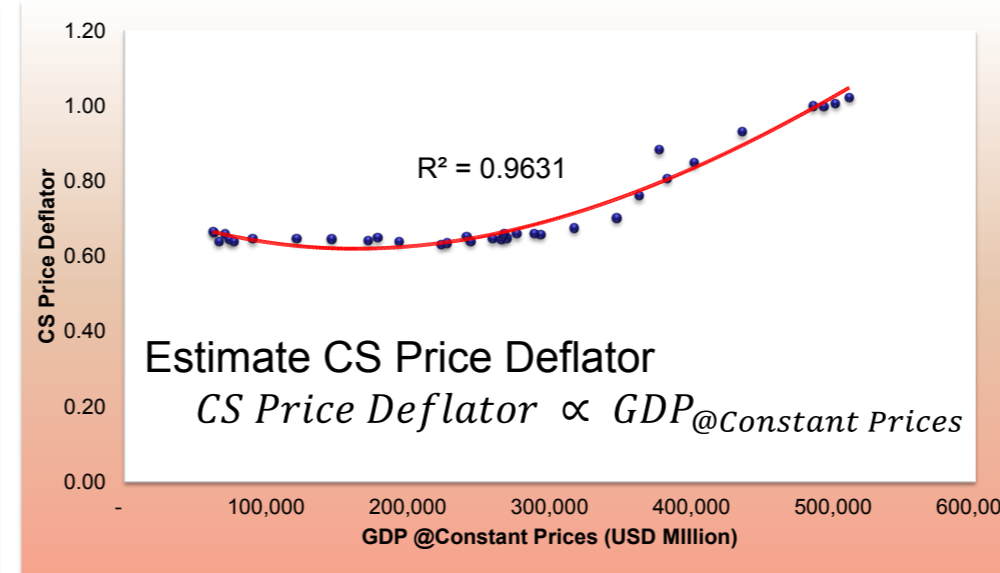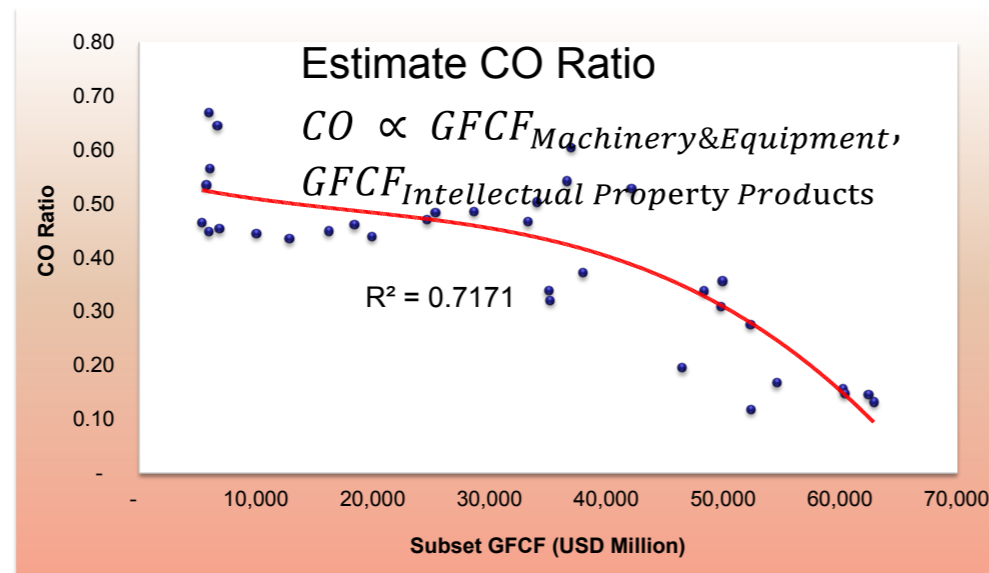# Estimating Building Value from Capital Stock – Taipei, Taiwan

Mansi Kalra, Pane Stojanovski, Edmond Y.M. Lo and Tso-Chien Pan
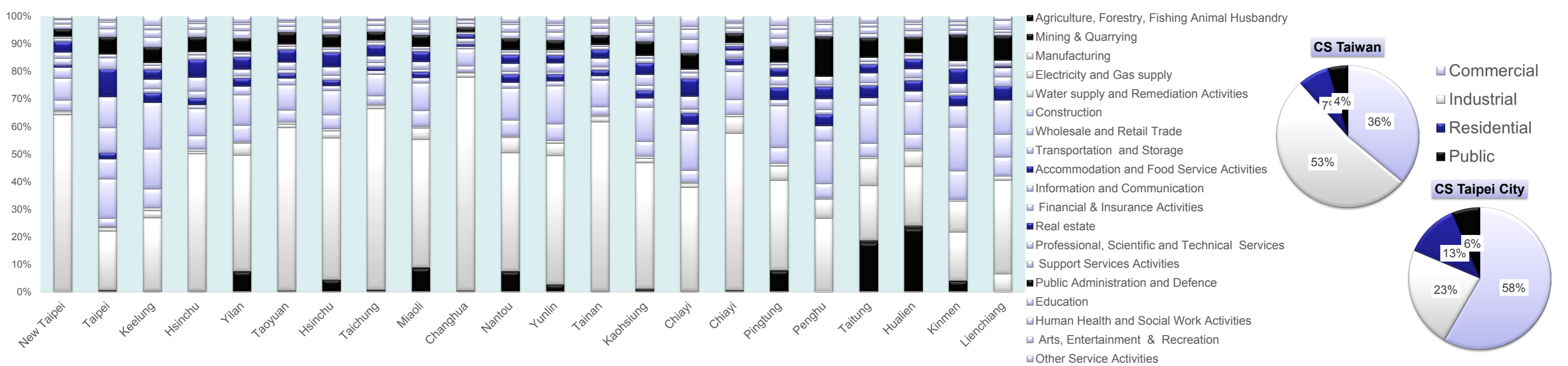Institute of Catastrophe Risk Management, NTU, Singapore

National Capital Stock

- Protection gap or Underinsurance in Asia is one of the biggest concerns for (re)insurance sector
- To address the protection gap we need to first estimate the economic exposure. The total economic exposure in a region gives an estimate of the insurable exposure
- Capital formation is a concept used in macroeconomics, national accounts and financial economics. It refers to the amount by which the total physical capital stock increased during an accounting period and is applied here for estimating economic exposure
- National Capital Stock (CS) is available from international sources and published by a country's national statistics

Estimate CO Ratio
$$CO \propto GFCF_{Machinery\&Equipment}, GFCF_{Intellectual\ Property\ Products}$$
$R^2 = 0.7171$

Estimate CS Price Deflator
$$CS\ Price\ Deflator \propto GDP_{@Constant\ Prices}$$
$R^2 = 0.9631$

Taiwan Projected CS 2017: USD 3.7 Trillion

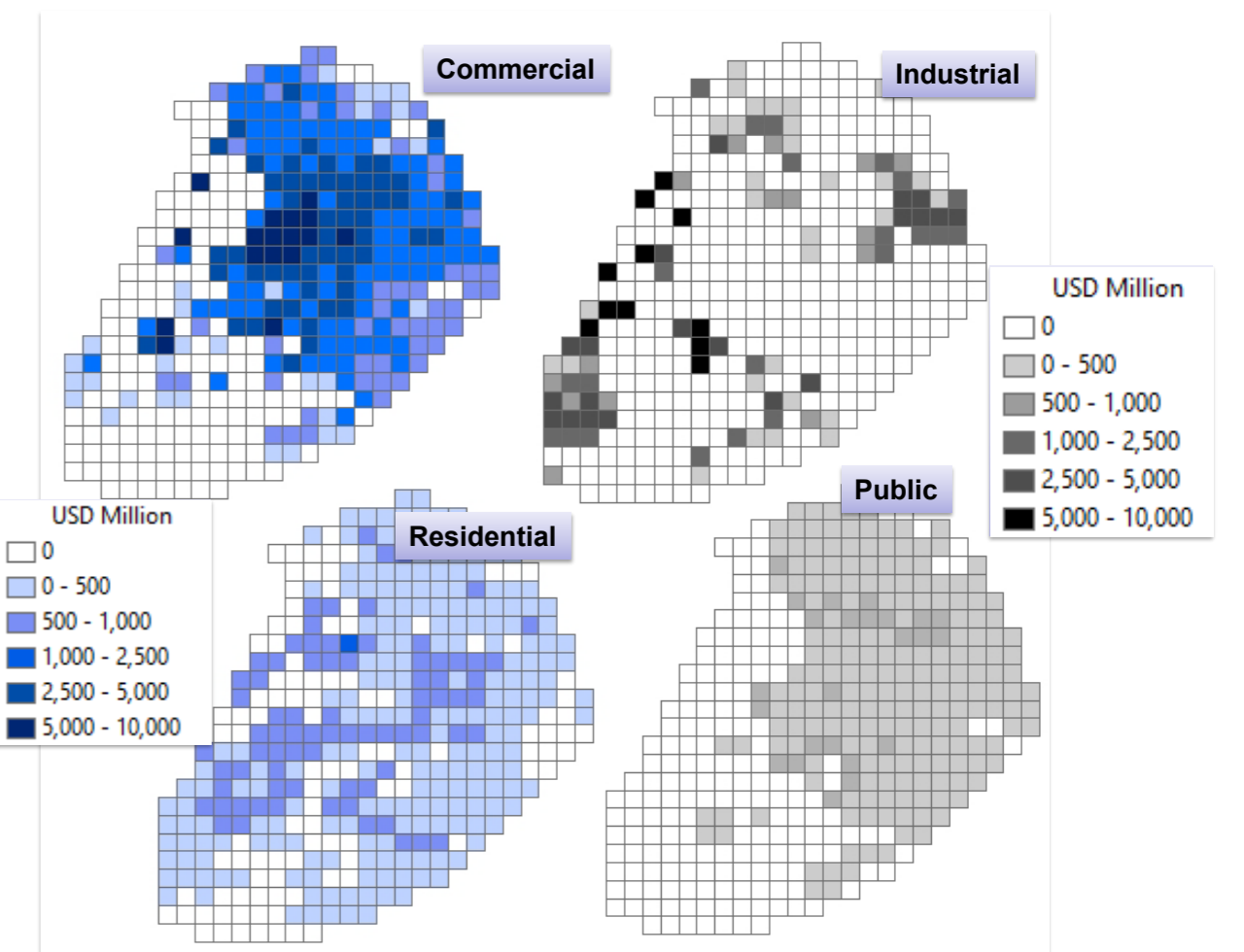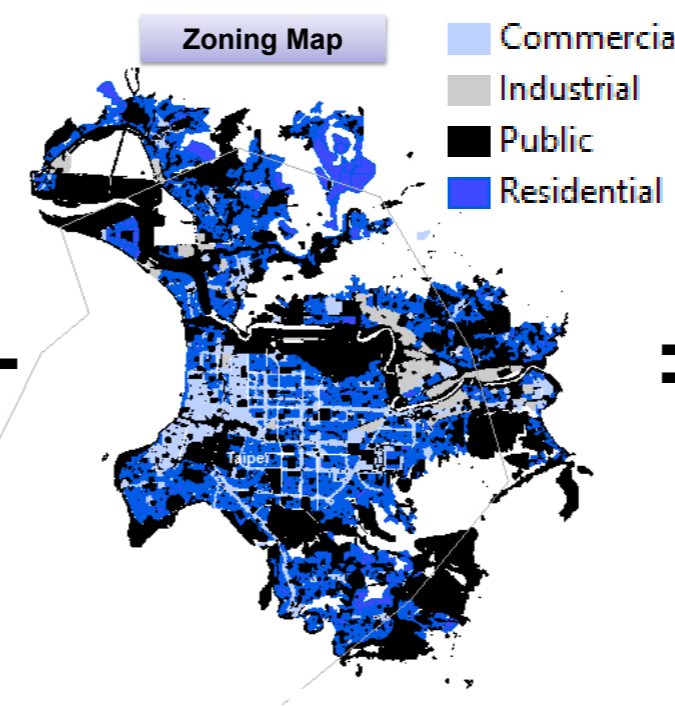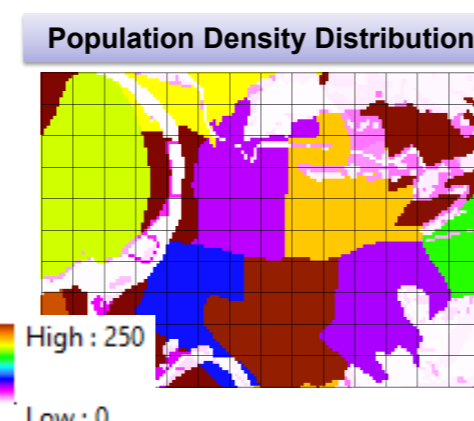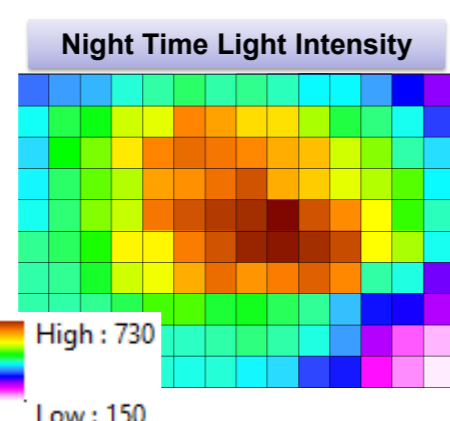Projected CS @ current prices   Actual CS @ current prices

Admin Capital Stock

- Each admin region has its own economic strategy depending on the resources and the capital available, so each admin region focuses on industrial or commercial sectors
- Manufacturing Sector is the major contributor of CS in Taiwan. New Taipei City, Taichung City and Chonghua County are Manufacturing Hubs
- CS contributions in Taipei City are majorly coming from: Wholesale and Retail Trade; Information and Communication; Financial & Insurance Activities and Real Estate

Agriculture, Forestry, Fishing Animal Husbandry
Mining & Quarrying
Manufacturing
Electricity and Gas supply
Water supply and Remediation Activities
Construction
Wholesale and Retail Trade
Transportation and Storage
Accommodation and Food Service Activities
Information & Communication
Financial & Insurance Activities
Real estate
Professional, Scientific and Technical Services
Support Services Activities
Public Administration and Defence
Education
Human Health and Social Work Activities
Arts, Entertainment & Recreation
Other Service Activities

CS Taiwan — Commercial, Industrial, Residential, Public (36%, 53%, 7%, 4%)

CS Taipei City (58%, 23%, 13%, 6%)

Grid Level Capital Stock

Night Time Light Intensity
High : 730
Low : 150

Population Density Distribution
High : 250
Low : 0

Zoning Map
Commercial
Industrial
Public
Residential

Commercial / Industrial / Residential / Public
USD Million
0
0 - 500
500 - 1,000
1,000 - 2,500
2,500 - 5,000
5,000 - 10,000

Building Value

- Using high resolution satellite imagery, photogrammetry and image processing, NatCatDAX has developed building footprint and height extraction routines.
- Characteristics such as occupancy types, construction class, building age and number of stories are further derived
- Building Occupancy, Total Floor Area (TFA) and Construction Cost (CC) are applied to estimate the building replacement value
- TFA in a grid by occupancy along with Nighttime Light and population density data are used in disaggregating CS for each grid to estimate the CS building value
- Comparing values from Construction Cost, Capital Stock and Reported figures help in estimating the Economic Exposure

Residential
Commercial
Industrial
Administrative
Cultural and educational
Other

Building Value (USD Million) Comparison for Commercial Buildings

Estimates of building replacement values:
Commercial: CS > CC
Residential: CS > CC
Public: CC < CC

CS Building   CC BuildingValue

NatCatDAX Natural Catastrophe Data Analytics Exchange

NatCatDAX Consortium Partners

PERILS   SINOTECH ENGINEERING CONSULTANTS, INC.