Meeting of Group of Experts on CPI

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Residential Property Price:
An alternative approach for house rent in CPI of Thailand

Benyasut Prayoth
Dispadung Chanikarn

BUREAU OF TRADE AND ECONOMIC INDICES,
MINISTRY OF COMMERCE, THAILAND

Content

Introduction

- House rent accounts for 15.19 percent (at base year 2007)

- largest for non-food and beverage on CPI basket of Thailand
  - Its movement significantly has implication on CPI index

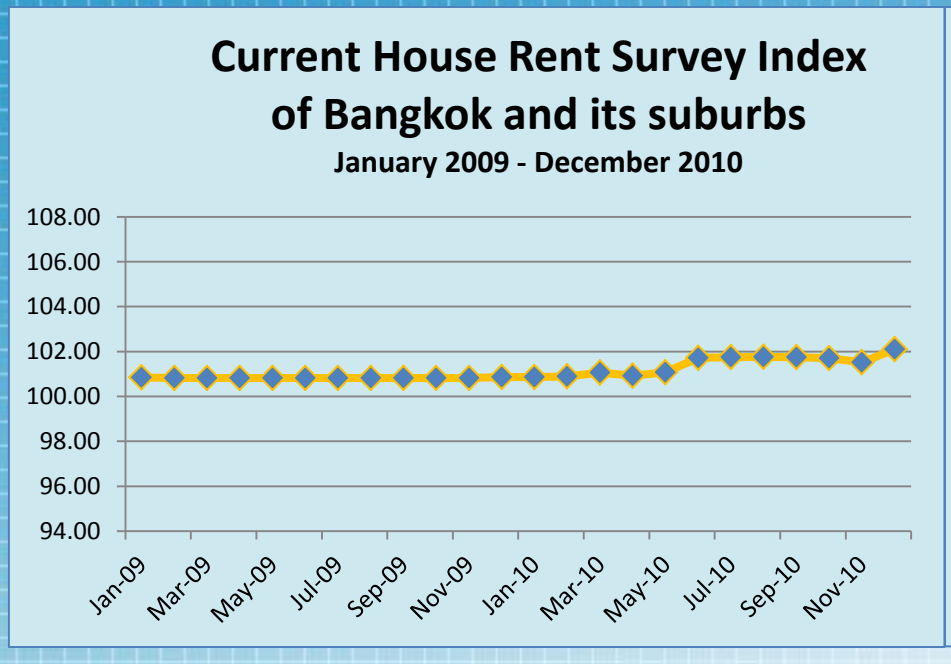
Introduction

- Currently, house rent index is solely compiled from actual rent survey

- However, composed of 2 different weights
  1. Owner's equivalent rent
  2. Actual rent

Introduction

- **Problems found**
  - **House rent index shows low rate of change overtime regardless of economic situation**



Introduction

- Problems found (cont.)
  - representation
    - 80 percent of private households occupy their own residences
    - Only 10 percent of private households rent shelter
      - actual rent survey has focused on small portion of households
  - sample selection bias
    - sample in rental survey based on price collectors' judgment

Objective of this study

HOUSE RENT INDEX

A comparison of house index series between

- *current approach – Rent Survey*
- *alternative approach – Hedonic House Price*

in the light of economic consistency to evaluate their effectiveness

Objective of the study:

- What is an alternative approach?
  - Hedonic regression of house price index in collaboration with the Bank of Thailand
  - Assuming that hedonic regression of house price index is a proxy for owner's equivalent rent index
  - Then, experimentally replaces current house rent index with hedonic house price index

Objective of this study:

Hedonic House Price index

New proxy for Owner's equivalent rent

New House rent Index

New consumer Price Index

Implication of new approach on CPI

Content

Data Source and Coverage

Hedonic House Price Index

- data of new mortgage loans from 17 registered commercial banks in Bangkok Metropolis and 5 suburbs:

  Nonthaburi, Pathumthani, Samut Prakarn, Samut Sakorn, and Nakornpathom
- Monthly data Since January 2008
- 4 indices available:

  Single house with land

  Town house with land

  Condominium

  Land

Implication to Consumer Price Index

- Survey Data in Bangkok Metropolis and 3 suburbs:

  Nonthaburi, Pathumthani, Samut Prakarn
- Monthly data Since January 2009
- Excerpt only 2 indices

  Single house with land

  Town house with land

Content

Methodology

Consists of 2 sections

- Hedonic regression method for house price index:
  - single house with land
  - town house with land

- Consumer Price Index compilation: combined with hedonic house price index movement

Methodology:

Hedonic regression method for house price index

Step1: run Log-linear regression to find relationship between property price and its price determining characteristics:

$$\ln(p_i) = \ln(p_0) + \sum_{k=1}^{K} \beta_k X_{ki} + \varepsilon_i$$

- use monthly data from January 2008 - December2010

Step 2: calculate fundamental price in each period (monthly)

$$\ln(p_0) = \frac{\sum_{i=1}^{n} \ln(p_i)}{n} - \sum_{k=1}^{K} \hat{\beta}_k \overline{X}_k$$

Step3: specify fixed (quantities of) four controlled characteristics:

- reference stock = properties in year 2009

Step 4: calculate property price in each period using fundamental price in step 2 and the predicted price based on those regression coefficients in step1, given that four price controlled determining characteristics are standardized to those reference stock in 2009

Step5: compile house price index (monthly)

Methodology:

Hedonic regression method for house price index

Step1: run Log-linear regression to find relationship between property price and its price determining characteristics

- relates property prices to their price determining characteristics
  - Age of property
  - Number of storey
  - Type of developer
  - Location

- focuses only price of single house with land and town house with land

Methodology:

Hedonic regression method for house price index

- **run monthly data from 2008 – 2010 of new mortgage loans from 17 commercial banks in Bangkok and suburbs**

$$\ln(p_i) = \ln(p_0) + \sum_{k=1}^{K} \beta_k x_{ki} + \varepsilon_i$$

where

p_i	=	appraisal price of each property in each month (Baht/square meter)
p_o	=	fundamental price of each property in each month
β_k	=	regression coefficient of price controlled characteristic *k*
X_{ki}	=	price determining characteristic

Methodology:

Hedonic regression method for house price index

- **The full model can be illustrated as:**

$$\ln(p_i) = \ln(p_n) + \beta_1 AG + \beta_2 FL + \beta_3 devd + \beta_4 cd + \beta_5 ed + \beta_6 nd + \beta_7 sd + \beta_8 td + \beta_9 d11$$
$$+ \beta_{10} d12 + \beta_{11} d13 + \beta_{12} d73 + \beta_{13} d74 + \varepsilon_i$$

1. AG = age of property (year)
2. FL = number of storey in horizontal plane
3. devd = dummy variable for type of developer
   - developers enlisted in Stock Exchange of Thailand = 1
   - developers not enlisted in Stock Exchange of Thailand and contractors = 0

4. Location = dummy variable
   - *cbdd* = inner area of Bangkok (base case)
   - *cd* = central Bangkok
   - *ed* = eastern Bangkok
   - *nd* = northern Bangkok
   - *sd* = southern Bangkok
   - *td* = thonburi area (Old capital area)
   - *d11, d12, d13, d73, d74* = suburbs of Bangkok, (Samut Prakan , Nonthaburi , Pathumthani , Nakhonpthom and Samut Sakorn respectively)

Methodology:

Hedonic regression method for house price index

Step 2: calculate fundamental price in each period (monthly)

- **where**

$$\ln(p_0) = \frac{\sum_{i=1}^{n} \ln(p_i)}{n} - \sum_{k=1}^{K} \hat{\beta}_k \bar{X}_k$$

p_0 = fundamental price of each property in each month

$\frac{\sum_{i=1}^{n} \ln(p_i)}{n}$ = appraisal property prices, on average, of *n* properties in each month (January 2008 – December 2010)

p_i = appraisal property prices price of each property in each month (January 2008 – December 2010)

$\bar{X}_k$ = average of controlled characteristic *k* of *n* properties in each month (January 2008 – December 2010)

Methodology:

Hedonic regression method for house price index

Step3: specify fixed (quantities of) four controlled characteristics: reference stock properties in year 2009

- According to standard matched-model, fixed (quantities) of characteristics are necessary to remove quality difference overtime
- Choose residential property database in 2009 as a reference stock by the reason of data completeness
- Plugging in fixed (quantities) of characteristics of single house with land and town house with land in 2009

Methodology:

Hedonic regression method for house price index

Step 4: calculate property price in each period using fundamental price in step 2 and the predicted price based on those regression coefficients in step1, given that four price controlled determining characteristics are standardized to those reference stock in 2009

- **Property prices are**

$$\begin{bmatrix} \ln(p_1) \\ \ln(p_2) \\ \cdot \\ \cdot \\ \cdot \\ \ln(p_j) \end{bmatrix} = \begin{bmatrix} \ln(p_0) \\ \ln(p_0) \\ \cdot \\ \cdot \\ \cdot \\ \ln(p_0) \end{bmatrix} + \begin{bmatrix} \sum_{k=1}^{K} \hat{\beta}_k X_{k,1\,of\ Re\ fYear} \\ \sum_{k=1}^{K} \hat{\beta}_k X_{k,2\,of\ Re\ fYear} \\ \cdot \\ \cdot \\ \cdot \\ \sum_{k=1}^{K} \hat{\beta}_k X_{k,j\,of\ Re\ fYear} \end{bmatrix}$$

Where

$j_{single\ house}$ = 1 to 14,367 which are number of single houses in reference year (2009)

$j_{town\ house}$ = 1 to 10,485 which are number of town houses in reference year (2009)

Methodology:

Hedonic regression method for house price index

Step 4: calculate property price in each period using fundamental price in step 2 and the predicted price based on those regression coefficients in step1, given that four price controlled determining characteristics are standardized to those reference stock in 2009

- **Imputed price obtained from previous matrix are equivalent to prices of property in respective year whose have matched characteristics as underlying property in reference year 2009**

Methodology:

Hedonic regression method for house price index

Step5: compile house price index (monthly)

- **Finally, monthly house price index (January 2009 = 100) is compiled, adjusted seasonal movement, then computed three months moving average**

Methodology:

CPI compilation with hedonic house price index movement

- **Bureau of Trade and Economic Indices is responsible to compile consumer price index in order to, ideally, quantify a cost of living of people in municipal areas**
  - **Bangkok Metropolis and its suburbs**
    - **Nonthaburi, Pathumthani, and Samut Prakarn**
    - ***less coverage than hedonic regression study by the Bank of Thailand***
  - **Northern region**
  - **Central region**
  - **North Eastern region**
  - **Southern region**

Methodology:

CPI compilation with hedonic house price index movement

- **Commodity basket is classified into 7 groups according to COICOP**

1. Food and Beverages
2. Apparel and Footwear
3. Housing and Furnishing
   - 3.1 **Shelter which includes house rent**
   - 3.2 Electricity, fuel and water supply
   - 3.3 Textile – house furnishing
   - 3.4 Miscellaneous appliances
   - 3.5 Household furnishing and equipments
   - 3.6 Cleaning supplies
   - 3.7 House services
4. Medical and Personal care
5. Transportation and Communication
6. Recreation and Education
7. Tobacco and Alcoholic beverages

Methodology:

CPI compilation with hedonic house price index movement

- **Formula used:**

$$\text{Modified Laspeyres index} = \sum_{i=1}^{n} \frac{p_{ib} q_{ib}}{p_{io} q_{ib}}$$

$$= \sum_{i=1}^{n} s_i * \frac{p_{it}}{p_{io}}$$

$$\text{Where } s_i * = \frac{(p_{ib} \cdot q_{ib}) \cdot \frac{p_{io}}{p_{ib}}}{\sum (p_{ib} \cdot q_{ib}) \cdot \frac{p_{io}}{p_{ib}}}$$

i = commodity i

$Variable_{ib}$ = variable of commodity i in a weight reference period

$Variable_{i0}$ = variable of commodity i in a price reference period

Methodology:

CPI compilation with hedonic house price index movement

To approximate the difference in CPI due to house rent index and hedonic house price index

Consequently, current house rent index is replaced by hedonic house price index

Aggregate up to housing and furnishing group and finally to consumer price index for Bangkok metropolis and suburbs – 7 groups altogether

- **assuming that expenditure structure and weight of new series remain unchanged**

Summary of Methodology

House Price Index is compiled from Bank of Thailand

- covers Bangkok metropolis, Nonthaburi, Pathumthani, Samut Prakarn, Samut Sakorn, and Nakornpathom
- hedonic regression

Single house with land index and Townhouse with land index

- base period = January 2009

Bureau of Trade and Economic Indices rebases current consumer price index as well as group index series in Bangkok metropolis and suburbs: Nonthaburi, Pathumthani, and Samut Prakarn, to January 2009

remove house rent index serie from current CPI in previous step

plug in those indices from Bank of Thailand to house rent serie (subgroup in housing and furnishing group)

aggregate up new house rent serie to Housing and furnishing group level assuming that other things being the same i.e. expenditure structure and weight.

compile new serie of consumer price index

- base period = January 2009

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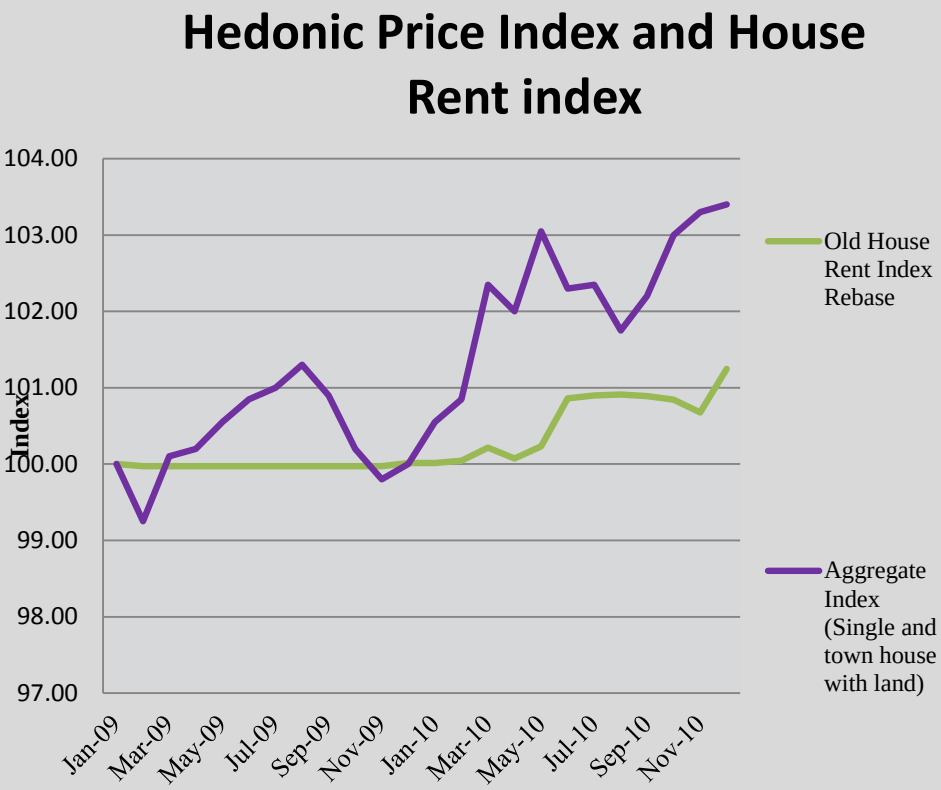
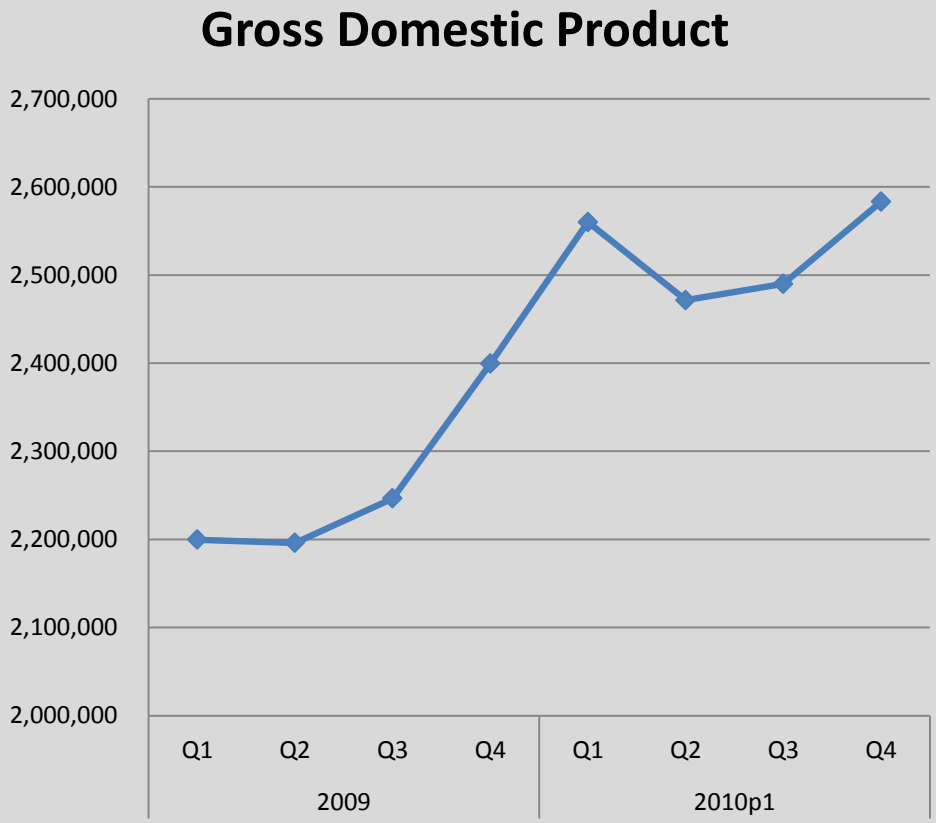
Results:

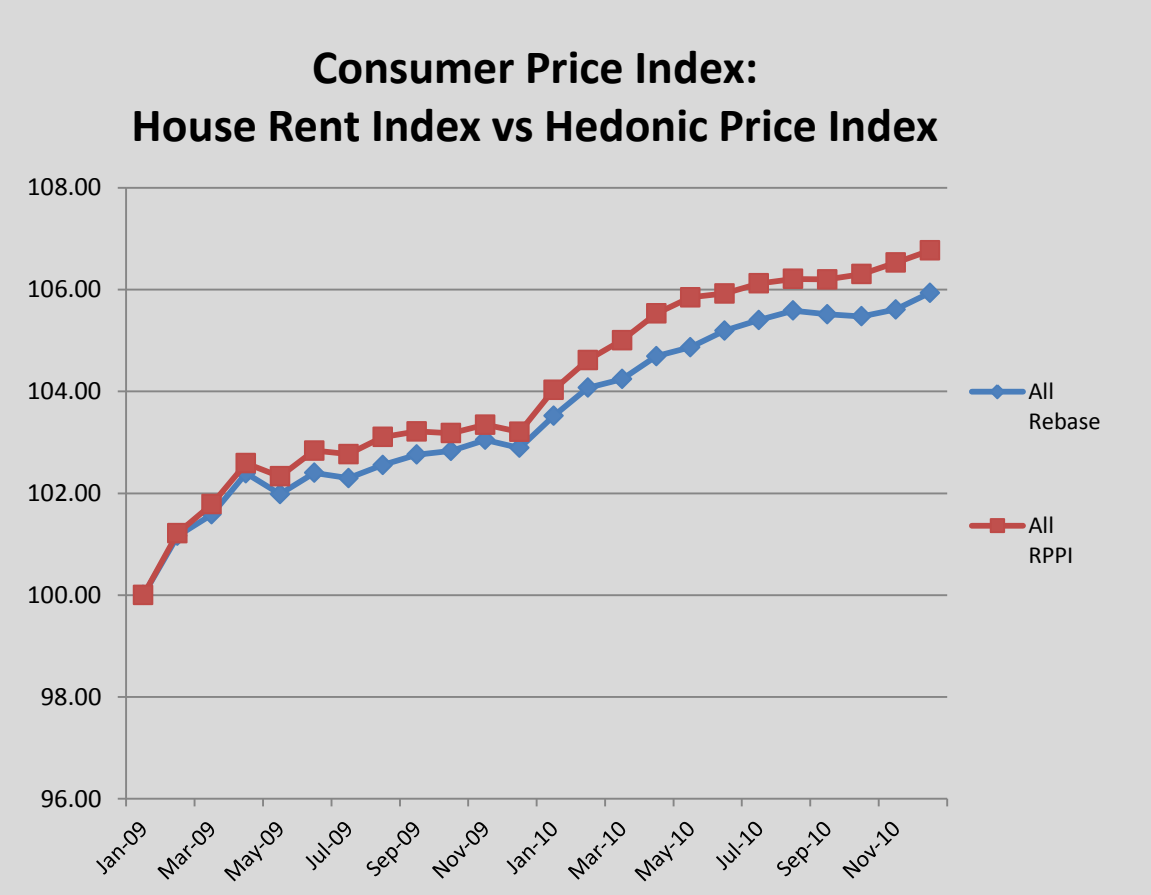




Hedonic house price index tends to be more consistent with economic cycle

Results:

Effect on Consumer Price Index



"the consumer price index with hedonic house price index increases by 0.51 percent on average as opposed to current method - house rent survey"

Implications & Conclusion:

- Based on hedonic house price index in Bangkok metropolis and its suburbs
  - CPI is more consistent with economic cycle
  - Less sample selection bias
    - Hedonic approach has specific selection criteria
    - better representation

- Hedonic house price index, taken into account as owners' equivalent rent in this case, can be an alternative proxy to improve the Consumer Price Index in Thailand in terms of representation and economic cycle consistency

Content

Limitations and Recommendations:

- **Difference in coverage area between hedonic house price regression and house rent survey**
  - overestimate a divergence of house rent as well as CPI between two approaches
  - However, we expect that an overestimation is scant due to similarity of 2 additional provinces to the rest of areas

- **Exclusion of condominium price in hedonic house price index for the sake of comparability with old consumer price index series**
  - nowadays people tend to live in condominiums, this urges index compilers to reconsider types of dwelling coverage in order to reflect people's current lifestyle

Limitations and Recommendations

- **Index variation might prevail when we have rebased consumer price index to the same period as hedonic house price index**

- **This study simplifies that price movement of single house with land and town house with land also represent the movement of other properties**
  - hedonic regression for other properties are essential in order to capture overall residential price movement precisely

Limitations and Recommendations

- A revision of regression is necessary to capture changes in price determining characteristics as well as other changes in the market such as market structure, monetary environment, and consumer behavior

- Some price determining characteristics have not been controlled in this study. Further assistance from many organizations is necessary in order to fill in the gap and strengthen the quality of hedonic house price index

Thanks!