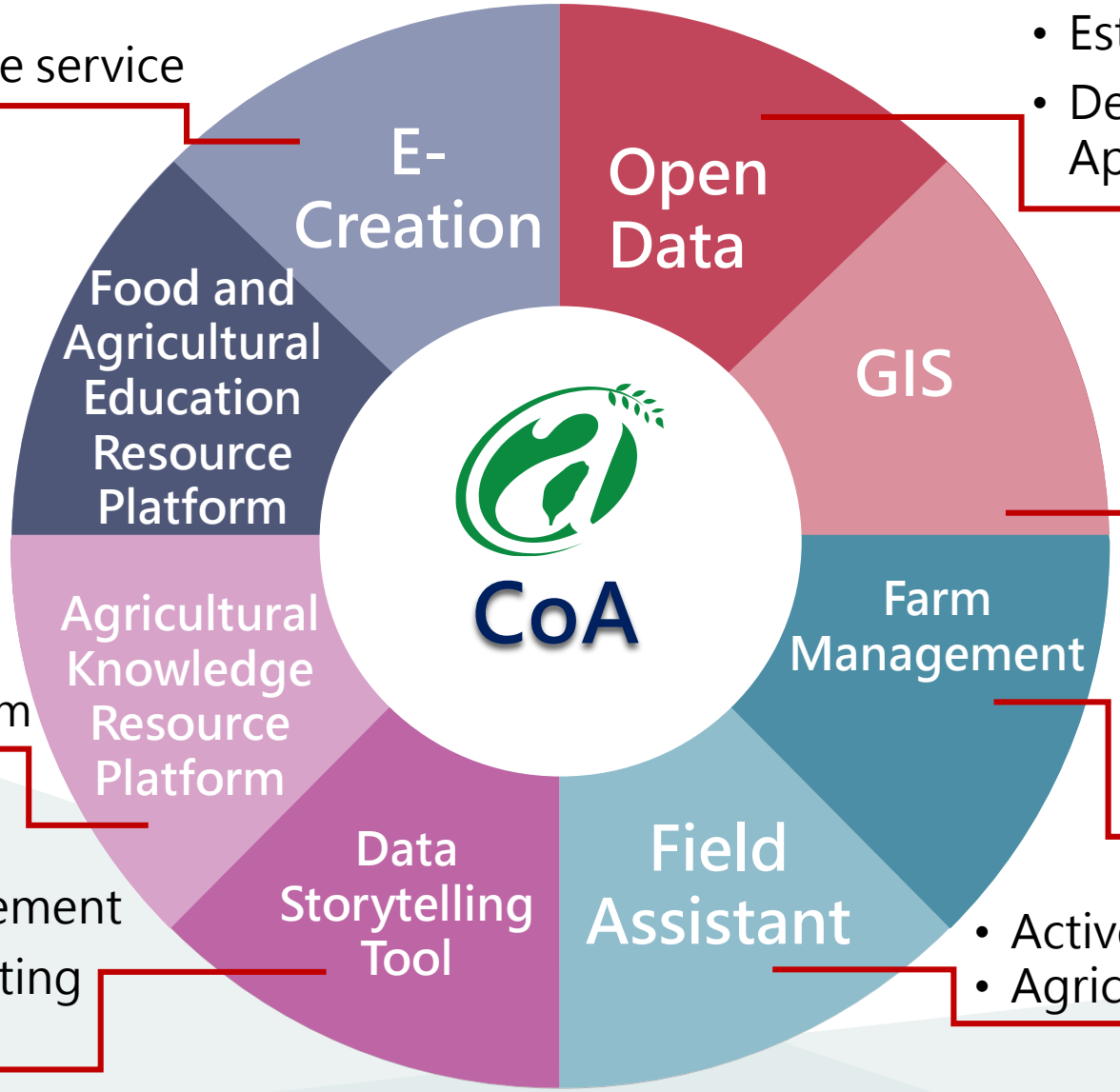
搜尋熱度的趨勢變化




Victoria Belle Spa
Lacie
Page
Messages 1
Insights
Posts
Build Audience
Help
Inbox
ALL
UNREAD
UNANSWERED
FLAGGED
Search tags and messages
Select All
AWAY
Laine Gregory
Gabe Reilly 1:42pm
I'd like to book an appointment for Monday...
Laine Gregory 1:42pm
Hi! Can you help me book an appointment?
Sam Lee 1:42pm
Hi! Just following up regarding that massage?
Alex Pak 1:42pm
Thanks for everything! It was great.
Ryan Ebanks 1:42pm
Which haircare products are you stocking now?
Meridith Blascovich 1:42pm
Hi! Have you posted your holiday hours?
Asher Rapkin 1:42pm
What's the best way to get to you by MUNI?
Karri Wane 1:42pm
Do you offer gift certificates?
Hi! Can you help me book a spa package?
Sure! I'd be more than happy to help. The last time you were here you did the two hour treatment. Would you like that same treatment again?
1:49 PM
Yep! That's the one!
Great -- I will check on our availability right now!
Thanks!
Type a reply...
Send
Laine Gregory
About
View Profile
Local time is 1:30pm
Liked since January 1, 2001
Works at Jasper's Market
Lives in Sunnyvale, California
From Santa Clara, California
Keywords
Important
VIP
Enter tag name
Your Notes
Add Notes

Big Data of Agriculture in Taiwan

Big Data in Agriculture

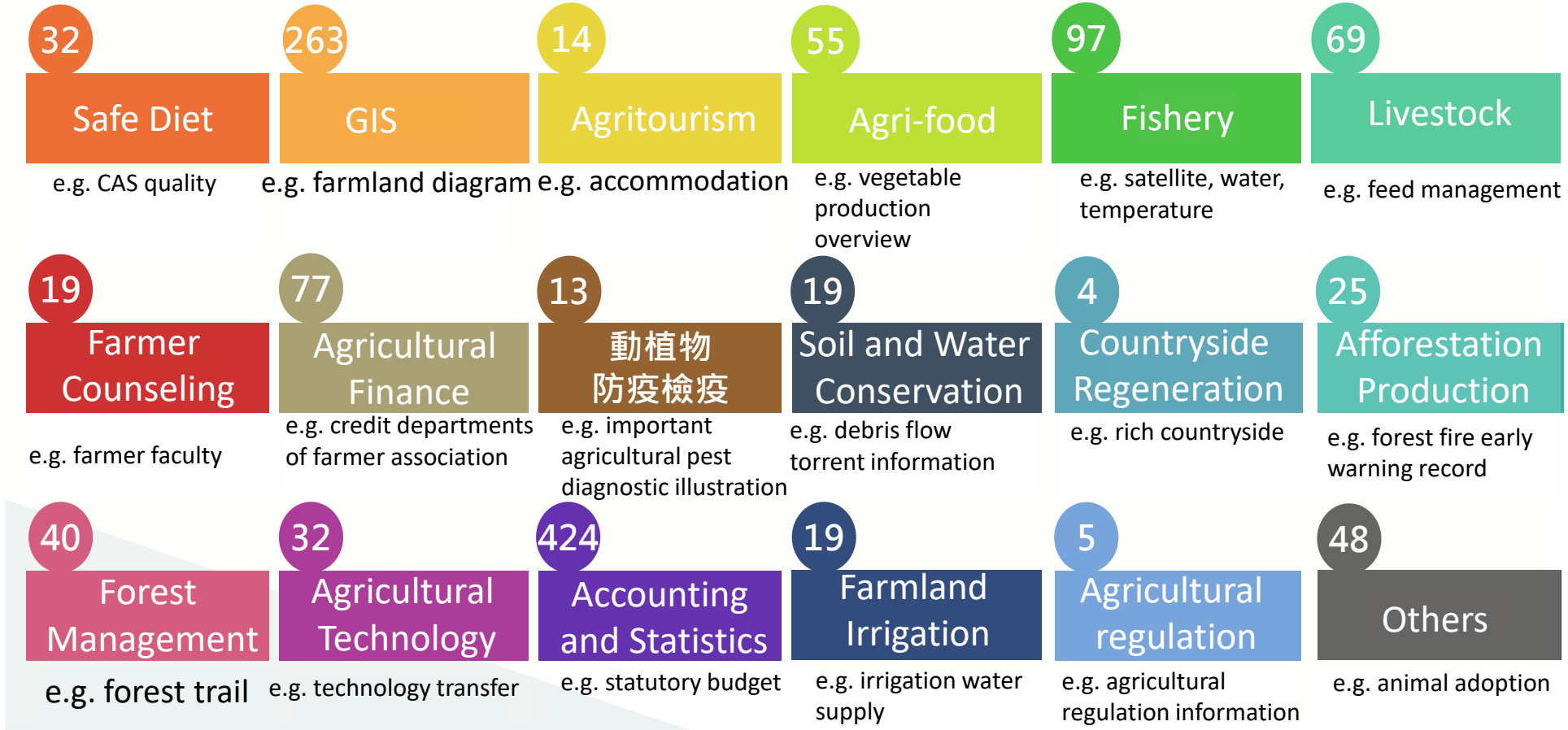


- Agricultural digital diverse service
- Establish OPEN API
- Develop Agricultural Application System
- Agricultural Production and Farmland Checking Map
- Crowdsourcing
- Filed Management
- Active Information Transfer
- Agricultural Service Line
- Storytelling Key Element
- Agricultural Marketing Assistant
- Agricultural Knowledge Website
- Agricultural Online Museum

13

Big Data in Agriculture

Website of open data http://data.coa.gov.tw



In total, 18 category · 1300 item

14

Agriculture GIS of Farmland

Farmland use is categorized into 35 items and 13 types

15

Application of Big Data
-- A New World of Visualization

Example of Solving Food Safety Problem

Distribution of factory wastewater complain cases

資料來源：行政院環境保護署

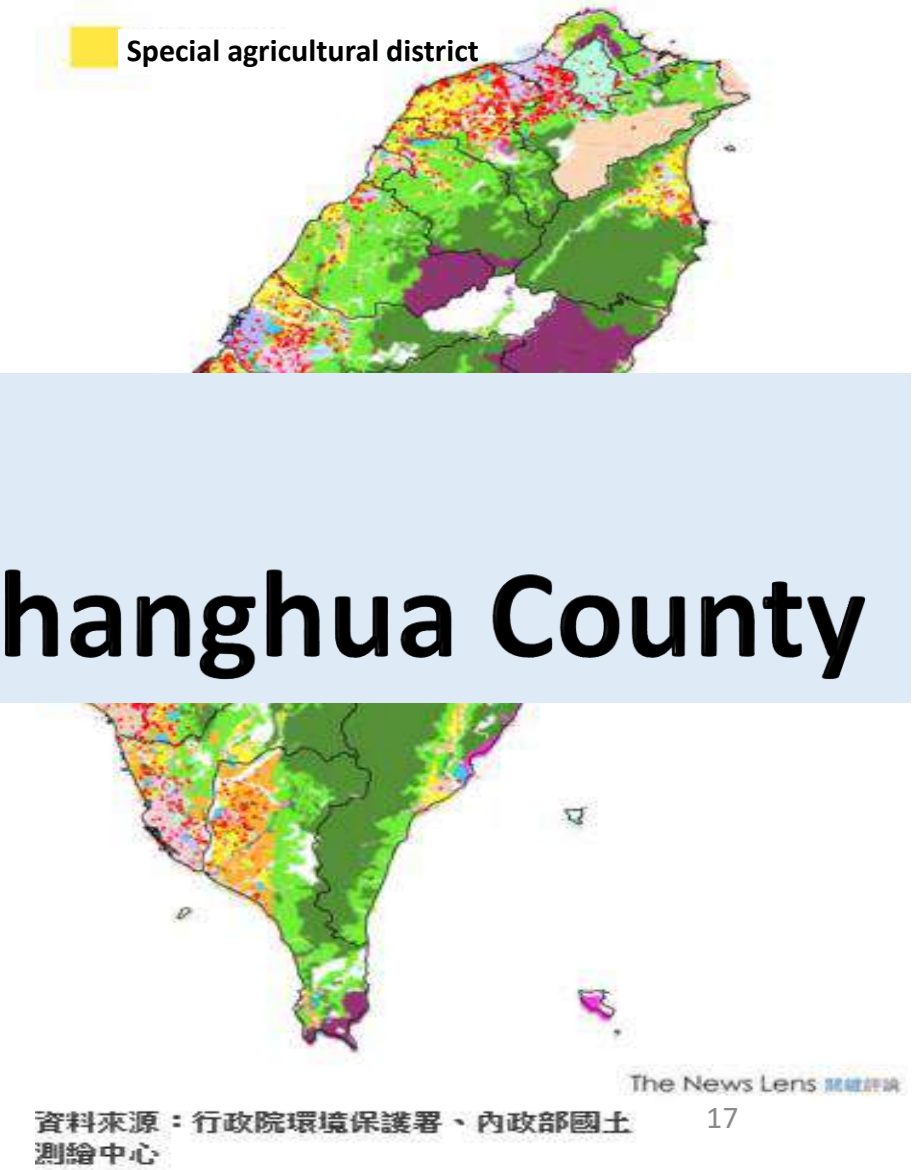
Types of land use

Special agricultural district

資料來源：內政部國土測繪中心

Mapping

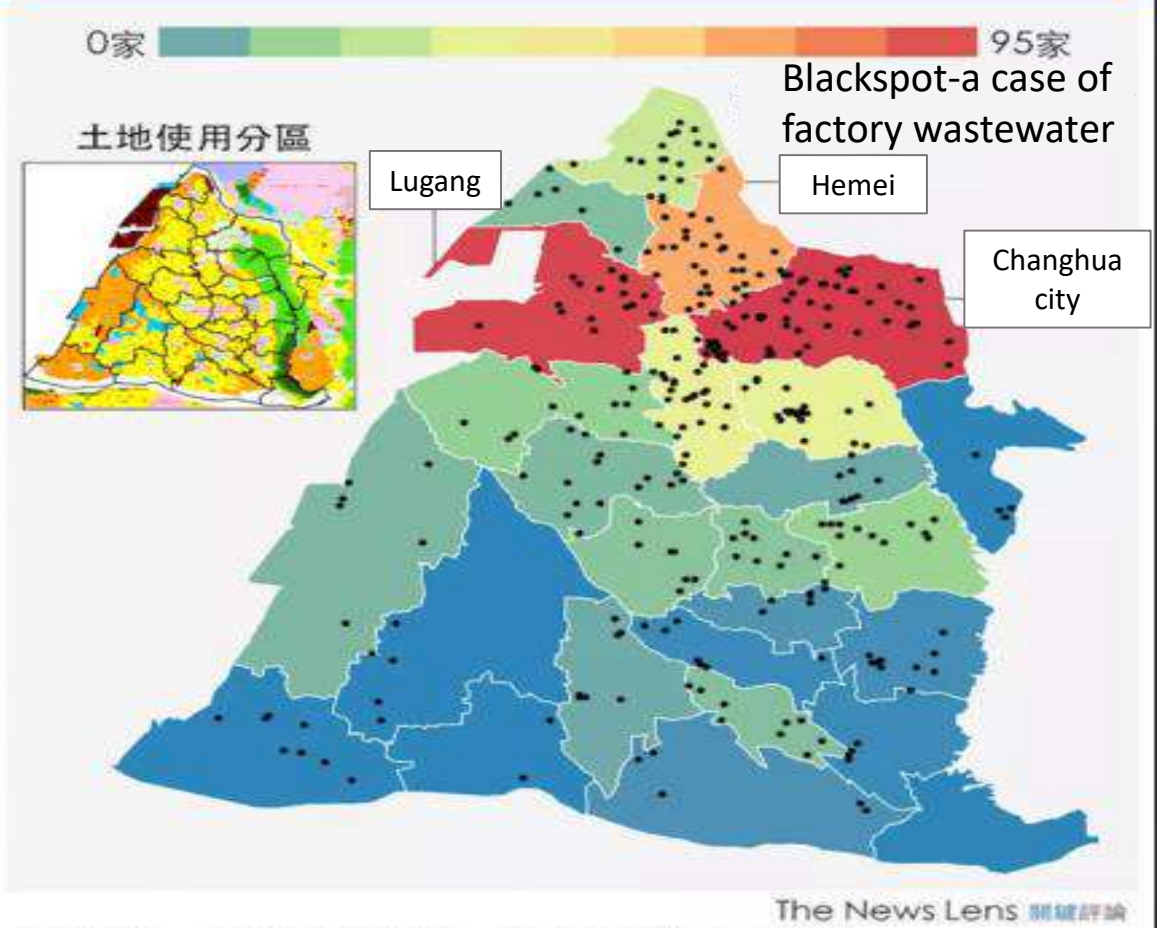
Special agricultural district



資料來源：行政院環境保護署、內政部國土測繪中心

Farmland
with serious wastewater in Changhua County

In which district there are the most metal processing factories



資料來源：行政院環境保護署、經濟部工業局、內政部國土測繪中心

- Map color-numbers of metal processing factories
- Land use division-Hemei town and Lugang town are special agricultural production districts.

farmland and metal factories are closely adjacent

Using Big Data analysis, we can explore the potential problem.

The Rural Revitalization Program (RRP)

-- The RRP was launched in 2010 to revive the economic vitality of rural farming communities as they suffer a steady outflow of people and reduced competition.

-- The RRP aims to improve agricultural life across Taiwan while preserving the ecological environment.

Policy Contents of the RRP

-- Village residents must complete a series of training courses before submitting a community revitalization plan. The purpose of the training is to help residents better understand the village's resources and unique character so that they can draft an action plan and discuss the community's vision—discussions that will expand participation and hopefully shape a common consensus and core values.

-- The RRP has trained *116,594 individuals at 2,141 communities nationwide*—more than half of communities in Taiwan. The 460 villages that have completed all courses have begun submitting revitalization plans.

County View Before the RRP

- Disorganized advertisements are posed almost everywhere.
- Business-orientated restaurants dominated the entire area.

Example of the RRP

- Participation of all residents
- Try to find the programs and come up with solutions by all residents

Community Meeting

Cleaning

Find local resource

Returning immigrates

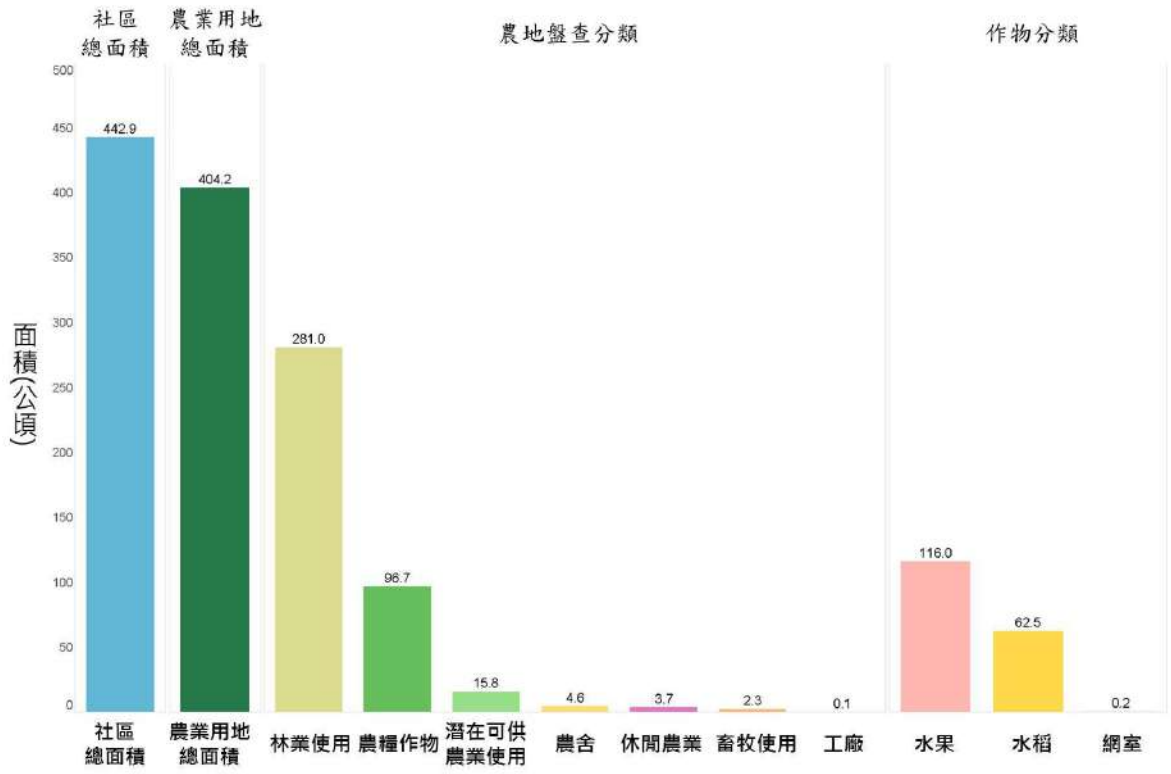
Before

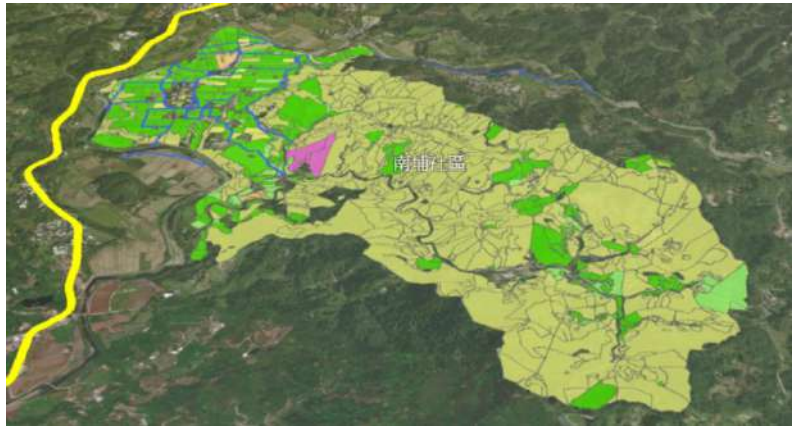
After

Example: Land analysis of rural re-generation community

- Select the area of rural revitalization community
- Retaining farmland inventory and trial results
- Use spatial and information of land registration to export graph and statistics

[Nanpu community]



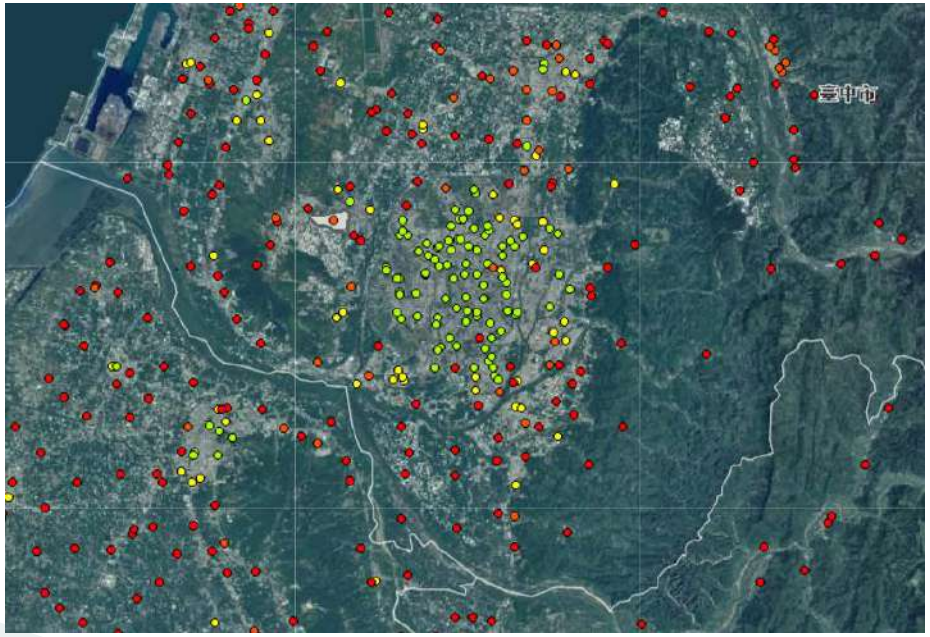


24

Example: Pesticide use control on children health

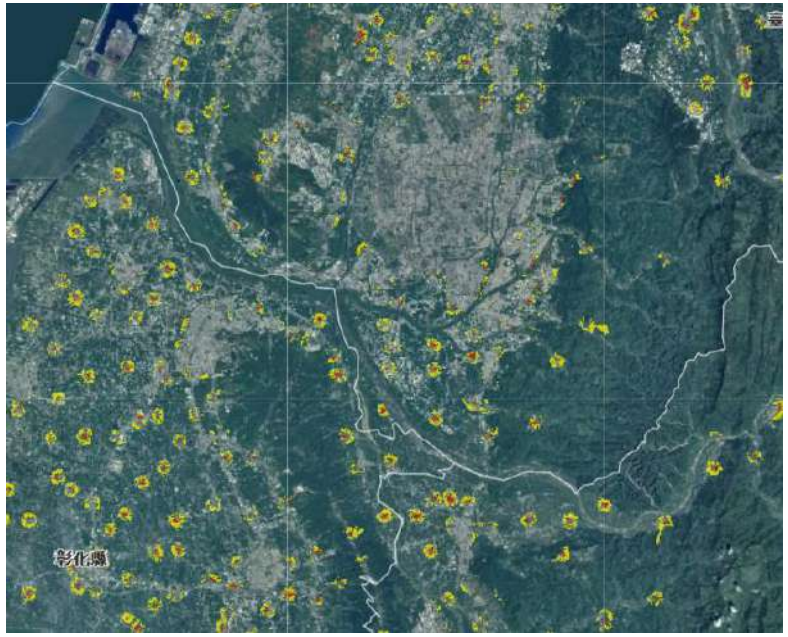
- Schools near farmland

  (30m, 100m, 300m)



- Farmland near schools

  (30m, 100m, 300m)



- Sources of data
  - Elementary and junior high school：open data of Ministry of Interior。
  - Farmland：Farmland inventory of agricultural crops, recreational farms, potential agricultural use and farmhouses

25

Food Product Traceability

■ Product Traceability-provide cultivation product traceability webpage

26

Successful Agribusiness Case

AgriWeather

AgriWeather

Media Interview

Business Model / Service

IOT in the field

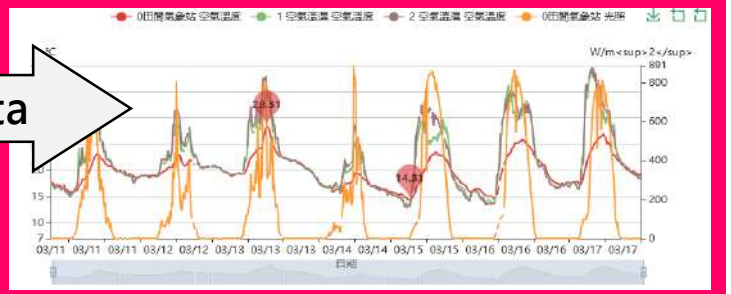
Data

Platform

- Updated Weather Data
- Alarming and Advice
- Monthly Report

Data

Data Analysis

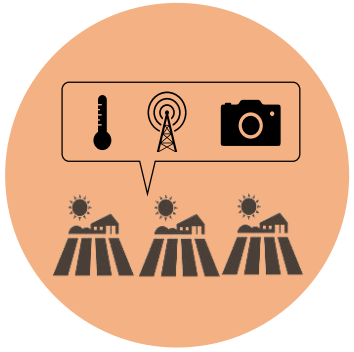


Knowledge

- Growth Path
- Harvest Prediction
- Agriculture Consulting

Benefits To Clients

Trading Company



AgriWeather

Farm Management Solution

Real-time Monitoring

Data Application

Reducing Risk

Brand Differentiation

Farm Manager

Phone Call

Visiting Farms

-20% /y

Profit Loss

Reduce

Labor Cost

AgriWeather

- POMELO

- PADDY RICE

- PINEAPPLE

Case Study

AgriWeather

Case 1: Fruit - Pomelo

Automatic Irrigation System

- save irrigation water
- increase production

AgriWeather

April to June, 2021
Save irrigation water from 1,099,494 L to 26,664 L.
Increase production from 160,000 tons to 200,000 tons.

Water Saving
↓97.5%

High quality Production
↑20%

Good that can put on the market
↑ 30%

AgriWeather

Water Saving
↓97.5%

High quality Production
↑20%

Good that can put on the market
↑ 30%

AgriWeather

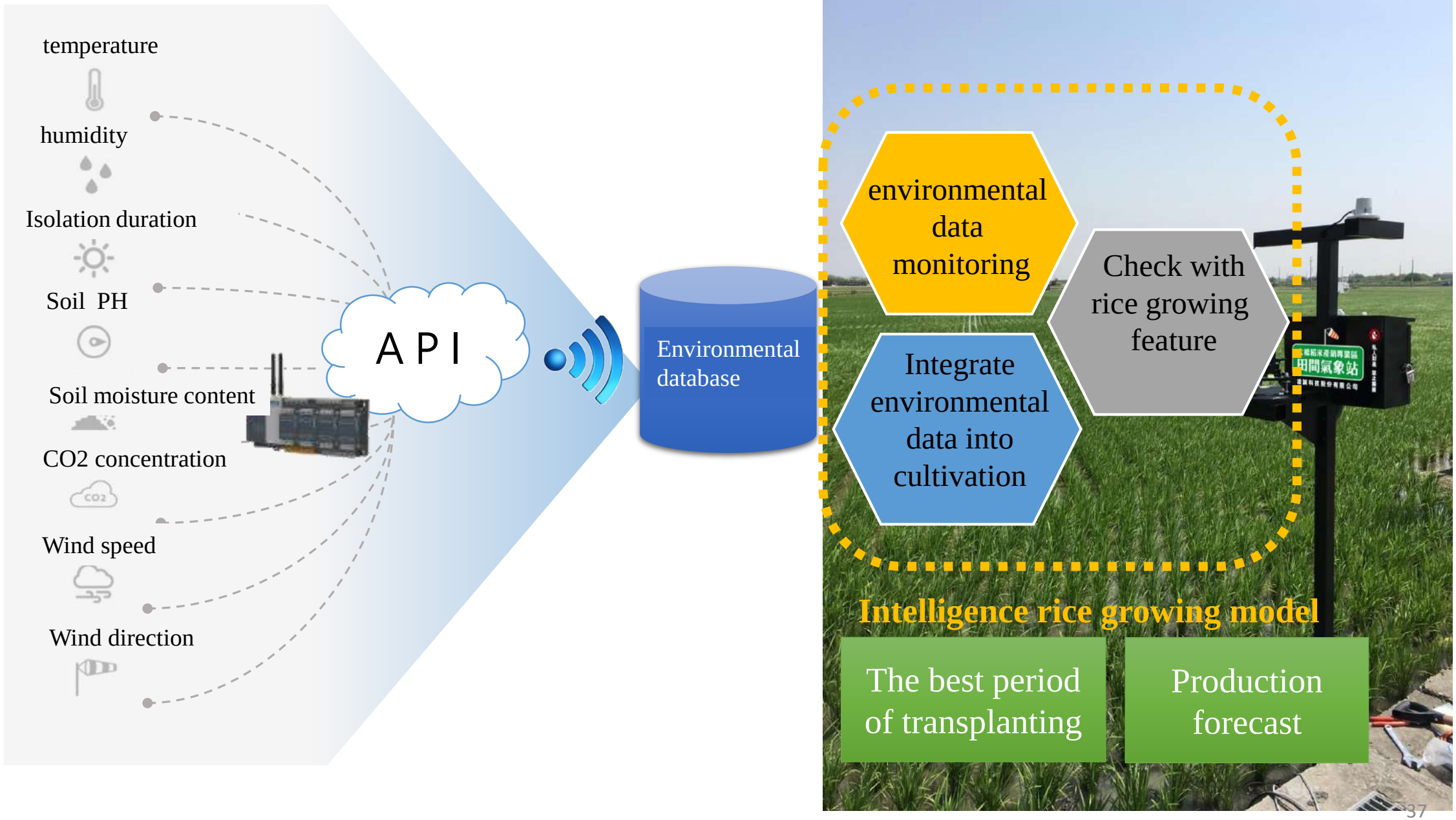
Case 2: Paddy Rice

Real-time Monitoring System

- fertilizer management
- quality improvement

AgriWeather

Environmental monitoring Using Sensor System



Data Used in Farm Decision Making

Paddy rice from
Taitung, Taiwan

Quality improved

Avoid fertilizer damage

Farmer shared experience using our IoT devices on social media. He makes decisions of fertilization according to data of soil EC. This help him avoid fertilizer overuse and improved rice quality.

AgriWeather

Successful story of a rice company

Top Special Rice Production and Marketing Area (contract farming)

Build the rice production and marketing area (company BBS)

Rice house and nearly 600 professional farmers form the BBS rice production and marketing area. The quality control is implemented by the “planting good rice and eating good rice”. The rice production technology has won the first place in the top rice production and marketing area.

Rice Varieties of Contract Farming

World top rice
Koshihikari

International new product
Fu rice/
Taichung 194

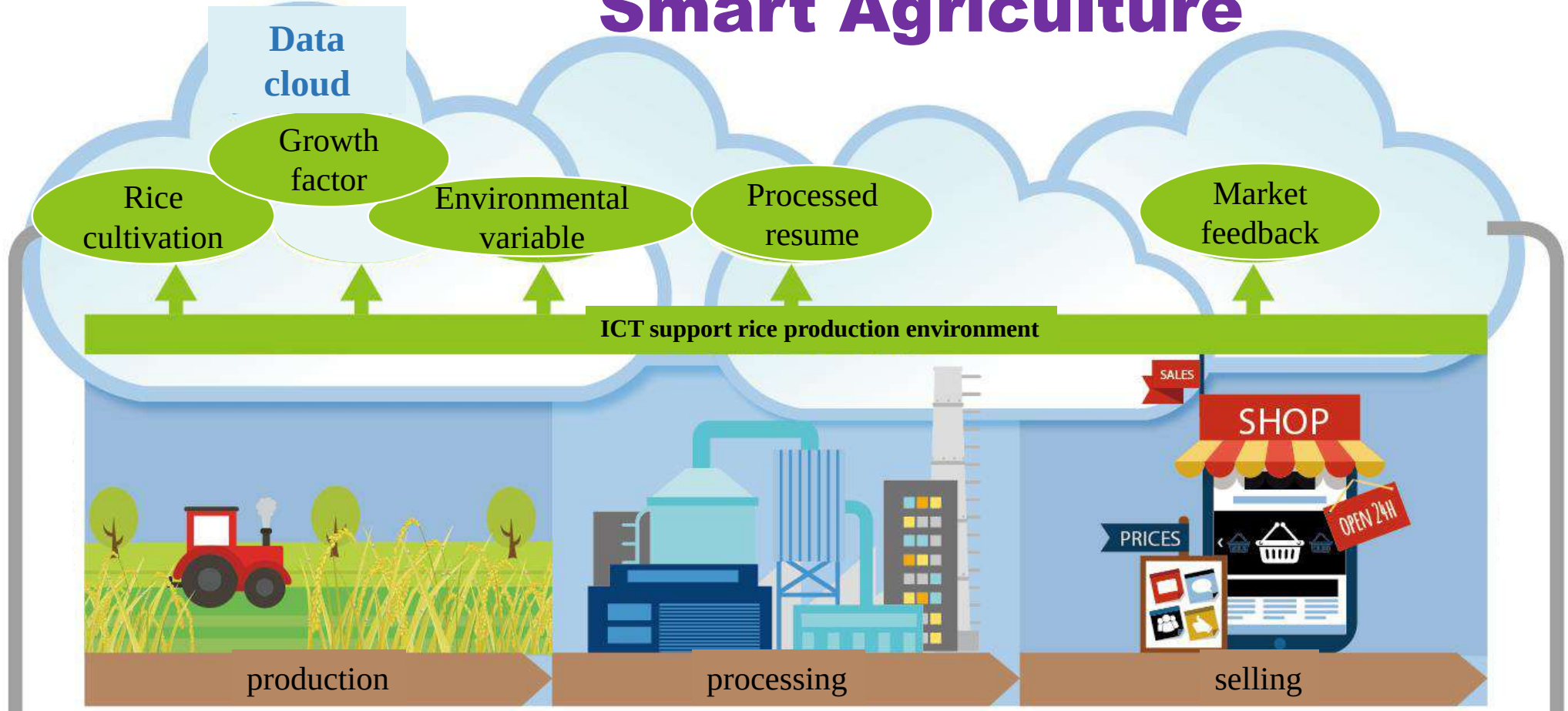
Taiwan champion rice
Lu-Ming rice/
Tainan 16

Taiwan popular rice
Taiken 9

Taiwan Fragrant rice
Kaohsiung 147

Taiwan best seller
Tainan 11

Smart Agriculture



Data mining

Data mining

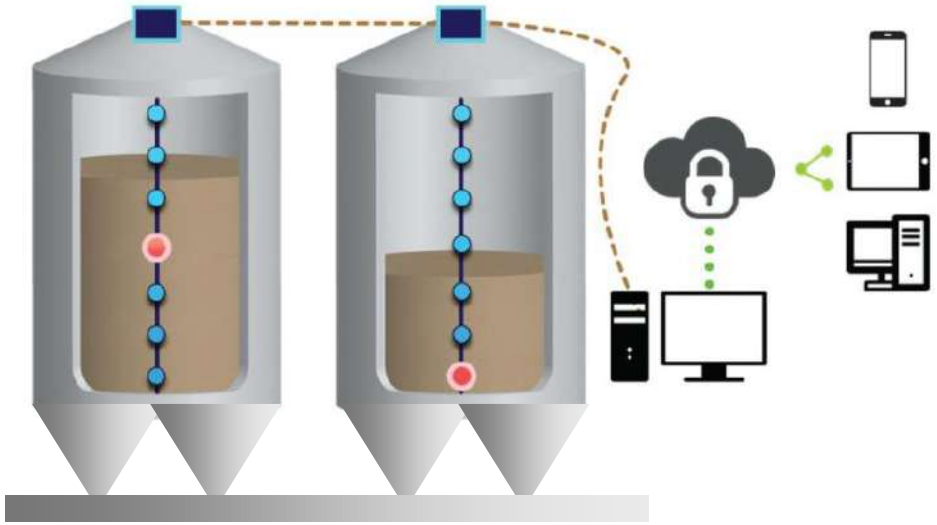
Standardized production model of rice cultivation

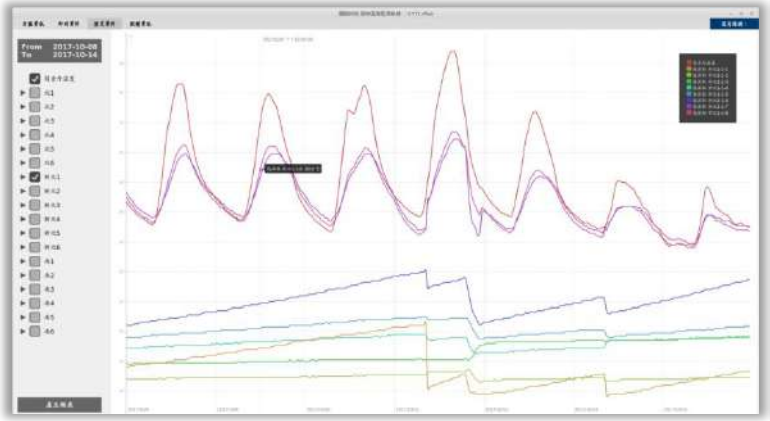
Traceability 2.0 (production + processing)

Demand forecast

Feedback to production plan

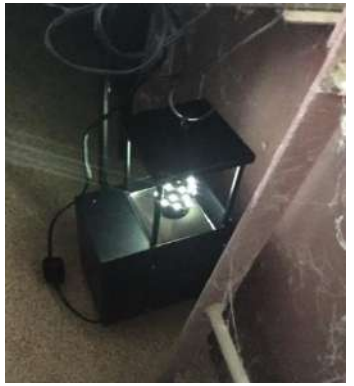
Intelligence Storage Management





Immediate monitoring of storage temperature

Immediate returning of insect pest in storage



Direct-Sales-to-Business-Consumer Marketing

Social Media Network and Advertisement

大橋越光米

Visit the Rice Field ? Agritourism !

My Research Using Big Data

-- two policy papers

Volume 95, Issue 4

July 2013

Old Farmer Pension Program and Farm Succession: Evidence from a Population-Based Survey of Farm Households in Taiwan

Hung-Hao Chang ✉

American Journal of Agricultural Economics, Volume 95, Issue 4, July 2013, Pages 976–991,

https://doi.org/10.1093/ajae/aat004

Published: 06 March 2013

Farmers in Taiwan

What Does the Government Need? Identify False Farmers Using Big Data

- The total number of farm workers are 0.54 million, while the number of FHI enrollee are 1.4 million.
- How to find false farmers?
- Cooperation among different agencies of the Council of Agriculture

  -- FHI registration profile.

  -- Farmland registration file.

  -- Income tax profile.

  -- National Health Insurance program registration profile.

Old Farmer Pension Program

To secure elderly farmers' economic wellbeing, the Farmer Health Insurance program (FHI) has been implemented in 1989.

- Farmers aged>=15 year can enroll in the FHI.
- Need to hold at least 0.01 hectares of farmland.
- FHI enrollees receive a favorable premium subsidy. FHI enrollees pay only 30% of health insurance premium, whereas other sector workers pay 40%.
- FHI enrollees also receive lump sum payments for pension upon turning age 65 (the OFP payments is NT$ 7,000 per month).
- The OFP payment is a *as-pay-as-you-go* payment.

Eligibility Rule of OFP Program

	Farmer's Age	
Farmer Health Insurance program (FHI)	>=65	<65
FHI=1	Yes (region A)	No (region B)
FHI=0	No (region C)	No (region D)

Research Objective

- This study contributes to the farm succession issue by using an example of the Old Farmer Pension program in Taiwan.
- To examine the extent to which a social security pension program for old farmers may affect family farm succession behavior.
- To investigate how the effect may vary among different types of farms.
- *Causality* issue has been carefully addressed.

Data

- The primary dataset is the Agriculture Census Survey in Taiwan in 2005, conducted by the Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Republic of China, Taiwan.

-- One principle farm operator is identified for each farm.

-- Data on socio-demographic characteristics of the principle farm operator were collected, as well as on farm activities of the farm operator and other family members.

-- No information of FHI enrollment is recorded.

Information of the FHI Status

- To obtain the FHI status of the farm operators, we merged the Agricultural Census Survey with a *National Administrative FHI Profiles* of the principle farm operators enrolled in the FHI program in 2005.
- For each enrollee of the FHI program, information regarding whether he/she ever received OFP payment is also documented.
- We merge Ag. Census Survey and FHI profile *only* for the principle farm operators.

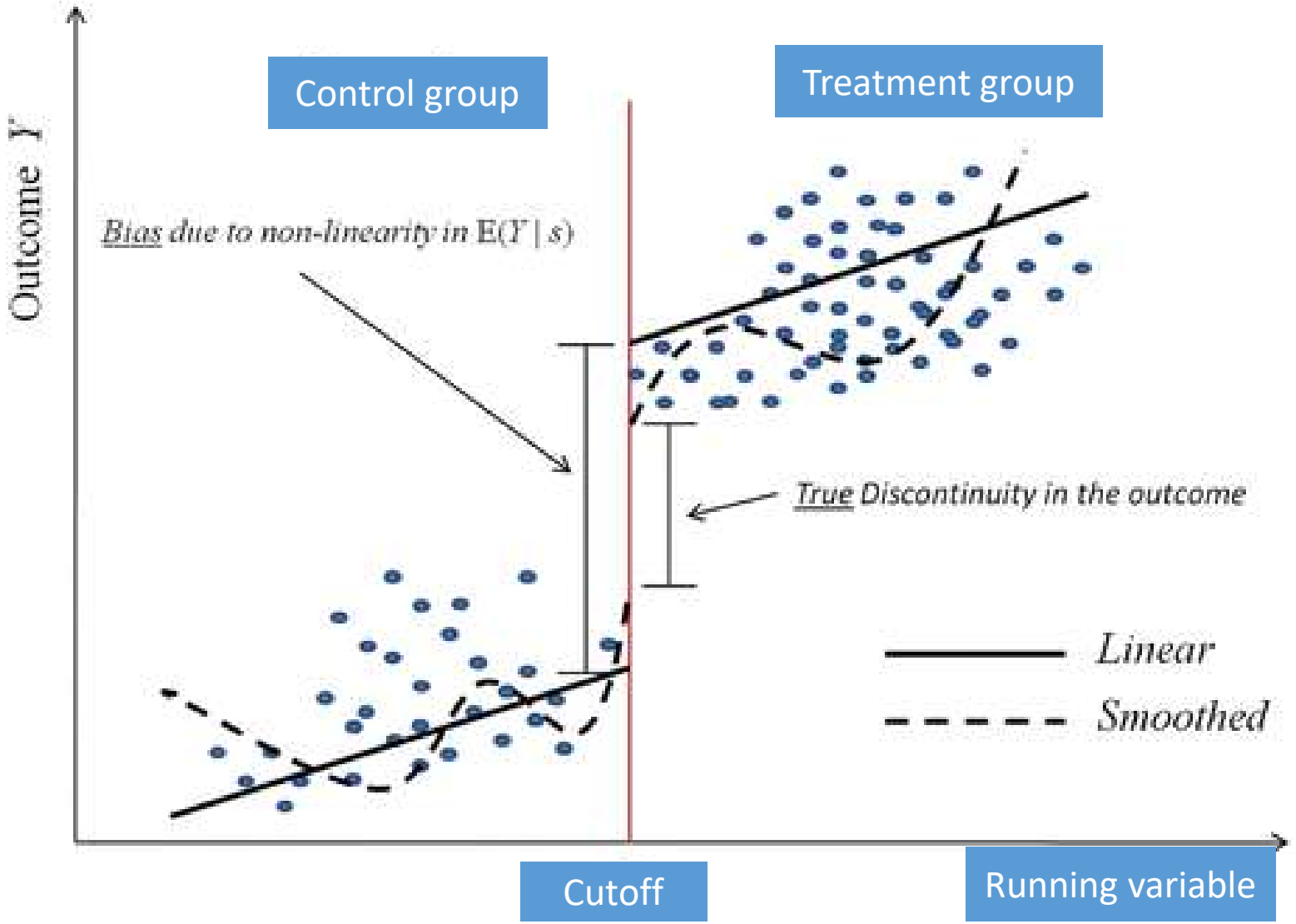
Our Sample

- A final matched sample of 703,287 crop farms. Among them, 411,213 (59%) were farms whose operators were enrolled in the FHI program.
- We limit our sample to farms whose farm operator age between 60 and 70.
- We exclude farms whose operators were 65 in 2005 because we do not have the information on the *exact date of birth*.
- The final sample consists of 161,018 crop farm households. Again, each farm has only one principle farm operator.

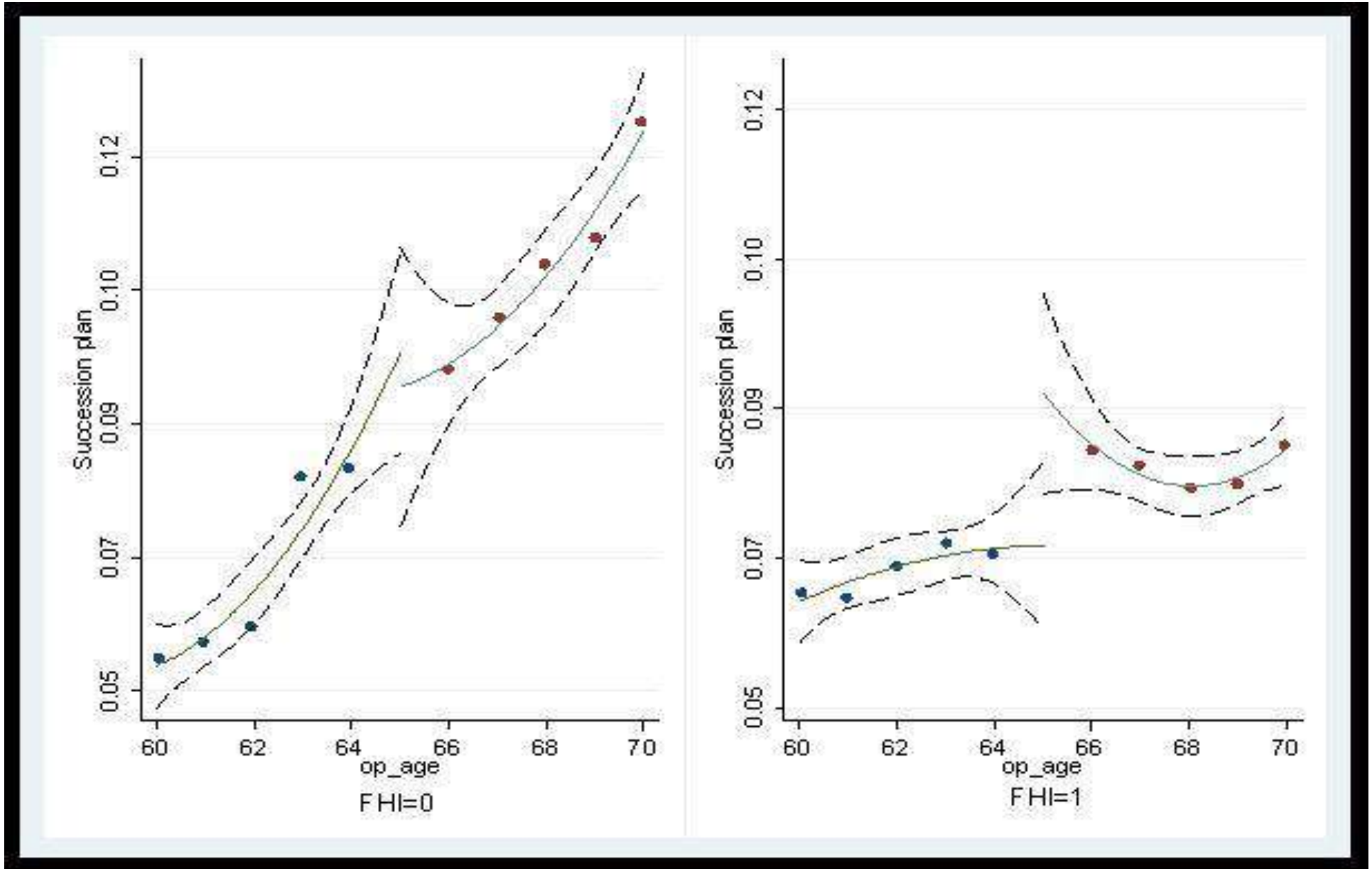
Definition of the Variables

- A dummy variable is defined if the farm operator *received OFP payments* in 2005.
- Farm succession was defined to indicate if a farm household had at least one family successor working on the farm in 2005.
- We also control for operator's gender, education, and family size in some selected age groups, and farm types.

Regression Discontinuity Design



Snapshot : Is there any *Jump* ?



Key Findings

- Farm succession is higher for farm operators age >65.
- However, the succession rate is also higher for non-FHI operators.
- The net effect of OFP om farm succession is negative. That is, OFP payments reduces the likelihood of farm succession.
- The negative effect is more pronounced among fruit farms.

Policy Implications

- Our study points out the evidence that there is a tradeoff between the social security program and farm succession.
- On the one hand, a monthly pension payment was paid to old farmers to sustain their wellbeing. On the other hand, this pension also resulted in an undesired effect on farm succession of the family farms.
- Why this is the case? To maintain the eligibility to receive pension, older farmers may choose to continue working on farms, which subsequently delay the intra-household transfer of farm business to their younger generation.

Paper 2

Journal of Health Economics
Volume 65, May 2019, Pages 117-132

Inter-brand competition in the convenience store industry, store density and healthcare utilization

Hung-Hao Chang [a] ✉, Chad D. Meyerhoefer [b, c] ✉

[a] Department of Agricultural Economics, National Taiwan University, Taiwan
[b] College of Business and Economics, Lehigh University, Bethlehem, United States
[c] National Bureau of Economic Research, Cambridge, United States

Received 23 July 2018, Revised 25 January 2019, Accepted 4 March 2019, Available online 25 March 2019.

- Impact of inter-brand competition on medical expenses.
- Main findings：More competition leads to lower medical expenses, especially for elderly in rural areas.

Research Objectives

- Investigate the effects of both food accessibility and market competition on the use and cost of medical care using a case study of convenience stores in Taiwan.
- Distinguish the effects of **food accessibility** and **inter-brand competition** on healthcare utilization.
- Consider different types of healthcare services (i.e. outpatient, inpatient and prescription drugs).
- Examine rural-urban disparities of the effect.
- Search for **mechanisms** responsible for reduced-form effects.

The first study to identify the effects of inter-brand competition of food outlets on healthcare utilization.

Convenience Store Analysis


台灣便利商家數 全球密度第二 僅次於韓國

財經

A A A 友善列印

20180925 23:38

百度攜Intel 5G＋AI邊緣計算聯合實驗室揭牌

Facebook Google+ Twitter Weibo

2018年09月05日 17:28 工商 譚淑珍

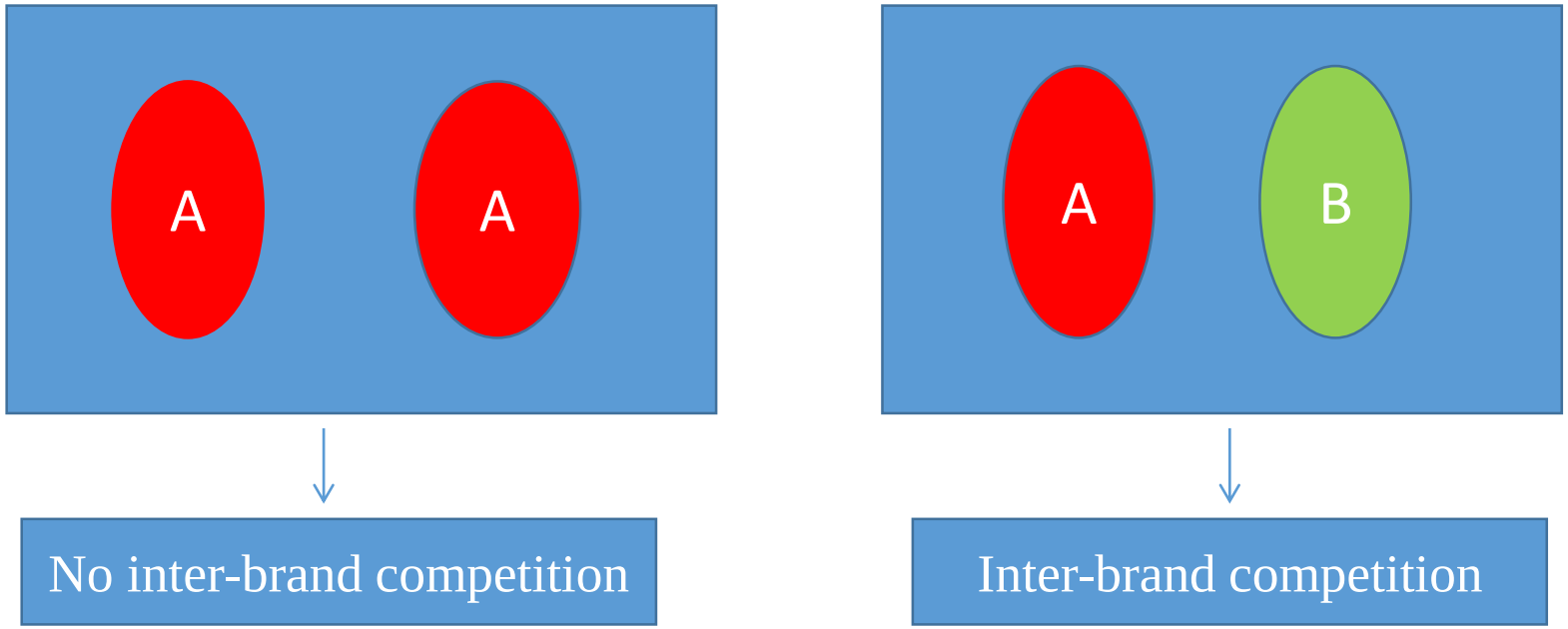
- Convenience store density in Taiwan is currently **the second highest** in the world
- The main four chain convenience store

-- 7-11, Family Mart, OK Mart, and Hi-Life account for 98% of all convenience stores.

- Market share: 7-11 (49%), Family Mart (29%), OK Mart (13%), Hi-Life (9%)

Food Accessibility vs. Competition

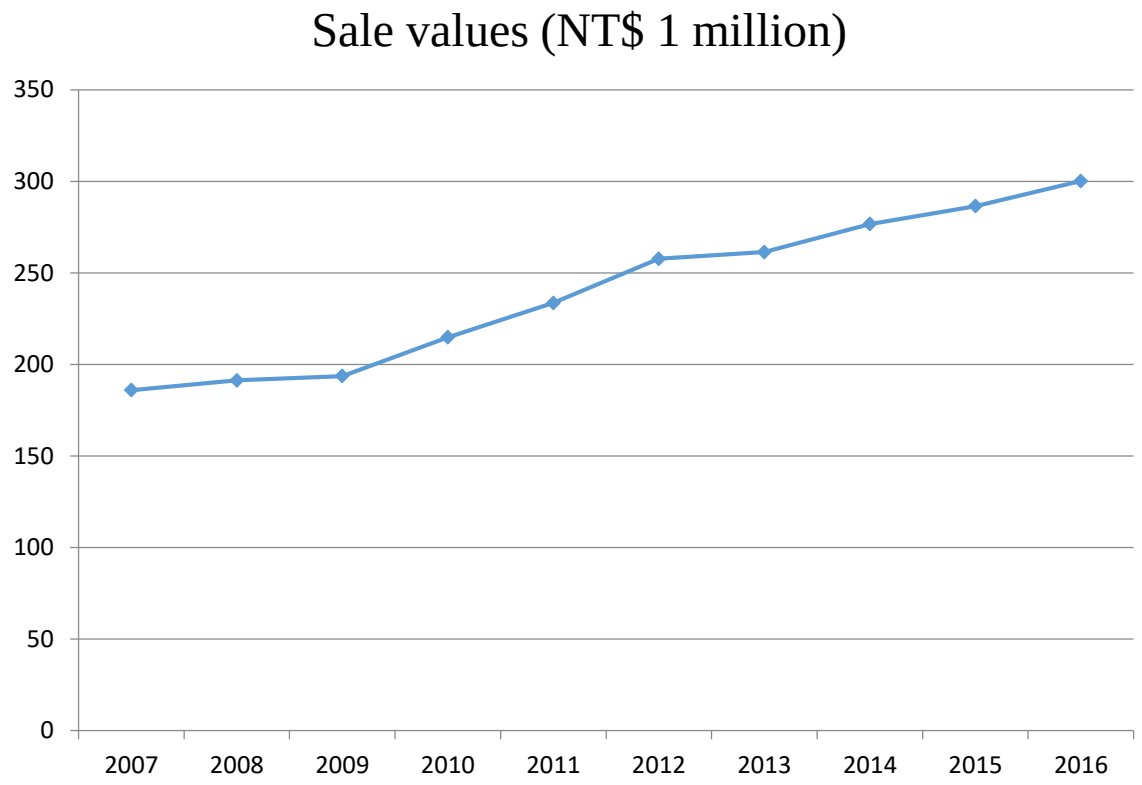
The level of competition between retail food outlets is a different concept than food availability.



Food accessibility is the same in both cases, but not competition

Convenience Store Industry in Taiwan

Since 2003, Taiwan has had the **highest density of convenience stores in the world**. In 2007, total sales in convenience store industry were NT$ 185 million, and reached to NT$ 300 million in 2016.



Market Structure of the Convenience Stores in Taiwan

- Four major chain convenience stores:

  7-Eleven, FamilyMart, Hi-Life, and OK-Mart account for 98% of the total number of convenience store outlets in Taiwan.

- In 2016, these four chains have 10,188 outlets. On average, one store serves 2,305 people. One store is in every 3.6 square kilometers of land.
- Market share: 7-Eleven (49%), Family-Mart (29%), Hi-Life (13%), OK-Mart (9%) of the total # of outlets.

Food Products Sold at Convenience Stores

- 25% of sales are **ready-to-eat foods** (e.g. meal boxes and sandwiches), and 24% of sales are **non-alcoholic drinks**.
- For ready-to-eat food, **private labels** account for 75% of sales, while national products only account for 25% of sales.
- Most common private label food products: Meal boxes, deserts and non-alcoholic drinks. Comprehensive **nutrition labels** are used on private label products and emphasize their health benefits and quality.

Advertisement on Healthy Food and Health in 7-11

Private Labels Food Products

- In contrast to national brand foods, chain companies control the production and supply chain for private label products and have exclusive control over price.
- With the introduction of private label products, stores began to provide **dining facilities** to allow the consumption of purchases on-site.
- Inter-brand competition among chains is the KEY.

- Private label food products and dining facilities put convenience stores in direct competition with Chinese restaurants, traditional markets, and meal shops.
- Between 2013 and 2016, the sales of the convenience store industry grew 19%, while a negative growth rate was found for breakfast and lunch shops (-7.6%) and food vendors (-8.06%).

7-11 meal box

Breakfast at a traditional market

Lunch shop

Food vendor

Data

A unique dataset that combined three administrative population-based profiles is constructed.

- Health claim profile of insurants in Taiwan's the National Health Insurance (NHI) program.
- The Convenience Stores Data (township)
- Healthcare resources (township)

Health Claim Profile of NHI Insurants

- The NHI covers 98% of the residents in Taiwan.
- In 2005, 1 million individual (~5% of the population) were randomly selected from the registry of NHI beneficiaries. This sampling file traces back all the medical utilization records of the same individual in other years.
- This dataset contains detailed records on healthcare utilization, including use and cost of **outpatient services**, **hospital admissions**, and **prescription drugs**.
- Gender, age, type of employment, and township of residence of the insurants.

- We use an individual-level panel NHI sampling file between 2002 and 2012 (11 years in total).
- We remove insurants that did not continuously participate in the NHI program over our sample period. The final sample contains **9,353,987** NHI insured individuals between 2002 and 2012.
- Dependent variables: use and cost of outpatient and inpatient services, and prescribe drugs.
- Control variables: gender, types of employment, income, townships of residence.

Convenience Store Competition Databank

- Administrative profile conducted by the Taiwan Fair Trade Commission (TFTC).
- To monitor the operation of CS industry, TFTC merges with sale values with geographical location of each store outlet drawn from the income taxi profile provided by the Ministry of Finance.
- Contain very precise information of sale values and geographical distribution of convenience store outlets in Taiwan.

We create two variables using this dataset:

-- **Accessibility to convenience stores**: the total number of the top four chain convenience store outlets divided by population of each township.

-- **Herfindahl-Hirschman index (HHI)**: calculated based on the sales of the top four chain convenience stores in each town. The HHI captures the inter-brand competition among the top four chain convenience stores.

$$HHI = \sum_{i=1}^{4} s_i^2 \cdot 10{,}000$$

We normalize the HHI between 0-1 in empirical analysis.

Data on Healthcare Provider Supply

We specify several variables to capture the differences in healthcare resources available in each town. These data were drawn from the Ministry of Health and Welfare in Taiwan.

-- The number of hospitals and clinics per 1,000 capita.

-- The number of hospital beds per 1,000 capita.

-- The number of medical personnel per 1,000 capita.

Other Aggregated Variables

- Collect variables for vehicle use, dust density, and air quality in each county in each year.
- These variables are helpful to control for the unobserved heterogeneity factors on healthcare use and expenses.

Sample Statistics of Healthcare Utilization

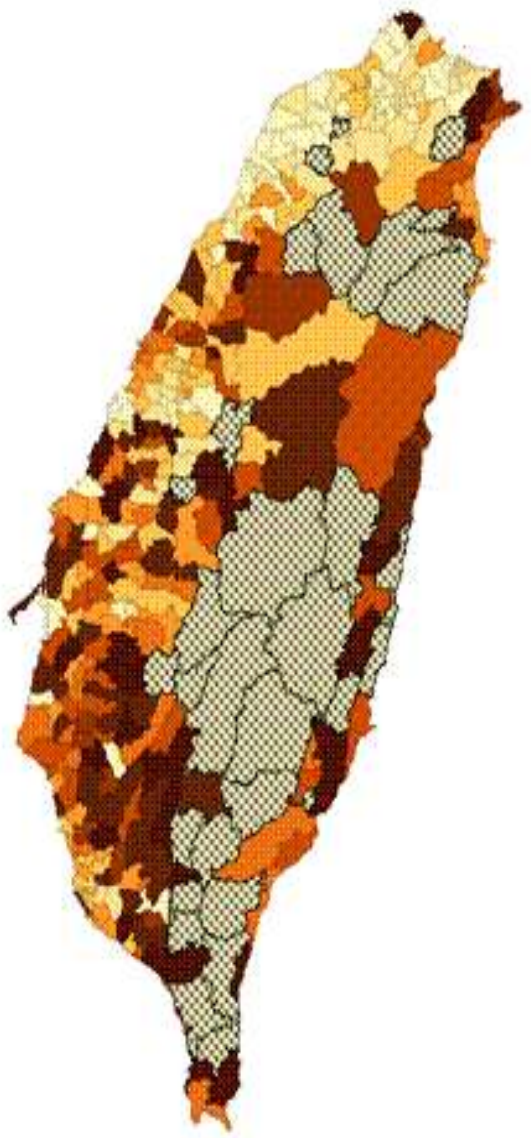
		Outpatient services		Inpatient services		Prescription drugs	
Year	Insurants	Usage (0 or 1)	Exp. NT$ 10K	Usage (0 or 1)	Exp. NT$ 10K	Usage (0 or 1)	Exp. NT$ 10K
2002	842,917	0.92	1.17	0.08	4.58	0.87	0.35
2003	846,477	0.92	1.23	0.07	5.33	0.85	0.38
2004	848,577	0.93	1.39	0.08	6.75	0.86	0.44
2005	850,969	0.93	1.43	0.08	8.55	0.85	0.45
2006	851,945	0.91	1.48	0.08	8.87	0.83	0.47
2007	852,112	0.91	1.53	0.08	9.22	0.82	0.48
2008	852,112	0.90	1.60	0.08	9.66	0.82	0.52
2009	852,112	0.90	1.67	0.08	9.57	0.82	0.54
2010	852,196	0.89	1.71	0.08	9.97	0.82	0.54
2011	852,285	0.89	1.80	0.08	10.16	0.82	0.58
2012	852,285	0.89	1.85	0.08	10.08	0.81	0.58

Accessibility and Market Competition of CS

Year	HHI 0-10,000	Store density Stores per 1,000 capita
2002	6,940	0.24
2003	6,648	0.26
2004	6,356	0.26
2005	6,287	0.28
2006	6,171	0.31
2007	6,060	0.34
2008	5,906	0.35
2009	5,814	0.35
2010	5,820	0.36
2011	5,686	0.35
2012	5,567	0.37

1. Inter-brand competition among the four brands is more intense over time.
2. Accessibility to convenience stores increases over time.

Regional Disparities in Competition



1. Average HHI values from 2002 to 2012 in each township.
2. Checkered areas have no convenience stores.
3. Areas with darkest colors have higher HHIs (i.e. least inter-brand competition).

Econometric Analysis

Two-part model (TPM) of medical care use and expenditures

- First stage is a linear probability model:

$$I^*_{ijt} = \alpha_0 + \alpha_1 * A_{jt} + +\alpha_2 * HHI_{jt} + X_{ijt}'\beta_1 + Z_{jt}'\beta_2 + u_j + T_t + \varepsilon_{ijt}$$

Insurant i ; township j ; year t

I_{ijt} =1 if I^*_{ijt}>0 and I_{ijt}=0 otherwise

A_{jt} is store density (# of store outlets/ population)

HHI_{ijt} is the Herfindahl-Hirschman index

$\boldsymbol{X}_{ijt}$ is a vector of socio-demographic characteristics

$\boldsymbol{Z}_{jt}$ is a vector variables measuring supply of medical services

u_j and T_t are township and time fixed effects

- Second part – log of healthcare expenditures (Y) for those with use:

$$\log(Y_{ijt} \mid I_{ijt} = 1) = \gamma_0 + \gamma_1 * A_{jt} + \gamma_2 * HHI_{jt} + X_{ijt}'\lambda_1 + Z_{jt}'\lambda_2 + u_j + T_t + v_{ijt}$$

- Unconditional mean

$$E(Y_{ijt}) = \Pr(I_{ijt} = 1) * E(Y_{ijt} \mid I_{ijt} = 1) + \Pr(I_{ijt} = 0) * E(Y_{ijt} \mid I_{ijt} = 0)$$
$$= \Pr(I_{ijt} = 1) * \exp(Y_{ijt} \mid I_{ijt} = 1) * \theta$$

- Unconditional marginal effects:

$$\frac{\partial E(Y_{ijt})}{\partial A_{jt}} = \exp(Y_{ijt} \mid I_{ijt} = 1) * [\alpha_1 + \gamma_1 * \Pr(I_{ijt} = 1)] * \theta$$

$$\frac{\partial E(Y_{ijt})}{\partial HHI_{jt}} = \exp(Y_{ijt} \mid I_{ijt} = 1) * [\alpha_2 + \gamma_2 * \Pr(I_{ijt} = 1)] * \theta$$

Main Findings

- Higher levels of inter-brand competition & greater store density reduce the use and cost of outpatient medical services and prescription drugs.
- Utilization of prescription drugs is most responsive to changes in the competitive landscape, although the magnitudes of the effects are small. A change from monopoly to perfect competition reduces the probability of using prescription drugs by 7% and reduces annual prescription drug expenditures by 1.7%.

Conclusion of My Talk Today

- Large data are representative to the population
  -- random survey vs. administrative profile
- Data are abundant. How to use the data appropriately is science of art
  -- idea matter !
  -- crowdsourcing is a possible solution
- Visualization of data increases transparency to the research question
  -- correlation vs. causality (cooperation with academy)
- Open Data vs. Open Mind (cooperation among regulators or agencies)
- Strengthen the weakness of the random survey
  -- World Bank experience; combine government and random survey.
- Non-structure data
  -- multi-disciplinary team work

Thank You for Your Listening

hunghaochang@ntu.edu.tw