Chapter 13

A Study on the Relation Between Residential Land Value and the Distance to the Center of the Tokyo Metropolitan Area (1970–2016)

Kenichi Ueno

Abstract The purpose of this paper is to investigate the relation between residential land value and the distance to the center of the Tokyo Metropolitan Area from 1970 to 2016. The result shows three trends in the relation: (1) residential land value had increased at all standard sites even while the interest rate was kept high; (2) when the interest rate has become lower, the shorter the distance to the center became, the higher residential land value has increased; and (3) recently the areas where residential land value fluctuate has become narrower. This paper discusses about these trends.

Keywords Residential land value · The distance to the center · Tokyo Metropolitan Area · Gradient curve

13.1 Introduction

According to Ministry of Land, Infrastructure, Transport, and Tourism's publishment of value of standard sites, all use average of value of standard sites in Japan rose in 2016 after an interval of 8 years. Value of standards sites continued to increase since the first publishment in 1975 till the collapse of Japan's economic bubble in the 1990s. However, value of standard sites has increased only twice between 2008 and 2009 and this time after the collapse of bubble economy. Why did such a change happen? Whether in the central or in the suburban area of the Tokyo Metropolitan Area did value of standards sites increased? One of the methods to answer these questions is to investigate the relation between the distance to the

K. Ueno (✉)
Nihon University, Tokyo, Japan
e-mail: ken-u@ab.cyberhome.ne.jp

center of Tokyo and value of standard sites. The graph of this correlation is called “the land value gradient curve”.

Looking at the preceding studies of land value gradient curve, Kasiwadani (1987) plotted the relation between the mean of value of standard sites and the mean time distance to the center of Tokyo on a chart to estimate the land value gradient curve using data calculated municipality by municipality in the Tokyo Metropolitan and Saitama prefecture, namely with the western part of the Tokyo Metropolitan Area. The gradients estimated by Kasiwadani were same between 1970, 1976, and 1985 except for gradients around the center of Tokyo in 1985. Nishimura (1990) said this study by Kasiwadani indicated land value was stable relatively until 1985.

Ando (1995) estimated the land value gradient curves using all the data of value of standard sites in residential and commercial areas in the Tokyo and the Osaka Metropolitan Areas, and analyzed the diffusion of sharp rise in land value from the city center to the suburbs during the bubble economy by analyzing changes in the land value gradient curve with focus on the time distance to the city center. Yamada (2010) set a sphere at each a distance of a kilometer from Tokyo Station of Japan Railway, estimated the relation between land value and the distance to Tokyo Station, and made the regression curve from 1991 to 2009, using the mean value of standard sites within each a sphere. By the curve, he indicated what extent of the functions of the Tokyo Metropolitan Area was put together. These proceeding studies clarified changes in the land gradient curve in a certain shorter period when the bubble occurred or collapsed, but little study has demonstrated how land value gradient curve has changed for the long period from 1970, when publishment of value of standard sites started, to now. The objective of this study is to simply examine whether changes in the land value gradient curve existed in the Tokyo Metropolitan Area over the time period from 1970 to now, and to examine changes in the residential land value by analyzing which factors caused such changes, if any.

13.2 Data and Results of Estimation

Some preceding studies contrived data handling of value of standard sites because the number of standard sites has increased from 970 in 1975 to 25,270 in 2016, and during the period, many standard sites were substituted by new sites as the land use patterns had changed. Therefore, we must investigate the relation between the distance to the center of Tokyo and the land value with data of a set of same sampling sites or sampling sites which are as close as possible with each other in order for the analysis not to be biased. We can use residential land standard sites with data of a set of sampling like this retroactively to 1975 but cannot use so commercial land standard sites. In this respect, this paper investigates residential land value, using commercial land value in relation to the influence to the residential land value gradient curve. Sampling sites is used from “examples of value of standard sites in residential area around the rail road station” (Refer to Appendix of p. 8), published by Ministry of Land, Infrastructure, Transport, and Tourism. The standard sites of these examples are around a distance of 1 km to the nearest railroad station, and

Table 13.1 Dummy variables

Value factor	Dummy variables
Availability of waterworks, gas service, and sewerage	A complete set: 1, not a complete set: 0
Building attribute	Detached: 0, Condominium: 1
Restricted zone	Category 1 or 2 low-rise exclusive residential restricts, from 1976 to 1994 Category 1 exclusive residential district, and in 1970 exclusive residential district: 0, the other: 1

many of them are detached houses in Category 1 low-rise exclusive residential districts, and even in the other respects, they are almost of same quality. We investigate land value at the same sites retroactively to 1975 but in case of re-selection of standard sites, we choose sampling sites which are as close as possible around 1 km to the station. In case of no station near the sites, we took it off the sampling sites, taking the influence to land value into considering.

We conducted a multiple regression analysis by Hedonic approach to estimate the relation between the distance to the center of Tokyo and land value of the site. The center of Tokyo is set at the Ginza 4-chome cross with the highest land value in 2016. Explained variable (Y) of the estimated model is the residential land value. Table 13.1 shows Dummy variables.

The estimated models are as follows:

$$\begin{aligned} \ln(Y) = & \alpha + \beta_1 (\text{Distance to the center of Tokyo(km)}) \\ & + \beta_2 (\text{Distance to the nearest station (km)}) + \beta_3 (\text{site area (m}^2\text{)}) \\ & + \beta_4 (\text{Width of the frontage road (m)}) \\ & + \beta_5 (\text{Dummies such as the sower}) + \beta_6 (\text{Building attribute dummy}) \\ & + \beta_7 (\text{Restricted zone dummy}) \end{aligned}$$

Table 13.2 shows the results of estimation of 1970, 1976, and 1985, of which Kasiwadani (1987) showed “the land value gradient curve”, 1988 and 1994, when the land value increased and decreased rapidly, and 2008, 2010, and 2016, when land value fluctuated much. The result shows that land value is strongly related to “distance to the center of Tokyo”, “dummy valuables of availability of waterworks, gas service, and sewerage” in all observation years. Especially “distance to the center of Tokyo area” is significant at a 1% level. Land value is strongly related to “site area”, “distance to the nearest station”, and “building attribute” in almost all years.

Consequently, if the site is at a distance of 1 km to the nearest station, with availability of waterworks, gas service, and sewerage, in Category 1, 2 low-rise exclusive residential districts, the site area is 200 m² and the width of the frontage road is 6 m, the relation between natural logarithm of land value (Y) and the distance to the center of Tokyo (X) is estimated as the relational expression of each year. For example, we obtain the relational expression of 2016:

Table 13.2 Results of estimation

	2016	2010	2008	1994	1988	1985	1976	1970
Constant term	12.86*** (0.26)	12.87*** (0.26)	13.10*** (0.26)	13.18*** (0.17)	14.02*** (0.26)	12.84*** (0.15)	11.80*** (0.15)	11.34*** (0.14)
Distance to the urban center	-0.033*** (0.003)	-0.033*** (0.003)	-0.034*** (0.003)	-0.023*** (0.002)	-0.038*** (0.004)	-0.026*** (0.002)	-0.026*** (0.002)	-0.030*** (0.003)
Distance to the nearest station	-0.430*** (0.166)	-0.406*** (0.150)	-0.458*** (0.146)	-0.225*** (0.094)	-0.289*** (0.135)	-0.104 (0.08)	-0.078 (0.054)	-0.044*** (0.066)
Sites area	0.001*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.002*** (0.001)	0.016*** (0.001)	0.001*** (0.001)	0 (0.001)	0.001*** (0.001)
Width of the frontage road	0.038 (0.031)	0.008 (0.029)	0.011 (0.03)	0.003 (0.022)	-0.001 (0.029)	0.002 (0.017)	0.040** (0.02)	-0.006 (0.017)
Water service, gas service, and sewerage	0.565*** (0.165)	0.471*** (0.150)	0.466*** (0.152)	0.143** (0.061)	0.336*** (0.091)	0.216*** (0.054)	0.285*** (0.064)	0.262*** (0.074)
Building attribute	0.231 (0.176)	0.326** (0.144)	0.381*** (0.145)	0.316** (0.143)	-	-	-	-
Restricted zone	-0.127* (0.076)	-0.065 (0.071)	-0.129* (0.071)	0.059 (0.054)	-0.324 (0.329)	0.108 (0.265)	-0.020 (0.057)	-0.181*** (0.078)
Adjusted R-squares	0.73	0.74	0.76	0.76	0.73	0.78	0.76	0.76
Prob (<i>F</i> -Statistics)	0	0	0	0	0	0	0	0
Sample size	129	129	129	121	121	114	111	69

Notes. Standard errors are given in parentheses ***, **, * are 1%, 5%, and 10% significance level each

$$\ln (Y) = 13.36 - 0.033X \tag{13.1}$$

I convert it into an exponential function and make the graph to become plain visually.

13.3 Chronological Changes of Land Value Gradient Curves

I make the relational expression (13.1) in the previous section the graph and explain about the chronological changes of the gradient curves, using the economic indicators which have generally a strong influence to land value.

Figure 13.2 shows the gradient curves of 1970, 1976, and 1985 within 50 km area to the center of Tokyo. The vertical axis of Fig. 13.2 is logarithmic scale like the graph of Kasiwadani. The gradient curves in Fig. 13.2 rise parallel just like Fig. 13.1, except the difference that the horizontal axis of Fig. 13.1 is the time distance, but the axis of Fig. 13.2 is the distance to the center of Tokyo. The interest rate: 10-year government bonds interest rate had been about 8% until 1983 and then began to decrease and became 6.6% in 1985. As Table 13.3 indicates, in the meanwhile the increased rate of residential land value was higher than the rate of the commercial

Fig. 13.1 The gradient curve in the west of Tokyo from Kasiwadani (1987)

Fig. 13.2 Changes of the gradient curve (1970, 1976, and 1985)

Table 13.3 Changes of Land value, GDP, and wages indexation (1970 = 100)

Year	Residential land price	Commercial land price	GDP	Wages index
1970	100	100	100	100
1976	226	165	227	265
1985	406	262	444	414
1988	856	703	519	449
1994	699	487	676	528
2008	440	204	668	518
2010	400	178	655	497
2016	391	180	682	—

land value. The mean residential land value in the Tokyo Metropolitan Area, GDP, and the index of wages increased in 1976 and 1985 at the same ratio as a basis of 1970. This indicates income increase influenced to the increase of the residential land value.

Next, I estimate the gradient curve of 1988 before the collapse of Japan’s economic bubble, and 1994 and 2008 after the collapse. I make the vertical axis a normal scale in order to show the land value was remarkably high in the bubble. Looking at Fig. 13.3, land value decreases as much as it becomes nearer to the center from 1988 through 1994. Land value of 1994 is less than half land value of 1988 around a distance of 10 km to the center. On the other hand, the gradient curves of 1988 and 1994 are adjacent to each other around a distance of 50 km from the center, because value of sites around a distance of 50 km increased or didn’t. After 1994, land value continued to decline for more than 10 years. Figure 13.3 also shows that the gradient curve in 2008 is falling down as much as it becomes far from the center,

Fig. 13.3 Changes gradient curves (1988, 1994, and 2008)

and this indicates land value decreased throughout the Tokyo Metropolitan Area from 1994 to 2008.

The long-term interest rate began to drop since the latter half of 1980s: the rate was 4.9% in 1988 and 3.3% in 1994. Table 13.3 shows that land value rose much more largely than GDP and Wages index from 1985 through 1988. Commercial land value increased much higher than residential land value during the same period, contrary to from 1970 through 1985. This situation continued until 1991.

The sharp drop of the interest rate since the latter half of the 1980s stimulated the demand for commercial land greatly, and as a result, land value increased highest at the center of the Tokyo Metropolitan Area and then expanded to the surrounding areas. Because the demand for residential land value was still strong, the shorter the distance to the center became, the higher residential land value has increased, with the increase of commercial land value. In the decrease situation, the shorter the distance to the center of Tokyo became, the more residential land value decreased. Land value increased in the center of Tokyo, and after then the increase extended throughout the Tokyo Metropolitan Area, because residential areas were newly developed even at a distance of more than 50 km to the center.

Judging from the gradient curves of 1988 and 1994, the shorter the distance to the center of Tokyo became, the more sharply residential land value decreased. Judging from the gradient curves of 1994 and 2008, residential land value decreased throughout the Tokyo Metropolitan Area, though changes of gradient curves during the period are not plotted. Figure 13.4 plotted the gradient curves of 2008, 2010, and 2016. Lehman Shock in 2010 caused residential land value to decrease sharply. The gradient curve moved counterclockwise from 2008 to 2010, and this means residential land value decreased as much as it was near to the center of Tokyo. But the extent of these changes of Fig. 13.4 is much smaller than Fig. 13.3. The gradient curve of 2016 is located between the curves of 2008 and 2010. This means that residential

Fig. 13.4 Changes of the gradient curve (2008, 2010, and 2016)

land value of standards sites of 2016 publication had the upward trend, but didn't recover to the level of 2008.

In 2006, the economic expansion continued for 4 years and forth month and consequently exceeded the bubble economy period which was the longest until then, and the interest rate of ten-year national debt dropped by 2%. In the economy expansion period, land value increased in 2007 and 2008. Like the state of the late 1980s, strong demands for commercial areas near the center of Tokyo area raised commercial land rent. Rent increase also caused the increase of residential land value. After the Lehman shock happened, demands for land dropped and land value decreased immediately. The latest increase of land value occurred mainly in the commercial areas, because the land demand was restored in the commercial areas around the center of Tokyo by the quantitative easing by the Bank of Japan. On the other hand, the increase of residential land value was not so large, because incomes decreased by the influence of a consumption tax increase.

It is evident from the above-mentioned consideration that changes of land value gradient curves have the next three patterns.

1. Though the interest rate was kept high, gradient curves of residential land value shift upward as a whole. In other words, for some period land value of all sampling sites increased.
2. When the interest rate has become lower, the shorter the distance to the center became, the higher residential land value has increased.
3. In these past 10 years, changes of land gradient curves became smaller. The shorter the distance to the center became, the higher residential land value has increased, but the areas where residential land value fluctuated have become narrower.

I discuss (3) from (1) further in the next chapter.

Fig. 13.5 The bit price at X_0 spot when income increases

13.4 Why Do Gradient Curves Change?

- (1) Wheaton (1973) developed a concentric ring model by Alonso into a general equilibrium model and got the theoretical conclusion about the relation between land rent and the distance to the city center. The premises of the model are as follows. Consumer goods are produced in the city center. Wage, price, and consumer goods cost are given exogenously. Employees working in the city center have same income and utility. There is a trade-off between land rent and the distance to the city center. In the closedown city, population scale is decided endogenously, while in the open city, utility level is given exogenously and population scale is decided endogenously. A landowner is a local monopolist and rents land to the person who bids the highest rent per one-unit area by auction.

The conclusion of the model is that income increase and a drop of traffic cost cause the border to enlarge in the closedown city and to lower rent as much as it is near the city center. The slope of the rent gradient curve is gentler according to the distance to the city center. On the contrary, in the open city, rent increases at all spots. I explain the case of open city briefly with reference to Nakagawa (2008). Looking at Fig. 13.5, all inhabitants are assumed to rent land of lot size L in each spot of the city and to consume synthetic goods Z . We maximize a utility function $U(Z, L)$ under a budget linear function: $Y = Z + R_0L + kX_0$, assuming transportation expenses to the X_0 spot as kX_0 . Because population flows in the open city and utility level is decided exogenously, the income increase ($Y_0 \rightarrow Y_1$) brings rent increase ($R_0 \rightarrow R_1$), as described in Fig. 13.5. This rent increase in all spots resulted in moving above the rent gradient curve as Fig. 13.6 indicates.

Fig. 13.6 The rent gradient curve when income increases

Next, I consider the relation between rent and land. The model above is built upon the assumption that a landowner, who monopolizes land in the region, does not sell but lent land by auction. This model assumes that the interest rate does not fluctuate, in that the model doesn't use the interest rate as variables. When in each spot rent is determined by auction, a landowner is supposed to calculate land value. I write land value P , rent R , the interest rate i , and the increase rate of rent θ . During all periods, i and θ are constant. If land value is equivalent to discount present worth of the profit that land will produce in the future,

$$P = R/(i - \theta)$$

In each spot $\Delta P/P = \Delta R/R$, and as a result, the land value gradient is equivalent to the rent gradient.

From 1965 through 1985, the Tokyo Metropolitan Area continued to enlarge by chronic shortage of house stock since the World War II and population inflow from the other areas. Until about 1985 the interest rate was fixed as the high level. These society economic conditions are similar to the assumption of the model above. One of the results obtained from the model, "In the open city income increase brings rent to increase at all spots", explains well that the index of wages and residential land value are about same until 1985 if the level of 1970 is 100, as Table 13.3 shows, and land value increased at the similar rate in all sampling spots; in other word, the gradient curve moves parallel at the upper right.

- (2) The model above can't explain the movement that when the interest rate has become lower, the shorter the distance to the center became, gradients of the residential land value curve has become bigger, namely the higher residential land value has increased. Lowering of the interest rate enhanced demand for commercial land and increased discount present worth of the profit and consequently influenced residential land value. It appears in that commercial land value became much bigger than residential land value at the increase rate from 1985 to 1988 as Table 13.3 shows.

Fig. 13.7 Office or apartment rent indication (Kanto region)

Note: H7 is 1995 and 25 is 2013.

The model of Wheaton assumes that production place is located at the center of a concentric circle and doesn't influence residential land rent. But if a drop of the interest rate enlarges the area of the center of the concentric circle, it consequently influences residential land value. According to Tomita (2015), the floor space of office changed from 1321 hectare of 1972–3589 hectare of 1995, of which 1076 hectare increased from 1982 to 1992. The increase of these spaces greatly exceeds the other uses and the other regionals. In addition, according to the investigation for condominiums in the three special wards of Tokyo Metropolitan, it is reported that about half of dwelling units were converted into non-house uses such as offices by house number ratio.

It is generally said that land value increase from the latter half of 1980s through 1991 was caused by the occurring of the economic bubble. During the period, there were two factors to increase residential land value. The first factor is that income increase and population flow since some time before 1985 made the gradient curve to move above. The second is that commercial rent increase by a drop of interest rate had some influence to residential land value.

In the decrease situation, the gradient curve fell down as much as it was near to the center and afterward all spots fell down gently. The sharp drop of commercial land value of the center of the Tokyo Metropolitan Area is the factor of the first decrease. The one cause of the gentle decrease in all spots since 1994 is that income had the tendency to decrease every year.

- (3) The common change between twice land value increases for these past ten years is that the shorter the distance to the center of Tokyo became, the more land value changed, and on the other hand, land value didn't increase in the sphere far from the center of the Tokyo Metropolitan Area. One factor of this change is that land rent has a tendency to decrease. Because we cannot observe land rent by data, but, alternatively, we use rent of office and apartment.

Looking at Fig. 13.7, office rent increased around 2006 and 2007, then turned to decrease, and increased again in 2013. On the other hand, apartment rent continues to decrease since 1995. Apartment rent excluding imputed rent of Consumer Price Index has decreased since 1997 in Kanto Region, namely almost the Tokyo Metropolitan Area. According to Basic Resident Register of these days, the past 3- or 4-year population tends to flow out in the sphere from 30 to 40 km of Tokyo metropolitan area.

Wheaton model assumes that in the open city population flows into suburbs until utility of inhabitants becomes same. Because recently the Tokyo Metropolitan Area population tends to flow out from the suburbs. The residential land value gradient curve tends to shift downward around the suburbs. As a result, land value of the residential area changed only near to the downtown area.

13.5 Conclusion

This paper finds two movements of the residential land gradient curve; the one is to shift upward as a whole because of a lack of residential land by population inflow and the increase of income, and the other is to shift upward near the center of the Tokyo Metropolitan Area by strong demand for the commercial area under the drop of the interest rate and the expansion of economic activities. In these past 10 years, apartment rent tends to decrease and house residential rent tends to shift downward as much as it becomes far from the center of the Tokyo Metropolitan Area. As a result, the increase of commercial land value by stronger demand for the commercial land around the center had some influence to the narrower sphere of the residential land. Land value of the residential area that is near to the center of the Tokyo Metropolitan Area increased recently, but if the commercial areas demand and the rent of office decreased in the economic recession situation, land value of the residential area would decrease.

The limitation of this paper is that we don't analyze the value forces of commercial land which influences residential land value. Value forces of commercial land have been made by the profit reduction price method, as securitization of the real estate has penetrated. It can be presumed that some factors except an interest rate let commercial land value change under an ultra-low interest in recent years. In future, it is critical to study further in what time commercial land value increases or decreases with a full understanding of exiting studies.

Appendix: Examples of Published Value of Standard Sites in Residential Area Around the Railroad Station in 2016

The vicinity of railroad	Standard site number
10 km range	Minato-2, Tiyo-da-3, Sinjuku-6, Taitou-1, Bunkyo-5, Shibuya-5, Shibuya-7, Sinagawa-11, Megro-9, Setagaya-5, Nakano-1, Toshima-15, Kita-9, Katushika-17
Keihin Express Line	Ota-3, Kounan-1, Yokohamakanazawa-11, Yokosuka-37
Yokosuka Line	Hodogaya-1, Kamakura-25, Zushi-7, Yokosuka-37
Keihin Tohoku Line, Nanbu Line	Ota-10, Yokohamaturumi-21, Kou-8
Tokaido Line	Yokohamanishi-5, Totsuka-12, Kamakura-15, Fujisawa-46, Hiratuka-24
Yokohama line, Soutetsu Line, Negishi Line	Yokohamamidori-3, Yokohamaasahi-1, Yokohamanaka-6, Isogo-8
Touyoko line, DenenToshi Line	Ota-30, Kouhoku-12, Kouhoku-34, Setagaya-59, Yokohamaaso-19, Yamato-9, Yokohamaaoba-12, Yokohamamidori-15,
Odakyu line, Odakyu Enoshima Line, Keiou line	Setagaya-39, Asou-29, Machida-19, Sagamiminami-4, Atsugi-20, Isehara-7, Yamato-6, Fujisawa-34, Setaga-1, Tyoufu-2, Tokyofutyu-2, Tama-6, Hino-24
Chuo Line, Musashino Line	Suginami-9, Musashino-14, Kokubunji-7, Kunitachi-10, Tachikawa-6, Hino-25, Hachioji-66, Hachioji-73, Yoshikawa-3, Saitama-9, Niiza-14
Oume Line, Itukaichi Line	Akishima-12, Oume-8, Akiruno-4
Seibu Sinjuku Line, Seibu Ikebukuro Line	Suginami-27, Nishitokyo-8, Kodaira-3, Sayama-12, Nerima-25, Nishitokyo-22, Kiyose-6, Tokorozawa-36, Iruma-3, Hannou-1
Tobu Tojo Line, Tobu Isesaki Line, Toubu Noda Line	Itabashi-4, Wakou-4, Shigi-2, Fujimino-6, Kawagoe-1, Sakato-2, Higashimatuyama-3, Adachi-39, Koshigaya-14, Kasukabe-12, Sugito-4, Nagareyama-10
Tskuba Express Line	Yashio-10, Nagareyama-14, Kasiwa-55, Moriya-3
Touhoku Line, Takasaki Line	Kawaguchi-45, Urawa-8, Omiya-9, Hasuta-8, Kuki-2, Ageo-12, Okegawa-5, Kounosu-8, Kounosu-15
Joban Line, Kantorailway, Joso Line	Adachi-3, Matsdo-1, Matsudo-42, Kasiwa-2, Abiko-17, Toride-29, Toride-13, Ushiku-1, Jousou-7
Soubu Line, Sotobo Line, Uchibo Line, Keiyo Line, Keisei Honsen Line	Ichikawa-6, Funabashi-45, Funabashi-10, Tibatyuo-13, Tibamidori-5, Ichihara-26, Ichihara-3, Kisarazu-5, Kimitu-5, Urayasu-12, Mihama-3, Yachiyo-5, Sakura-5, Sakura-7, Narita-11

[129 spots]

References

- Ando A (1995) Spatial structure of land value. In: Urban and land economics. Nihonhyoronsha, Tokyo, pp 106–114
- Kasiwadani N (1987) Land price decision in Metropolitan area – from theory to reality. Japan J Real Estate Sci 3(2):15
- Nakagawa M (2008) Public economics and urban policy. Nihonhyoronsha, Tokyo, pp 121–129
- Nishimura K (1990) Land prices decision mechanism of Japan. In: The stock and land prices -price decision mechanism. University Publish Association, Tokyo, pp 113–114
- Tomita K (2015) Transformation and apartment location of the big city downtown area. Kokonshoin, Tokyo, pp 1–16
- Wheaton WC (1973) A comparative static analysis of urban structure. J Econ Theory 9(2):223–227
- Yamada H (2010) Quantitative grasp of intensive urban structure by using land value; a case study of Kanto region. In: Bulletin of Yamagata university humanities, no 17, vol 1, pp 93–101

Open Access This chapter is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.