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

Residential Property Price:

An alternative approach for house rent in Consumer Price Index of Thailand

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[This paper is an extensive study from "An amendment study of House Price Index from commercial banks' mortgage loans", the Bank of Thailand. The authors are grateful for useful information and valued comments]

Content

I. Introduction

House rent index compilation varies among countries as opposed to consumer price index compilation where the approach has been standardized to the same alignment around the world. Many methods are proposed, yet it has not been concluded which is the best one. Due to the fact that each country applies an approach considered the best at that time, house rent index has still been critical and ambiguous part in Consumer Price Index for many years.

Since house rent accounts for 15.19 percent (at base year, 2007) in Consumer Price Index of Thailand – the largest for non-food and beverage in CPI basket, its movement significantly affects the index. Currently, house rent index in Thailand is compiled from actual rent survey across country. Even though it shows actual rent that each household spends, it is doubtful in terms of representation. Due to the fact that 80 percent of private households occupy their own residences while only 10 percent rent shelter according to the National Statistical Office[1], actual rent survey might not represent true housing service of majority. In addition, sample selection in rent survey is based on price collectors' judgment rather than statistical rationale, it is likely to contribute sample bias and inevitably affect the quality of house rent index as well as consumer price index. Moreover, house rent index in Thailand indicates low rate of change over time - close to zero - regardless of economic cycle. This is unlikely since house rent tends to fluctuate with economy, particularly real estate sector. These factors encourage Thailand for a further study in order to improve indices in terms of house rent and consumer price.

Bureau of Trade and Economic Indices, the Ministry of Commerce is writing this paper in collaboration with the Bank of Thailand to initiate an alternative approach for house rent index in consumer price index of Thailand. This study consists of two main sections:

[1] the 2000 population and housing census whole kingdom, the National of Statistical Office, Office of the Prime Minister, 2000

hedonic regression of house price index[2] – considered as owners' equivalent rent index in this study – and implication of its movement to house rent index and consumer price index of Thailand.

With highly-integrated database of new mortgage loans from 17 commercial banks in Bangkok metropolis and suburb areas using hedonic regression model, the Bank of Thailand has constructed house price index which consists of single house with land, town house with land, condominium and land on monthly basis from March 2008. Assuming that owner's equivalent rent index has the same movement as house price index, Bureau of Trade and Economic Indices turns to account of those indices and experimentally applies them to house rent index and consumer price index respectively. A comparison of index series between current and alternative approach in the light of economic cycle consistency will allow us to evaluate their effectiveness for the sake of methodology recommendation in the future.

II. Data source and coverage

As for house price index, monthly data of new mortgage loans from 17 registered commercial banks in Bangkok metropolis and 5 suburbs: Nothaburi, Pathumthani, Samut Prakarn, Samut Sakorn, and Nakornpathom since January 2008 is used for index compilation. The data is categorized into 3 groups: borrower features, loan features, and housing features. The appraisal property price with land within housing features category will be extracted to impute housing price and compile the index due to its reliability and completeness. Note that 83 percent of new personal loans in this database are mainly for new residential property. This implies that the house price index would rather reflect the price of newly established residential property than used residential property.

[2] House price index: Commercial banks mortgages' loans in Thailand, 2011, Bank of Thailand

Regarding consumer price index compilation, Bureau of Trade and Economic Indices, the Ministry of Commerce will excerpt only single house with land and town house with land price index and consolidate them into consumer price index within the same area and time coverage. Although Bank of Thailand provides separate price index for single house with land, town house with land, condominium, and land; both condominium and land are less likely to be included in house rent survey. Furthermore, single house and town house account for 78.8 percent of total dwellings according to the National Statistical Office[3].

III. Methodology

(1) Hedonic regression method for House price index: Single house with land and Town house with land

Since repeat sales method requires intensive and well-developed used property database and Thailand has yet developed into this stage, hedonic regression method seems to be the best option to construct house price index in Thailand[4]. Basically, hedonic regression method relates property prices to their price determining characteristics. Furthermore, to compare the prices in different period, those characteristics are standardized in order to remove the difference in terms of quality and location of properties. This implies that property prices will be qualitatively adjusted and reflects movement in prices only. Ideally, this approach obliges extensive database particularly dominant price determining characteristics to capture estimated property prices; however, some variables are difficult to quantify. Each country has selected those variables from their availability, completeness and significance in the model. There are no standardized selection criteria. In the case of Thailand, the Bank of Thailand includes 4 variables: age, number of storey, type of

[3] the 2010 population and housing census whole kingdom, the National of Statistical Office, Office of the Prime Minister, 2010

[4] House price index: Commercial banks mortgages' loans in Thailand, 2011, Bank of Thailand

developer, and location in the model. These variables will be standardized afterwards to remove quality difference over time.

To compile hedonic house price index, regressions between property price and its price determining characteristics are run using monthly data from 2008 - 2010, then the index is compiled using the predicted prices based on those regression coefficients, given that four price determining characteristics are standardized to average fixed (quantities of) characteristics in base year[5]. The log-linear house price model which relates property prices (p_i) to *k* price determining characteristics is shown below:

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

The full model can be illustrated as

$$\ln(p_i) = \ln(p_0) + \beta_1 AG + \beta_2 FL + \beta_3 devd + \beta_4 cd + \beta_5 ed + \beta_6 nd + \beta_7 sd + \beta_8 td + \beta_9 d11$$
$$+ \beta_{10} d12 + \beta_{11} d13 + \beta_{12} d73 + \beta_{13} d74 + \varepsilon_i$$

where

p_i = appraisal price of each property in each month (Baht/square meter)

p_0 = fundamental price of each property in each month

β_k = regression coefficient of price controlled characteristic *k*

$X_{k,i}$ = price determining characteristic

1) AG = age of property (year)
2) FL = number of storey in horizontal plane

[5] Residential Property Price Index Handbook, European Commission, November 2011

3) devd = dummy variable for type of developer

a. developers enlisted in Stock Exchange of Thailand = 1

b. developers not enlisted in Stock Exchange of Thailand and contractors = 0

4) Location = dummy variable

a. cbdd = inner area of Bangkok

b. cd = central Bangkok

c. ed = eastern Bangkok

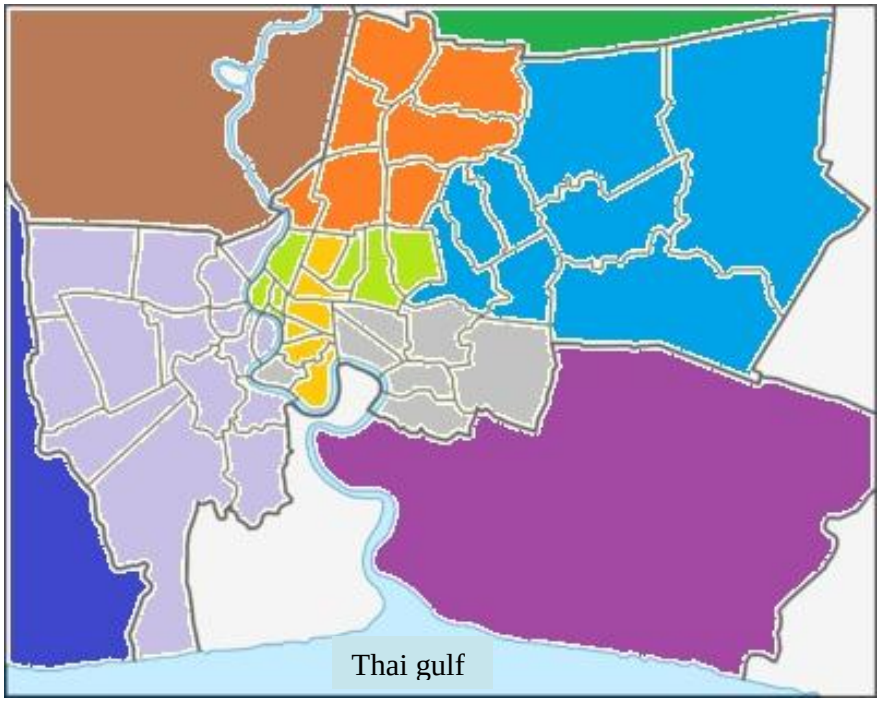
d. nd = northern Bangkok

e. sd = southern Bangkok

f. td = thonburi area (Old capital area)

g. d11, d12, d13, d73, d74 = suburbs of Bangkok which are Samut Prakan , Nonthaburi , Pathumthani , Nakhonpthom and Samut Sakorn respectively

Figure 1: Bangkok map showing areas in each dummy group



Monthly data of new mortgage loans from 17 registered commercial banks in Bangkok metropolis and 5 suburbs from January 2008 to December 2010 is screened[6] prior to being run in regression model above. The result of property price estimations for single house with land and town house with land are as follows:

Single house with land:

$$\ln(p_i) = 9.66 - 0.02\,AG^{*} + 0.30\,FL^{*} + 0.19\,devd^{*} - 0.11\,cd^{*} - 0.38\,ed^{*} - 0.28\,nd^{*} - 0.15\,sd^{*}$$
$$- 0.33\,td^{*} - 0.40\,d11^{*} - 0.34\,d12^{*} - 0.54\,d13^{*} - 0.59\,d73^{*} - 0.55\,d74^{*} \text{ .....} (2)$$
$$R^2 = 0.32$$

Town house with land:

$$\ln(p_i) = 9.65 - 0.02\,AG^{*} + 0.40\,FL^{*} + 0.17\,devd^{*} - 0.36\,cd^{*} - 0.71\,ed^{*} - 0.62\,nd^{*} - 0.49\,sd^{*}$$
$$- 0.74\,td^{*} - 0.90\,d11^{*} - 0.77\,d12^{*} - 0.99\,d13^{*} - 1.07\,d73^{*} - 1.00\,d74^{*} \text{ .....} (3)$$
$$R^2 = 0.52$$

*at significant level of 0.01

The result shows that all four price determining characteristics (age of property, number of storey, type of developer, and location) have significant effect on property price both single house with land and town house with land at significant level of 0.01. Moreover, the signs of each coefficient are consistent with theory and market situation in those periods other things being the same.

According to standard matched-model, fixed (quantities of) characteristics are necessary for comparability over time[7]. Bank of Thailand has chosen residential property

6 See selection criteria in Appendix

7 Residential Property Price Index Handbook, European Commission, November 2011

database in 2009 and taken it as reference stock by reason of data completeness[8]. Plugging in fixed (quantities of) four controlled characteristics of single house with land and town house with land in 2009 into equation (2) and (3), property price can be described below:

$$\ln(p_j) = \ln(p_0) + \sum_{k=1}^{K} \hat{\beta}_k X_{kj_{\text{Re fyear}}} \quad \text{.....(4)}$$

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

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)

and

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

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

8 Structure of stock of residential property in 2009 is illustrated in Appendix

(January 2008 – December 2010)

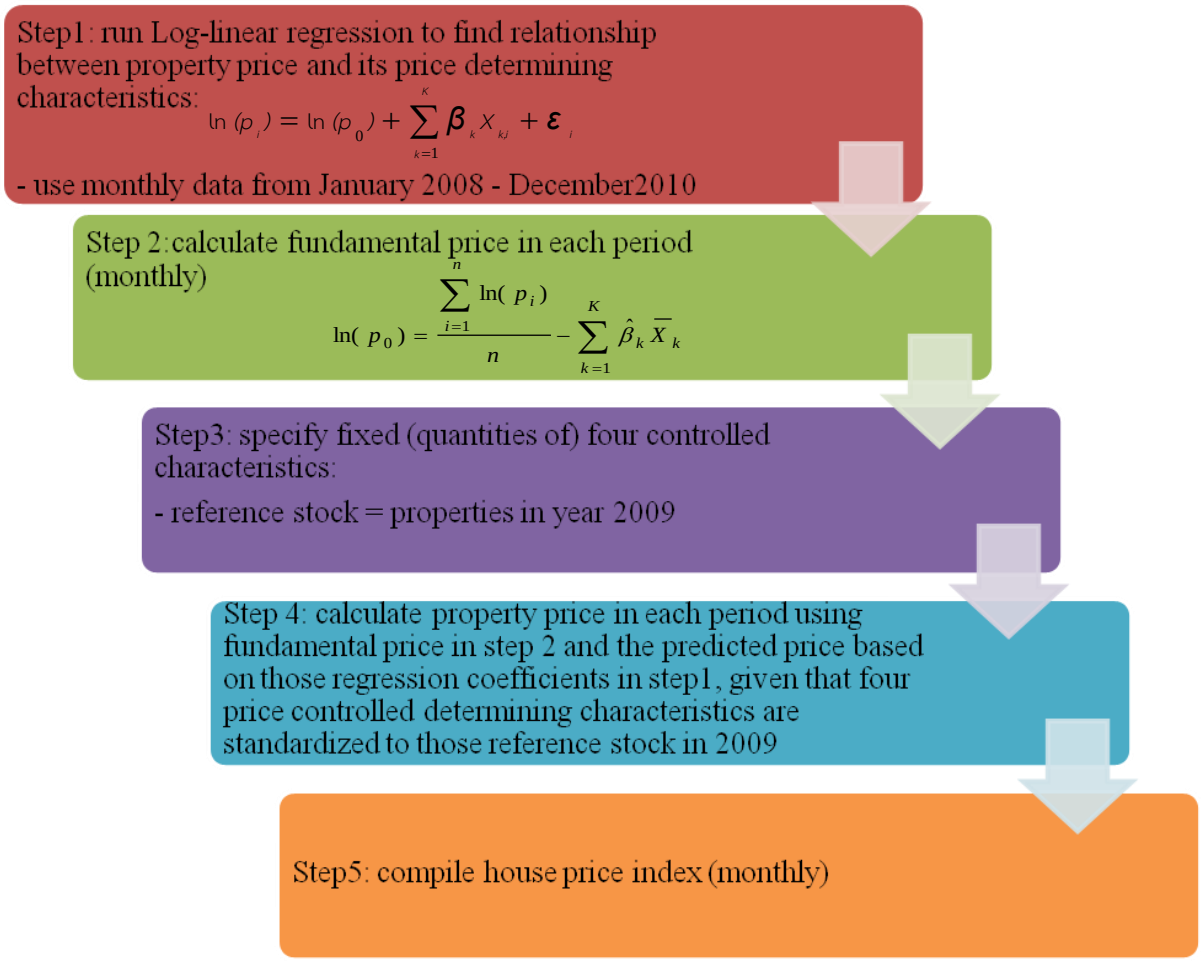
$\bar{X}_k$ = average of controlled characteristic *k* of *n* properties in each month

(January 2008 – December 2010)

Imputed prices from equation *(4)* above are equivalent to prices of property in respective year whose have matched characteristics as underlying property in reference year (2009).

In the final step, monthly house price index (January 2009 =100) is compiled, adjusted for seasonal movement, and then computed three months moving average[9]. In summary, house price index compilation can be illustrated in diagram below.

Diagram 1: Summary of house price index compilation



[9] Result is shown in Appendix

(2) Consumer Price Index compilation: combined with House Price Index movement

Bureau of Trade and Economic Indices, the Ministry of Commerce Thailand has compiled consumer price index to quantify a cost of living of people in municipal areas which are grouped into 5 regions: Bangkok metropolis and suburbs, Northern region, Central region, North Eastern region, and Southern region. Bangkok metropolis and suburbs consists of Bangkok, Nonthabuti, Pathumthanui, and Samut Prakarn – less coverage than the data used for house price index explained above.

Consumer Price Index is calculated from an arithmetic mean of changes in commodity prices in a reference basket. Those commodities are classified into 7 groups[10] according to Classification of Individual Consumption According to Purpose, COICOP, by the United Nations):

1. Food and Beverages
2. Apparel and Footwear
3. Housing and Furnishing
    a. Shelter which includes house rent
    b. Electricity, fuel and water supply
    c. Textile – house furnishing
    d. Miscellaneous appliances
    e. Household furnishing and equipments
    f. Cleaning supplies
    g. House services
4. Medical and Personal care
5. Transportation and Communication

[10] Subgroup details are illustrated in Appendix

6. Recreation and Education
7. Tobacco and Alcoholic beverages

The formula Bureau of Trade and Economic Indices has used to construct consumer price index is a "Modified-Laspeyres index"[11].

Formula

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

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

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

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

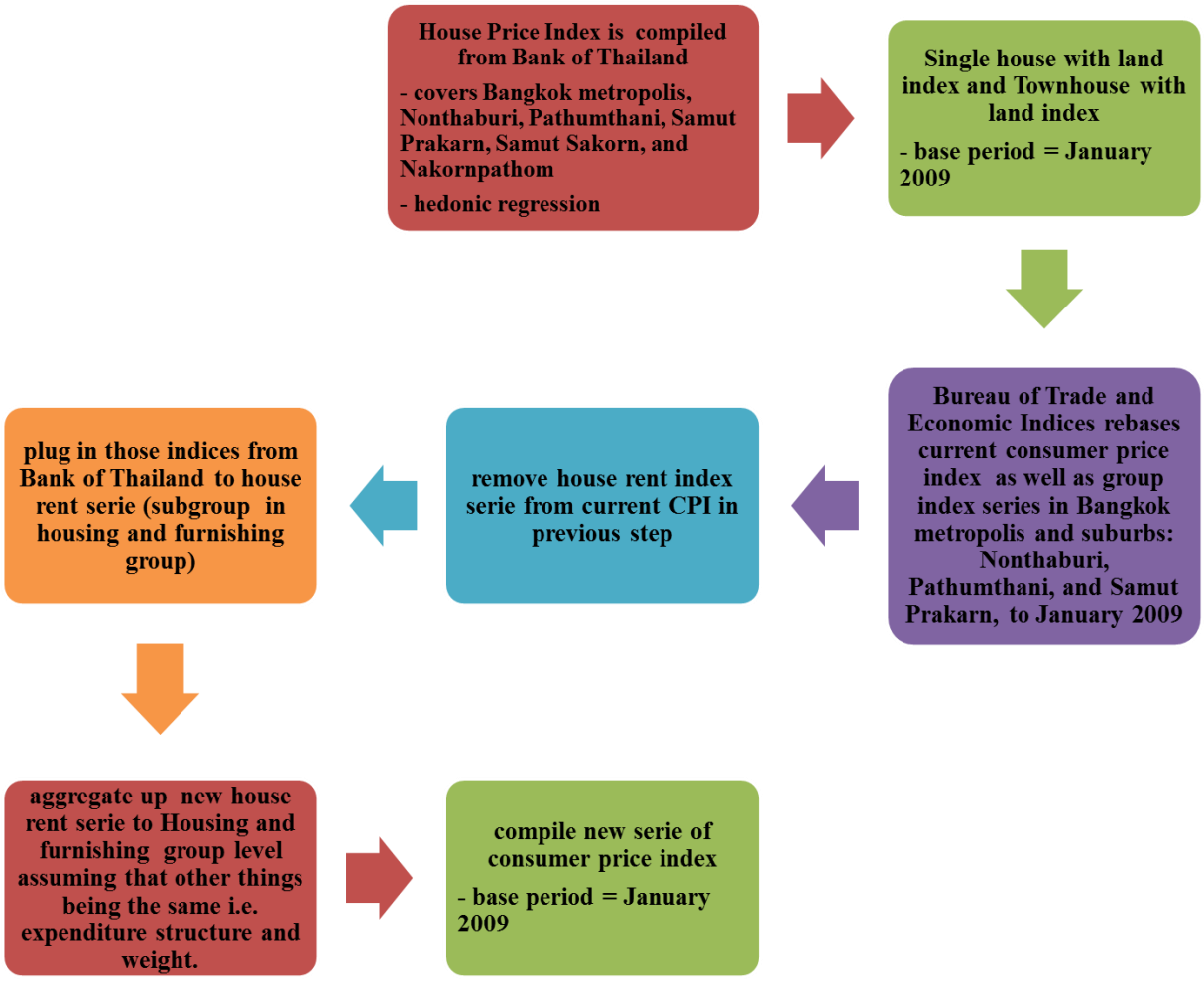
Whereas price reference period and weight reference period are the same in Laspeyres index; Modified Laspeyres index distinguishes those periods.

This study aims to approximate the difference in consumer price index due to house rent index and house price index using an implication of residential property price index. To differentiate the result from two series, current house rent index is replaced by house price index from residential property price in previous step. Afterward, house rent subgroup is aggregated up to housing and furnishing group. Finally, new consumer price index for Bangkok metropolis and suburbs is obtained after aggregating 7 groups together – weighted

11 What Was the Consumer Price Index Then? A Data Study, Lawrence H.Officer

with group weight. However, it is assumed that expenditure structure and weight for new series of consumer price index remain unchanged from old series. In the end, all consumer price index series are rebased to January 2009 in the same alignment as house price index study from the Bank of Thailand. Two steps of methodology can be summarized in diagram below

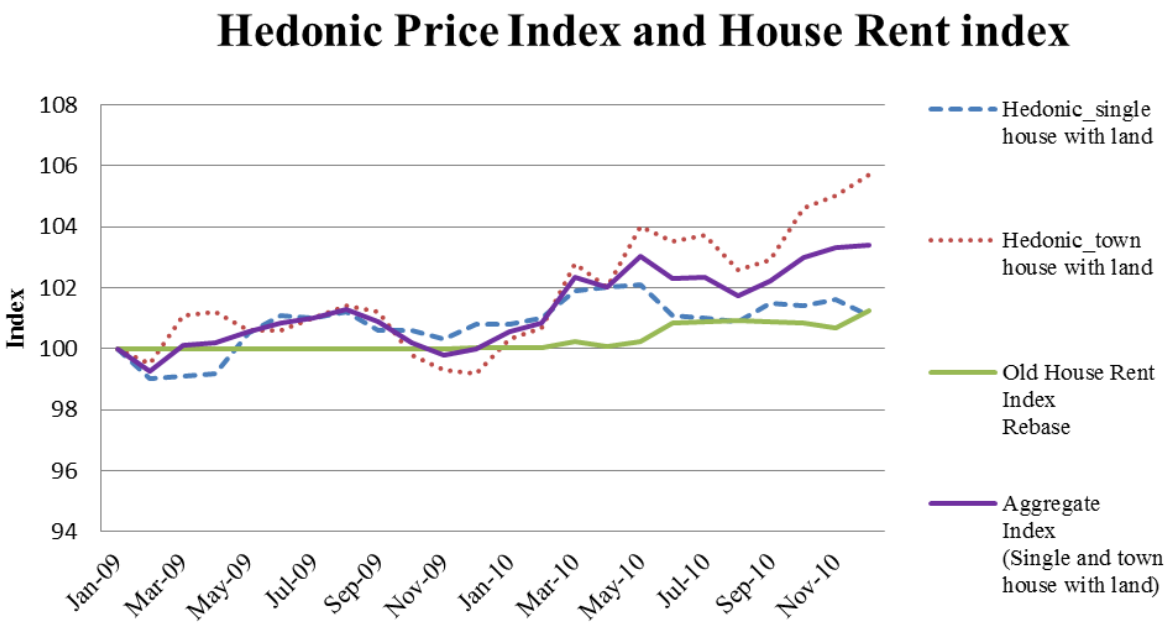
Diagram 2: Summary of methodology



IV. Results

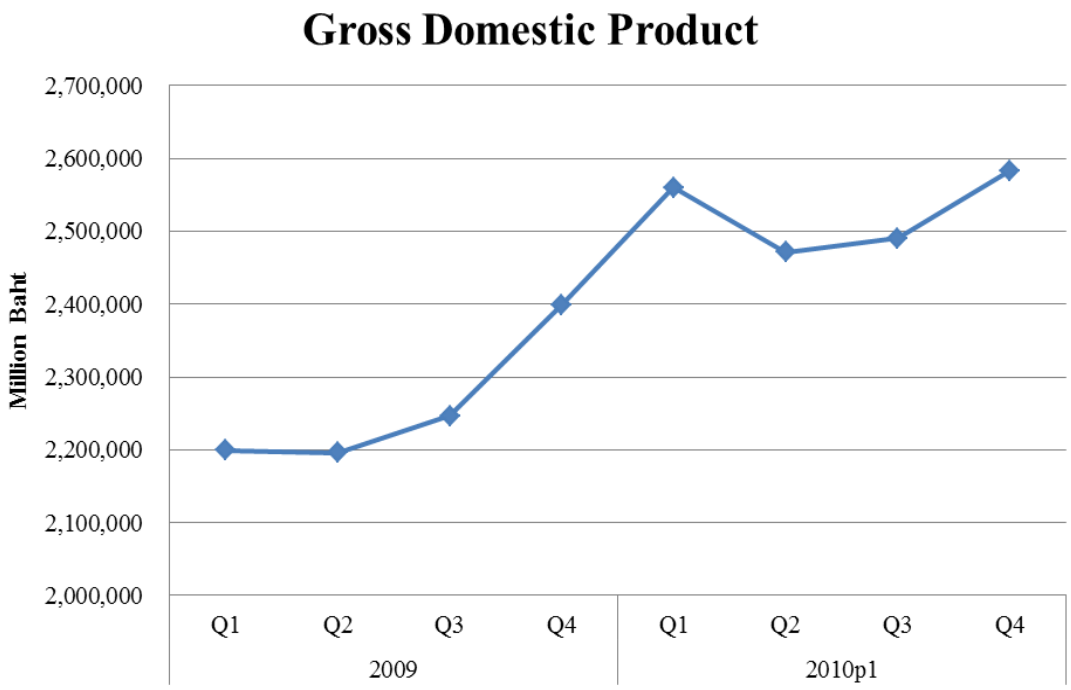
Hedonic regression study demonstrates that prices of single house with land and town house with land in Bangkok metropolis and suburbs increased 1.1 percent and 5.7 percent respectively in 2 years from January 2009 to December 2010. In other words, the prices moved 3.4 percent on average in contrast to price movement from house rent index which shows only 1.25 percent increase. The graph below demonstrates index of each serie within a study period.

Diagram 3: House price index from hedonic price regression and house rent index



Source: Bank of Thailand and Bureau of Trade and Economic Indices, Ministry of Commerce, April 2012

Diagram 4: Gross Domestic Product (GDP) of Thailand in 2009 - 2010

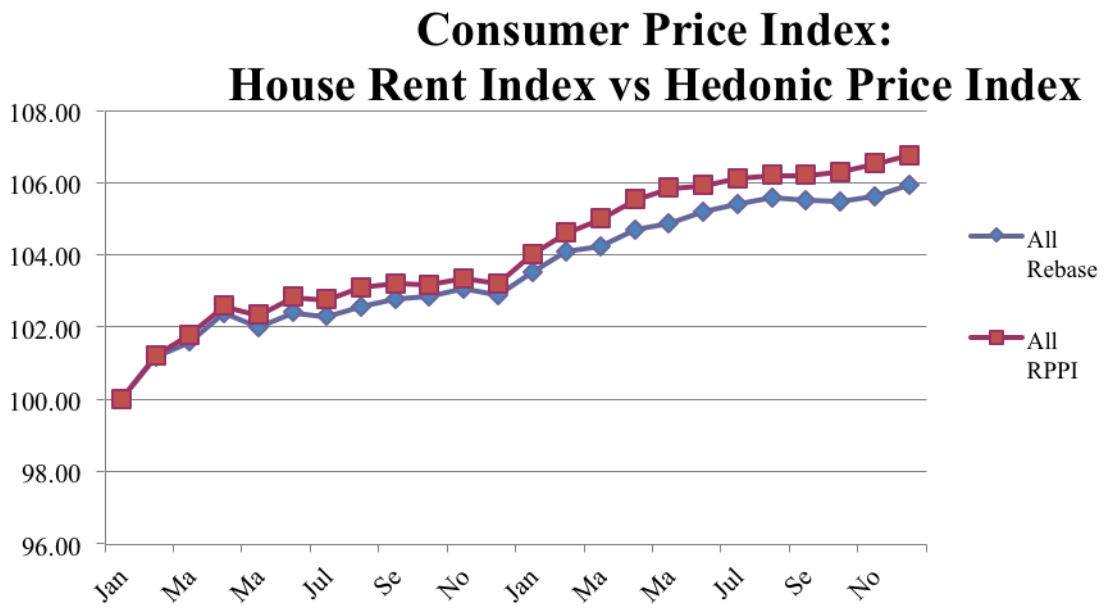


Source: National Economic and Social Development Board, Thailand

From graphs above, there is significant difference between two approaches: hedonic regression and house rent survey. In terms of price movement, the diagram shows that hedonic house price index tends to be more consistent with economic cycle than house rent index. Since a demand for residential property has been growing recently, house rent is expected to increase as well to reflect this high demand. However, house rent survey does not illustrate this implication and shows slight change in house rent.

In addition, this difference has transmitted to consumer price index in Bangkok metropolis and suburbs area as shown in the diagram below.

Diagram 5: Effect on Consumer Price Index (Bangkok and its suburbs)



Source: Bank of Thailand and Bureau of Trade and Economic Indices, April 2012

The Consumer Price Index in Bangkok metropolis and suburbs shifts upward when it is applied by hedonic house price index in house rent subgroup shown in all RPPI serie. In other words, the consumer price index with hedonic house price index increases by 0.51 percent on average as opposed to current method - house rent survey.

Based on data from Bangkok metropolis and suburbs, this study implies that a problem of sample selection bias is expected to be less as hedonic house price index has specific sample selection criteria. After all, this contributes to better representation on consumer price index. Above and beyond, hedonic house price index is able to provide more favorable index regarding economic cycle consistency particularly with real estate sector. In conclusion, hedonic house price index - taken into account as owners' equivalent rent in this case - computed from new mortgage loans data from commercial banks can be an alternative proxy which improves the Consumer Price Index in Thailand concerning better representation and economic cycle consistency.

V. Limitations of study and Recommendation

1. Difference in coverage area between hedonic house price regression and house rent survey might overestimate a divergence of house rent in this study. It would influence consumer price index after all. House rent survey as well as consumer price index has covered 4 provinces which are Bangkok metropolis, Nonthaburi, Pathumthani, and Samut Prakarn while hedonic house price index has used more extensive data – 6 provinces from Bangkok metropolis, Nonthaburi, Pathumthani, Samut Prakarn, Samut Sakorn, and Nakornpathom. However, we expect that an overestimation is scant since a behavior of 2 additional provinces in hedonic house price index study are likely to be similar to the rest of the suburb areas.

2. This study has excluded hedonic price index of condominium price for the sake of comparability with old consumer price index series due to the fact that few condominiums are included in house rent survey. In fact, 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.

3. As index from hedonic regression and consumer price have different base periods, index variation might prevail when we have rebased consumer price index to the same period as hedonic house price index.

4. This study simplifies that price movement of single house with land and town house with land represents the movement of other properties as well. This might overstate price movement of all properties in general since the market of single house and town house has currently been more widespread and competitive. In order to capture overall residential price movement precisely, hedonic regression for other properties are essential.

5. In spite that four price determining characteristics are controlled in hedonic regression: age of property, number of storey, types of developer, and location; standardized quantity of these variables might vary over time. A revision of regression is necessary to capture their changes as well as other changes in the market such as market structure, monetary environment, and consumer behavior.

6. Additionally, other price determining characteristics have not been controlled in hedonic regression study due to inaccessibility to those data. Likewise, some of them are sophisticated to quantify. Further assistance from many organizations is necessary in order to fill in the gap and strengthen the quality of hedonic house price index.

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Reference

Ruja Adisornkarnjana and Phongpiyapaiboon Notisarn, “An amended study of House Price Index from commercial banks’ mortgage loans”, Bank of Thailand, May 2011

The 2010 population and housing census whole kingdom, National of Statistical Office, Office of the Prime Minister, 2010

“Residential Property Price Index Handbook”, European Commission, November 2011

Prayoth Benyasut, “Consumer Price Index Handbook”, Bureau of Trade and Economic Indices

Lawrence H.Officer , “What Was the Consumer Price Index Then? A Data Study”, University of Illinois at Chicago

Appendix

Table 1: Data screening criteria

Type of property	Single house	Town house
Appraisal price (price per house)	500,000– 900,000	300,000 - 40,000,000
Age of property (year)	Less than 30	Less than 30
Number of storey	1-3	1-3
Usage area (square meter)	90 – 1,300	60 – 400
Size of land (square two-meters)	50 – 1,000	16 - 45

Source: A study of Residential Property Price Index of Thailand, May 2011

Table 2: Regression samples in Bangkok Metropolis and suburbs in 2008 – 2010 after data screening process

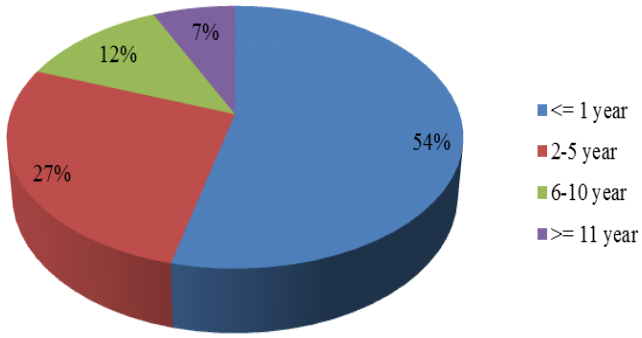
Type of property	Total data	Incomplete data (refer to table 1)	Samples
Single house	69,168	30,176	38,992
Town house	61,961	28,460	33,501

Source: A study of Residential Property Price Index of Thailand, May 2011

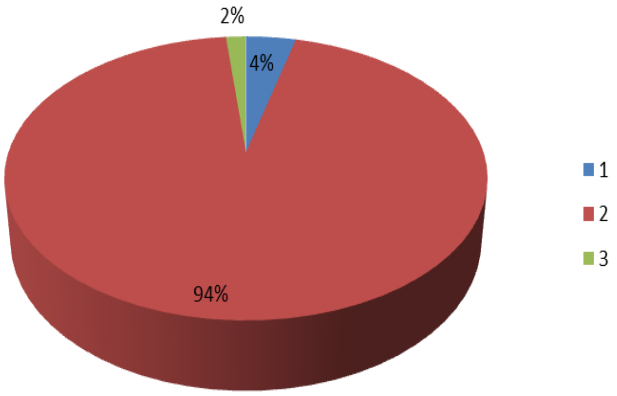
Diagram 1: Structure of reference stock in 2009

Single house

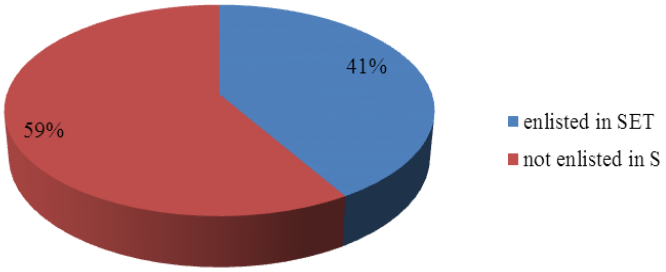
Age of Property



Number of Storey

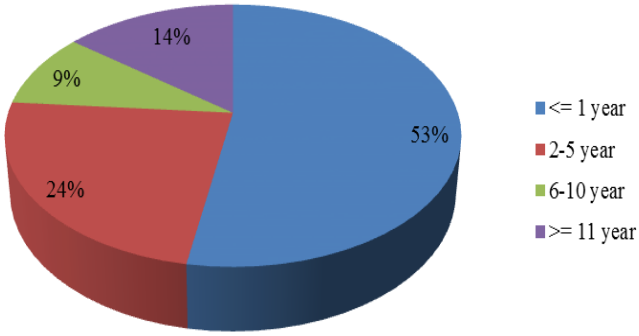


Type of developer

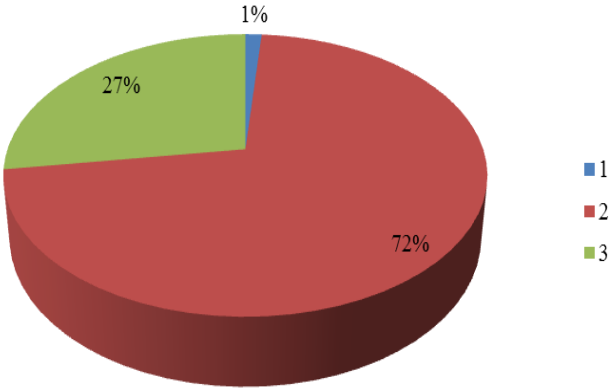


Town House

Age of Property



Number of Storey



Type of developer

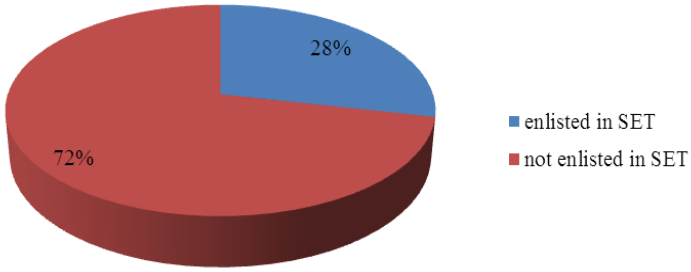


Diagram 1 (cont.): Structure of reference stock in 2009

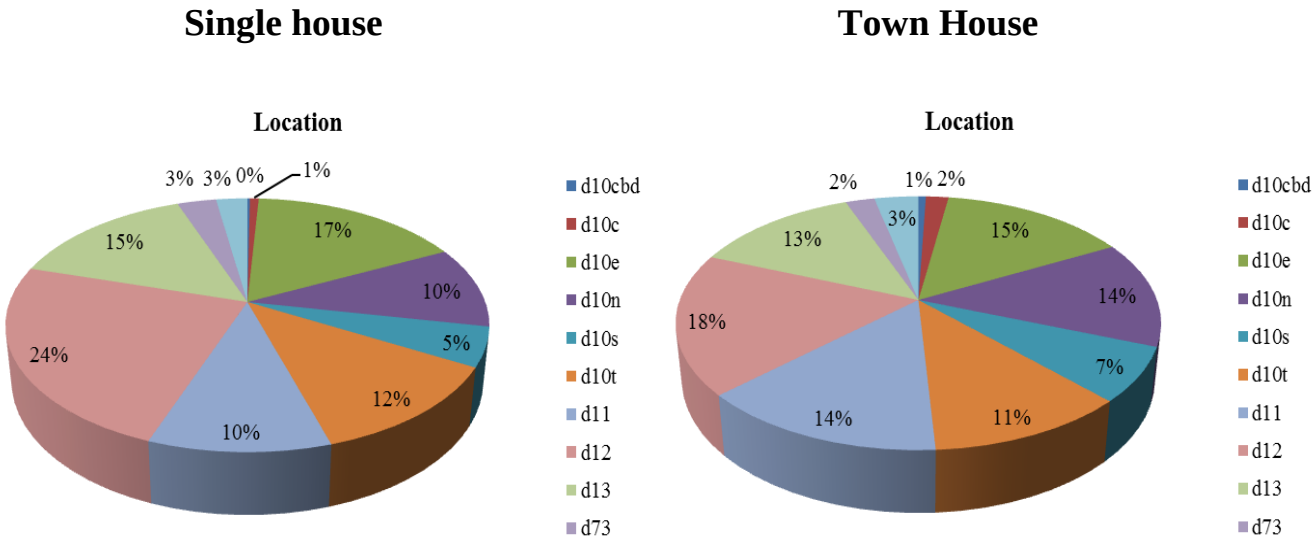


Table 3: House Price Index: Hedonic Regression Result

Period	Hedonic_single house with land	Hedonic_town house with land	Aggregate Index (Single and town house with land)
Jan-09	100.00	100.00	100.00
Feb-09	99.00	99.50	99.25
Mar-09	99.10	101.10	100.10
Apr-09	99.20	101.20	100.20
May-09	100.50	100.60	100.55
Jun-09	101.10	100.60	100.85
Jul-09	101.00	101.00	101.00
Aug-09	101.20	101.40	101.30
Sep-09	100.60	101.20	100.90
Oct-09	100.60	99.80	100.20
Nov-09	100.30	99.30	99.80
Dec-09	100.80	99.20	100.00
Jan-10	100.80	100.30	100.55
Feb-10	101.00	100.70	100.85
Mar-10	101.90	102.80	102.35
Apr-10	102.00	102.00	102.00
May-10	102.10	104.00	103.05
Jun-10	101.10	103.50	102.30
Jul-10	101.00	103.70	102.35

Table 3 (cont.): Residential Property Price Index: Hedonic Regression Result

Period	Hedonic_single house with land	Hedonic_town house with land	Aggregate Index (Single and town house with land)
Aug-10	100.90	102.60	101.75
Sep-10	101.50	102.90	102.20
Oct-10	101.40	104.60	103.00
Nov-10	101.60	105.00	103.30
Dec-10	101.10	105.70	103.40

Source: Bank of Thailand

Table 4: Groups and Subgroups in Consumer Price Index of Thailand

CODE	GROUP	SUBGROUP	WEIGHT IN BASE YEAR
0	ALL COMMODITIES		100
1000	FOOD AND BEVERAGES		33.01
1110		RICE, FLOUR AND CEREAL PRODUCTS	2.88
1120		MEATS, POULTRY AND FISH	5.73
1121		MEATS	2.29
1122		DUCK, CHICKEN AND FROG	1.08
1123		FISH AND AQUATIC ANIMALS	2.37
1130		EGGS AND DAIRY PRODUCTS	2.1
1140		VEGETABLES AND FRUITS	3.9
1150		SEASONINGS AND CONDIMENTS	1.95
1160		NON-ALCOHOLIC BEVERAGES	2
1200		PREPARED FOOD	14.45
1210		PREPARED FOOD AT HOME	7.93
1220		FOOD AWAY FROM HOME	6.52
2000	APPAREL AND FOOTWARE		2.96
3000	HOUSING AND FURNISHING		23.48
3100		SHELTER	15.91
3110		HOUSE RENT	15.19
3200		ELECTRICITY, FUEL AND WATER SUPPLY	5.1
3300		TEXTILE - HOUSE FURNISHING	0.18
3400		MISCELLANEIUS APPLIANCES	
3500		HOUSEHOLD FURNISHING AND EQUIPMENTS	

Table 4 (cont.): Groups and Subgroups in Consumer Price Index of Thailand

CODE	GROUP	SUBGROUP	WEIGHT IN BASE YEAR
3600		CLEANIMG SUPPLIES	1.43
3700		HOUSE SERVICES	
4000	MEDICAL AND PERSONAL CARE		6.87
4100		MEDICAL CARE	2.17
4200		PERSONAL CARE EXPENDITURES	3.8
5000	TRANSPORTATION AND COMMUNICATION		26.8
5100		PUBLIC TRANSPORTATION SERVICES	5.22
5200		VEHICLES AND VEHICLE OPERATION	13.56
5400		COMMUNICATION AND EQUIPMENTS	4.48
6000	RECREATION AND EDUCATION		5.21
7000	TOBACCO AND ALCOHOLIC BEVERAGES		1.66

Table 5: Results of Consumer Price Index compilation: combined with House Price Index movement

Period	All Rebase	All RPPI
Jan-09	100.00	100.00
Feb-09	101.16	101.22
Mar-09	101.59	101.78
Apr-09	102.39	102.59
May-09	101.98	102.33
Jun-09	102.40	102.84
Jul-09	102.30	102.77
Aug-09	102.55	103.10
Sep-09	102.76	103.22
Oct-09	102.83	103.18
Nov-09	103.05	103.35
Dec-09	102.89	103.21
Jan-10	103.52	104.03
Feb-10	104.07	104.62
Mar-10	104.24	105.01
Apr-10	104.69	105.53
May-10	104.87	105.85

Table 5 (cont.): Results of Consumer Price Index compilation: combined with House Price Index movement

Period	All Rebase	All RPPI
Jun-10	105.19	105.92
July-10	105.40	106.12
Aug-10	105.59	106.21
Sept-10	105.52	106.20
Oct-10	105.47	106.30
Nov-10	105.61	106.53
Dec-10	105.94	106.77

Source: Bureau of Trade and Economic Indices, Ministry of Commerce