



Hedonic Approach for House Rents in Japan

Makoto Shimizu

Director for International Statistical Affairs

Office of Director-General for Policy Planning (Statistical Standards)

Ministry of International Affairs and Communications, Japan

Outline

- Rent Data in Japan
- Regression Model for Rents
- Reviewing Quality Adjustment for Rents
- Conclusions

I Rent Data in Japan

- The rent survey districts are shifted every five years, corresponding to the Population Census.
- The monthly data on the rents and the floor space are collected from all households in rented houses owned by private sectors in the rent survey districts.
- The districts are divided into three reporting groups, and rent data are collected every three months for each group.
- Rent per unit area is obtained by dividing total gross rents by total floor spaces rented in each municipality.

Problem on Rent Data

- The change of average rents by removals of tenants, or building or disappearances of houses, sometimes shifts the index of rents for tenants with a large scale, when sample sizes within a type are too small, or when rents of exchanged tenants are outliers.
- The problem does not rise in case when rent data exist continuously by rapid transfer between the old and the new tenants but in case when data are unavailable during vacant period beside the transfer, because unavailability of data sometimes causes large movements in municipal rent indices which are calculated as averages among existing tenants in municipalities.

Candidate Methods for Quality Adjustment

- Typical methodology is carrying forward or backward of unavailable data.
- The Hedonic imputation can be an alternative method for missing data.
- From the renewal of the rent survey districts in 2007 for samples from 2008, construction year of houses has been newly asked by price collectors at the initial registration for the survey, can be used as a measure to evaluate deterioration of quality of houses.
- Another candidate methodology is consolidation of house type category for samples.

II Regression Model for Rents

$$r_k = e^a \prod_{i=1}^3 x_{ik}^{b_i} \quad \longleftrightarrow \quad \ln r_k = a + \sum_{i=1}^3 b_i \ln x_{ik}$$

r_k rent

x_{1k} floor space

x_{2k} construction year

x_{3k} land price

Table 1 Performance of the Regression Model for Rents in May, 2008 As an Example

	Small Wodden Houses		Medium Wodden Houses		Small Non-wodden Houses		Medium Non-wodden Houses	
	coefficient	t-value	coefficient	t-value	coefficient	t-value	coefficient	t-value
constant	-251	-44	-208	-66	-122	-30	-144	-47
floor space	0.45	22	0.47	43	0.61	54	0.70	100
construction year	33.58	44	27.91	67	16.44	31	19.11	47
land price	0.28	49	0.25	73	0.30	104	0.33	130
n	1658		5207		4799		10650	
adj.R ²	0.73		0.68		0.75		0.71	

III Reviewing Quality Adjustment for Rents

Prerequisites to Solve the Problem

- Accessibility to all necessary data for the methodology before compilation of the CPI which has to be released for short period after the survey.
- Stability of the methodology, with which the procedure of the compilation remains the same although data change.

Methods for Comparison

- Carrying backward of the data in the previous month for the data of tenants which newly entered the sample
- Carrying forward is applied for data in the month when tenants exit from the sample
- Imputation with the regression method for data in the previous month for entrance and those in the month for exit
- Application of estimation by the Hedonic method to all rent data, making it possible to adjust quality for all rent data including outliers

Table 2 Weighted Averaged Differences of Monthly Rents per Floor Space among Carrying Forward or Backward, Regression Model and the Hedonic Method from the Original Results in Some Months 2008 (Yen per Square Meter)

	small wooden houses					medium wooden houses					small non-wooden houses					medium non-wooden houses				
	entrance		exit			entrance		exit			entrance		exit			entrance		exit		
mon.	Car.	Reg.	Car.	Reg.	Hed.	Car.	Reg.	Car.	Reg.	Hed.	Car.	Reg.	Car.	Reg.	Hed.	Car.	Reg.	Car.	Reg.	Hed.
Apr.	1	2	2	0	-70	1	1	0	0	-11	1	2	0	0	-57	0	2	0	-1	-58
May	1	0	2	-3	-79	1	0	0	-1	-14	-1	0	1	-3	-59	0	0	0	-1	-58
Jun.	1	2	5	2	-81	1	0	0	0	-15	-1	1	0	0	-58	0	0	0	0	-58
Jul.	0	0	-5	-3	-81	1	0	0	0	-15	0	2	8	6	-54	0	0	1	0	-58
Aug.	2	0	3	2	-78	0	0	2	0	-14	-2	0	0	-2	-57	0	0	1	0	-57
Sep.	0	1	0	-3	-79	2	0	0	0	-13	1	0	0	0	-56	-2	-1	0	0	-56

Note:

Car. carrying forward or backward of missing data

Reg. regression model for imputation of missing data

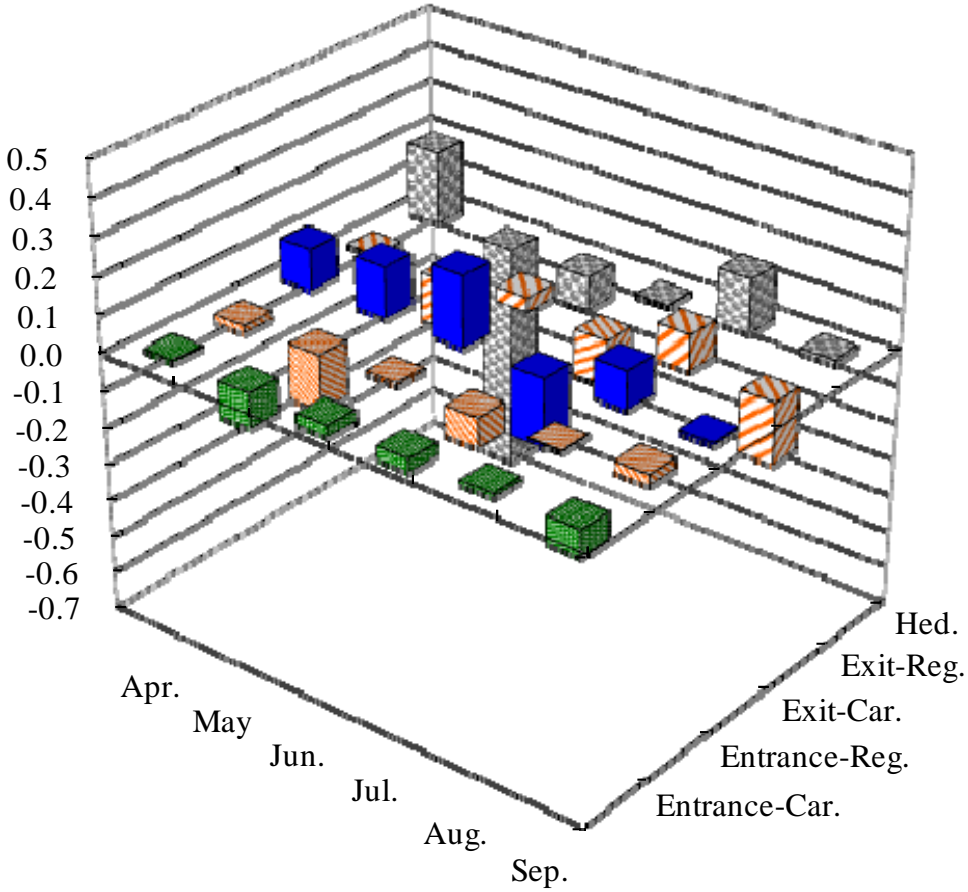
Hed. the Hedonic method replacing all actual data with estimations.

Table 3 Weighted Averaged Standard Deviations of Monthly Changes of Rents per Floor Space among Original Results, Carrying Forward or Backward, Regression Model and the Hedonic Method in 2008 (Percent Point)

	method of imputation	small wooden houses	medium wooden houses	small non-wooden houses	medium non-wooden houses
original results		1.7	1.1	1.7	0.7
entrance	carrying backward	1.6	0.9	1.4	0.5
	regression model	1.7	1.1	1.7	0.7
exit	carrying forward	0.8	0.7	0.7	0.5
	regression model	1.6	1.0	1.5	0.8
Hedonic		0.2	0.1	0.2	0.1

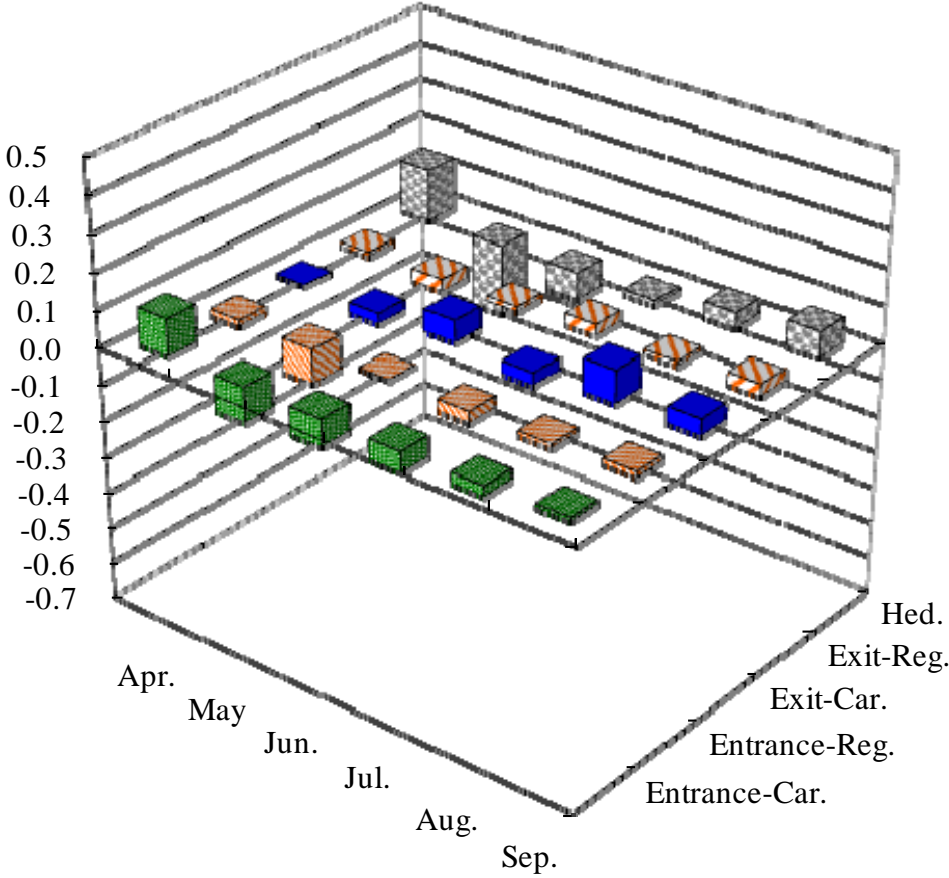
Note:
Effects by expansion of sample area are excluded.

Figure 1-1 Weighted Averaged Estimation Biases of Monthly Changes among Carrying Forward or Backward and Regression Model, and the Hedonic Method from Original Results in Some Months 2008 for Small Wooden Houses (Percent Point)



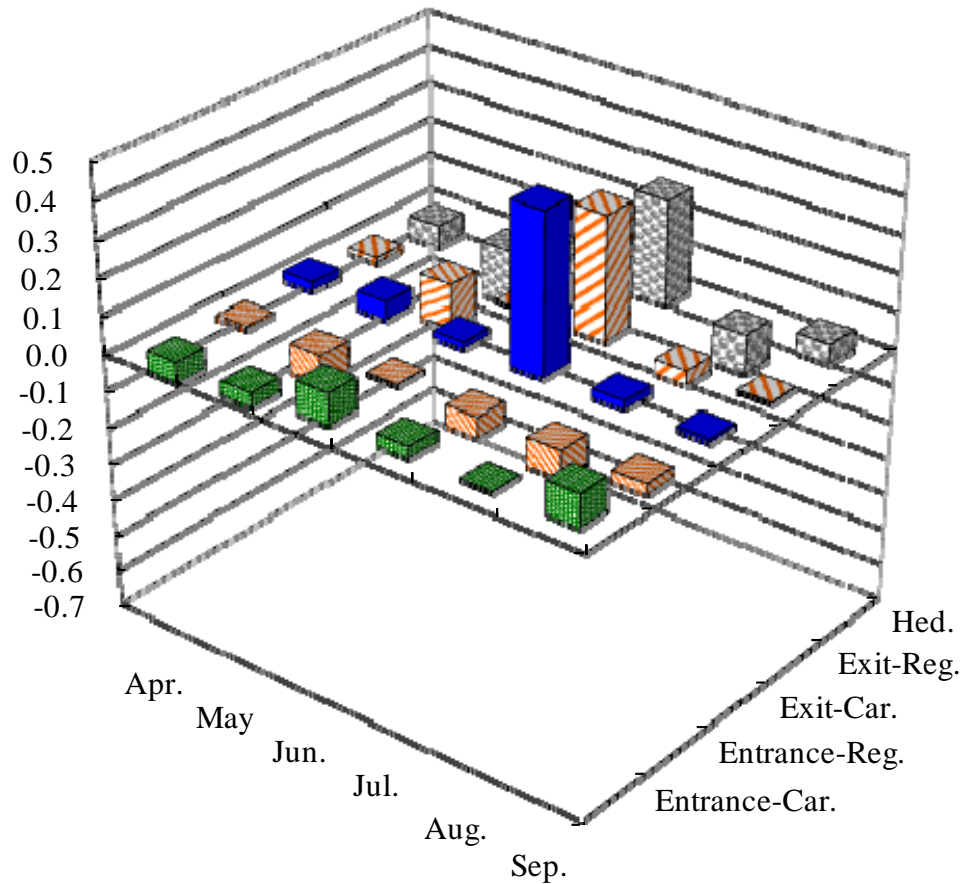
Note:
 Car. carrying forward or backward of missing data
 Reg. regression model for imputation of missing data
 Hed. the Hedonic method replacing all actual data with estimations.

Figure 1-2 Weighted Averaged Estimation Biases of Monthly Changes among Carrying Forward or Backward and Regression Model, and the Hedonic Method from Original Results in Some Months 2008 for Medium Wooden Houses (Percent Point)



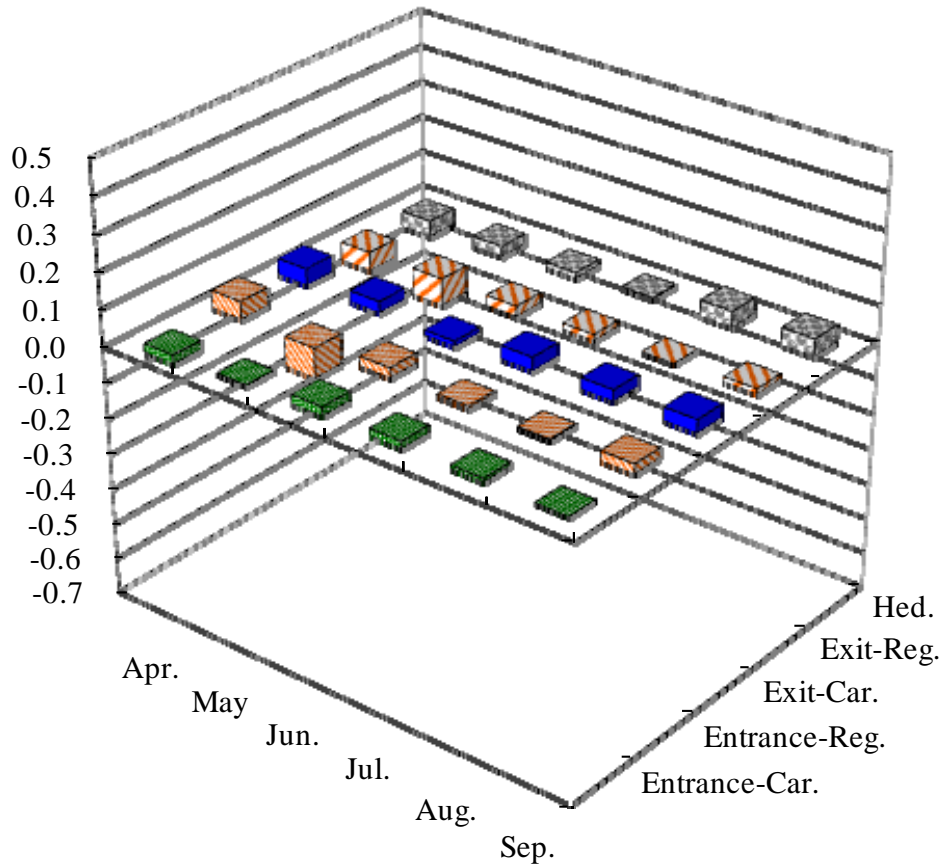
Note:
 Car.
 carrying forward
 or backward of
 missing data
 Reg.
 regression model
 for imputation of
 missing data
 Hed.
 the Hedonic
 method replacing
 all actual data
 with estimations.

Figure 1-3 Weighted Averaged Estimation Biases of Monthly Changes among Carrying Forward or Backward and Regression Model, and the Hedonic Method from Original Results in Some Months 2008 for Small Non-wooden Houses (Percent Point)



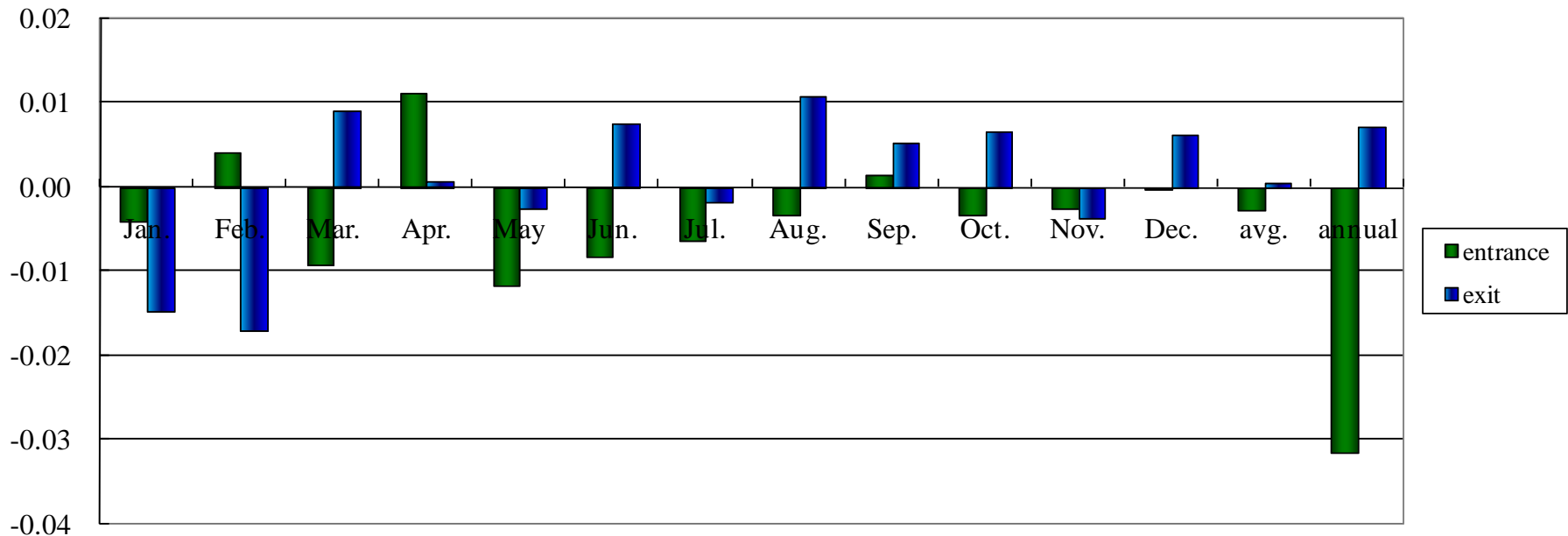
Note:
 Car.
 carrying forward
 or backward of
 missing data
 Reg.
 regression model
 for imputation of
 missing data
 Hed.
 the Hedonic
 method replacing
 all actual data
 with estimations.

Figure 1-4 Weighted Averaged Estimation Biases of Monthly Changes among Carrying Forward or Backward and Regression Model, and the Hedonic Method from Original Results in Some Months 2008 for Medium Non-wooden Houses (Percent Point)



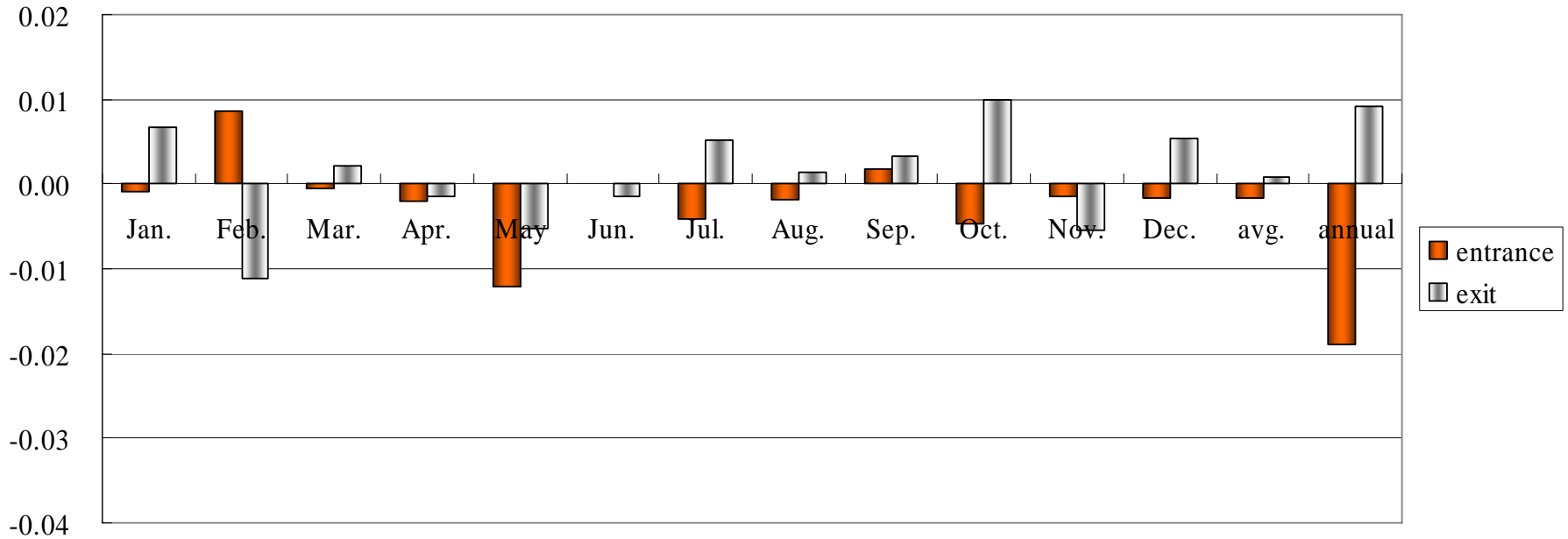
Note:
 Car. carrying forward or backward of missing data
 Reg. regression model for imputation of missing data
 Hed. the Hedonic method replacing all actual data with estimations.

Figure 2-1 Influences of Estimation Biases on Changes of the Official CPI for Carrying Forward or Backward in 2008 (Percent Point)



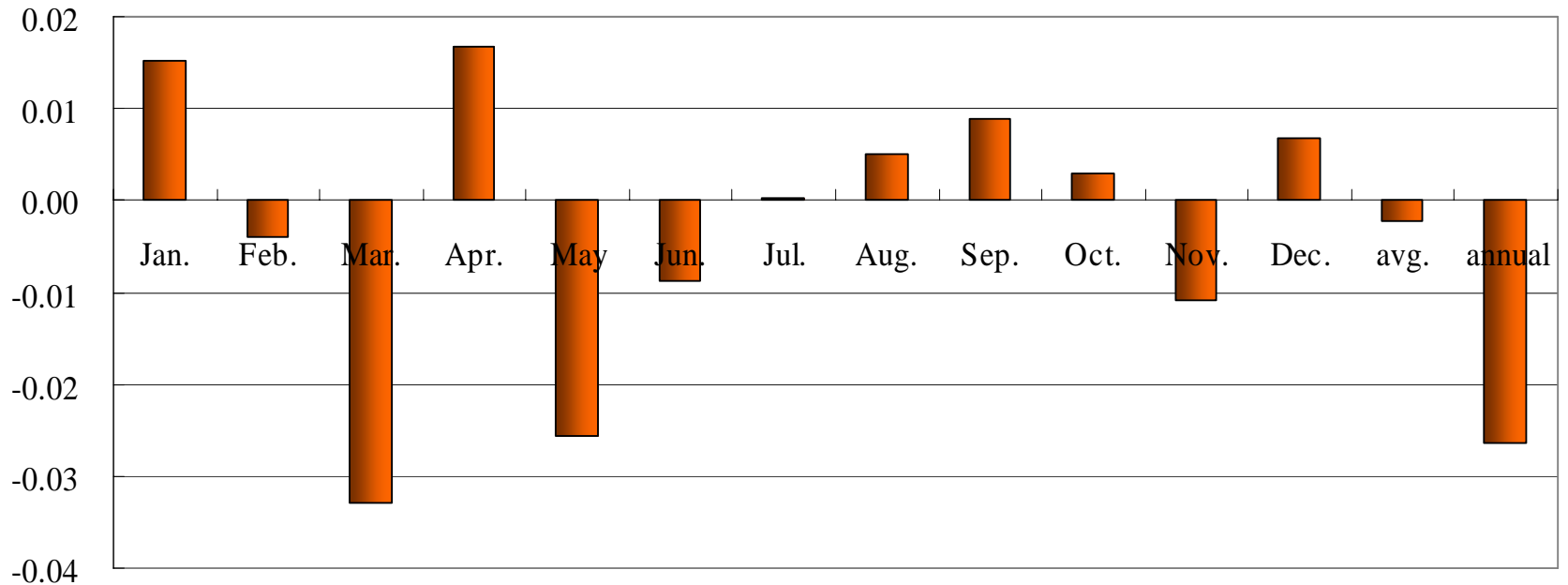
Note:
Effects by expansion of sample area are excluded.

Figure 2-2 Influences of Estimation Biases on Changes of the Official CPI for Regression Model in 2008 (Percent Point)



Note:
Effects by expansion of sample area are excluded.

Figure 2-3 Influences of Estimation Biases on Changes of the Official CPI for the Hedonic Method in 2008 (Percent Point)



Note:
Effects by expansion of sample area are excluded.

Evaluation of Methodologies

- From stability of rent indices, the best method is the Hedonic method, the next carrying forward and backward, the last regression model.
- From estimation biases, the order conversed, the best is regression model followed by carrying forward and backward.
- It is difficult by a single methodology to satisfy both of stability and approximation to original data.
- More detailed and long-term data should be applied to scrutinize further issues for improving estimations considering practical situation.

Conclusions

- Rents can be explained by a cross sectional regression model with floor space, construction year and land price.
- The model can strengthen stability of rent indices in area with small samples at the local level.