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Conference Paper

Municipal sizes and municipal restructuring in Japan

54th Congress of the European Regional Science Association: "Regional development & globalisation: Best practices", 26-29 August 2014, St. Petersburg, Russia

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Nakagawa, Kuninori (2014) : Municipal sizes and municipal restructuring in Japan, 54th Congress of the European Regional Science Association: "Regional development & globalisation: Best practices", 26-29 August 2014, St. Petersburg, Russia, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

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Title

Municipal sizes and municipal restructuring in Japan¹

Abstract

In this article, we quantitatively analyze changes in the size distribution of municipal jurisdictions in Japan by using their rank–size distribution to capture the changes. In Japan, the central government sometimes enacts large-scale municipal mergers, aimed at creating municipalities of a certain size. Japan’s local governance policy allocates tax revenues to municipalities based on the financial shortages of each municipality, which is designed to ensure financial equality among municipalities so that the central government can evenly maintain public services, especially in rural areas. Thus, if the central government eases population discrepancy among municipalities and creates a large number of uniformly sized municipalities, then the central government can reduce subsidies to local governments. The government’s previous policies on municipal mergers were enacted to foster this sort of efficiency. We examine changes in the distribution of municipal jurisdiction sizes to determine the actual effect of municipal merger policies. Our results show that the discrepancy in population among municipalities was once leveled by the great municipal mergers of the 1950s Showa era.

JEL classification codes: H11, O18, O53, R11, R12, R58

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¹ I am grateful for discussions with Taro Kanatani and Naoya Sueishi, which have been insightful. I also would like to thank Haruo Imai, Henk Folmer, Hiroto Kuninaka, and Se-il Mun for their comments. Any remaining errors are mine.

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1 Introduction

In Japan, the central government sometimes enacts large-scale municipal mergers throughout the nation. There were three periods of such mergers after the Meiji Restoration that introduced the modern system of central government. These occurred during 1888–1889 in the Meiji era, 1953–1961 in the Showa era, and 1999–2006 in the Heisei era. As a result, the number of municipalities³ decreased as follows: from 71,314 in 1888 to 15,859 in 1889 during the Meiji consolidation; from 9,868 in 1953 to 3,472 in 1961 during the Showa consolidation; and from 3,229 in 1999 to 1,821 in 2006 during the Heisei consolidation.

These three major mergers aimed to create municipalities of a certain size as required by the central governments of those times. Japan's local governance policy allocates tax revenues to municipalities to cover any shortfall of financial revenues within each municipality. This system is designed to ensure financial equality between municipalities and makes it possible to maintain public services evenly, especially in rural areas. This is the primary reason behind the large-scale municipal mergers carried out throughout the nation by the central government.

If the central government eases discrepancies in population size between municipalities and creates a large number of uniformly sized municipalities, then it can reduce subsidies to local governments. For example, school districts can be established efficiently. Education up to junior high is compulsory in Japan under the 1946 Constitution after World War 2. Moreover, municipalities have duties to operate junior high schools in the local government system that began under the Local Autonomy Law (1947).

The Showa consolidation aimed for an efficient allocation of junior high school districts, which are areas comprising one junior high school each. The Showa consolidation was promoted by the enactment of two special laws. First, the Municipality Merger Promotion Law of 1953 intended to promote municipal mergers intensively and reduced the number of municipalities from 9,868 in 1953 to 3,975 in 1956. Second, the New Municipality Creation Promotion Law of 1956 replaced the first law and reduced the number of municipalities to 3,472 in 1961 (Yokomichi, 2007). Similarly, the Meiji consolidation was carried out with the aim of achieving an efficient allocation of elementary school districts established in that period. The government's past policies on municipal mergers were enacted to foster the efficiencies described.

In this study, we focus on the government administration after 1945 because the system of local government in Japan changed drastically around World War 2. We examine the changes that resulted from the mass municipal reforms of the two most recent great mergers, namely, those in the Showa and Heisei eras. Specifically, we examine changes in the distribution of municipal jurisdiction sizes to determine the actual effects of municipal merger policies. The effects of the mergers of cities, towns, and villages are usually analyzed from the perspective of the finances of local public entities, in other words, in

³ In Japan, municipalities can be divided into three types, *shi* (city), *cho* (town), and *son* (village).

terms of money. However, as discussed above, analysis of the population changes in each municipality plays an important role in evaluating subsequent changes resulting from municipal mergers. In this study, we focus on the changes in the distribution of municipal jurisdiction sizes during the periods of the great mergers. We quantitatively analyze changes in the size distribution of municipal jurisdictions in Japan by using their rank–size distribution. Our results show that the distribution of the municipal jurisdictions was immediately leveled by the great mergers of the 1950s Showa era. That is, these mergers eased the population discrepancies between municipalities.

2 Method and Analysis

The city size distribution (rank–size distribution) is the order statistics obtained by arranging the populations of cities in descending order. We apply this distribution to our analysis of the size distribution of municipal jurisdictions.

We examine changes in the size distribution of municipal jurisdictions during the Showa era by estimating the coefficients of their rank–size distribution. Specifically, using census data from 1950 (Showa25) to 1965 (Showa40) and from 1995 (Heisei7) to 2010 (Heisei22), we estimate an ordinary least squares (OLS) estimator in Equation (1) as follows.⁴ Let $S_i, i = 1, \dots, n$ be the population of municipalities and S_i the order statistics that satisfies $S_1 > S_2 > \dots > S_n$.⁵ Then, we obtain

$$\ln S_i \sim \alpha_0 + \alpha_1 \ln i, i = 1, \dots, n, \quad (1)$$

where $\alpha_0 > 0$ and $\alpha_1 < 0$. We use this coefficient α_1 to develop an index that captures the macro-structural change of the size distribution of municipal jurisdictions in Japan. It is well known that when the coefficient of $\alpha_1 = -1$, this relationship between city sizes and their ranks is called the rank–size rule.

However, in our study, the interpretation of this coefficient differs from that in the usual context of the rank–size rule mentioned above. We instead consider the size distribution of municipal jurisdictions. Municipal jurisdictions are not urban areas in economics but cities, towns, and villages in the form of administrative districts. Their distribution changes, depending on not only economic reasons but also policies implemented by the central government, namely, municipal mergers. Therefore, -1 is not a magic number in our study. We use this coefficient as an index to analyze the size distribution of municipal jurisdictions that are changed by municipal mergers.

We briefly review the traditional literature on this coefficient. It is well known in regional science that the city size distribution exhibits remarkable “regularity.” There are numerous studies about this “regularity.” For example, Rosen and Resnick (1980) examine city size distributions in 44 countries. The mean of the estimates for the reciprocal of the

⁴ We follow the notation and terminology of Nishiyama et al. (2008).

⁵ In this study, there were some municipalities with the same population size. Thus, each population size of municipality S_i satisfies $S_1 \geq S_2 \geq \dots \geq S_n$.

coefficient of $\log(\text{rank})$ (i.e., $1/\alpha_1$) is -1.14 . On the other hand, OLS estimation of the coefficient with regard to Equation (1) involves statistical problems when we obtain a true and unbiased estimator and apply a statistical test, that is, a t-test, to an obtained estimator. The methodological research focuses on evaluating whether the value of the estimated coefficient is -1 or not. Nishiyama et al. (2008) study the statistical problems in this estimation of the coefficient. They conclude that the rank–size rule holds in previous research, including Rosen and Resnick (1980) and Soo (2005).

Moreover, Eaton and Eckstein (1997) show that the size distribution of cities has been highly stable over time in France and Japan, and they offer a theoretical implication for the stability of city size distribution. In addition, Berry (1961) examines another aspect—the city size distribution patterns of 37 countries—and finds a clear relationship with their levels of economic development. Parr (1985) also examines the same relationship in 12 countries over a period of 70 years. However, the theoretical foundation is vague. The rank–size rule is a famous example of Zipf’s law (Zipf, 1949), which is as follows. Let S denote a random variable representing city size measured by its population; then, for a large x , $P(S > x) = A/x$ for some $A > 0$ or a Pareto distribution with unit exponent. For example, the size of the largest city is twice the size of the second largest city and three times the size of the third largest city.⁶ In the context of economic geography, Gabaix (1999), Duranton (2006), and Hsu (2012) construct city growth models that lead to Zipf’s law. Thus, to some extent, these studies provide the micro foundations for the establishment of Zipf’s law as a result of city growth, and hence, the foundations for the rank–size rule.

As mentioned earlier in this section, we calculate the coefficient in the same way as in the traditional literature. However, we use the coefficient in quite a different way to the traditional literature, that is, we use the coefficient as an index to analyze changes in the size distribution of municipalities. Therefore, the meaning of this coefficient differs from “regularity,” which is discussed in the original interpretation of the rank–size rule.

For example, assume there are four municipalities in a country with populations of 60, 30, 20, and 15. Now, the coefficient of the size distribution of these municipalities is -1 . In this country, municipal mergers are carried out by the central government. We consider two typical patterns. First, if the municipalities with the populations of 60 and 15 merge, the new municipality after the consolidation would have a population of 75, and there would now be three municipalities in the country with populations of 75, 30, and 20. We can calculate the coefficient of the new size distribution of the municipalities as -1.21 . Second, if the municipalities with the populations of 30 and 15 merge, the new municipality after the consolidation would have a population of 45. In this case, the coefficient is -0.94 .

⁶ Here, a city does not mean *shi*, that is, the type of administrative district that we analyze in this study. Cities in economics are usually defined as an urban area. In Japan, Kanemoto and Tokuoka (2002) suggest a metropolitan area definition that is equivalent to a metropolitan area defined in the United States.

Obviously, the incline of the regression line, which this coefficient α_1 shows, becomes steep from -1 to -1.21 when the distribution becomes more skewed; on the other hand, the gradient is mild from -1 to -0.94 when the distribution is flatter.

The relationship between changes to the inclination of the regression line and that of size distribution are depicted in the real world by the following two scenarios, which have been popular in Japan's municipal mergers. One is the merger of a large city and a small town. In Japan, we usually call this an absorption-type merger. The other is the merger on equal terms of two towns of similar scale, both of which are ranked in the middle or at the low end of size distribution. If the former scenario is dominant in municipal mergers, the absolute value of the coefficient becomes large. If the latter scenario is dominant, the absolute value of the coefficient becomes small.

In the next section, we show the results obtained by applying this method to the rank-size distribution of municipalities at each period.

3 Results

The Great Showa consolidation was carried out between 1953 and 1961. Using data from four national censuses from 1950 to 1965,⁷ we calculate the OLS estimator of Equation (1) for each year and obtain the coefficients α_1 of Equation (1).⁸ The results are shown in Table 1 as follows.

Year	Value of α_1
1950	-0.751
1955	-0.959
1960	-0.886
1965	-0.956

Table 1. The Value of α_1 from 1950 to 1965

The value of α_1 decreases from -0.959 in 1955 to -0.886 in 1960. This result shows that the distribution of the municipal jurisdictions was at once leveled in 1960.

In addition, using data from four national censuses from 1995 to 2010,⁹ we apply the same method to the Great Heisei consolidation, which was carried out between 1999 and 2006. The results are shown in Table 2 as follows. In contrast to Table 1, we can easily

⁷ We do not include the population of Okinawa prefecture when we construct the datasets during the Showa consolidation. When we construct the data of the 1960 census, we exclude the population of the area in a boundary dispute between Nagano and Gifu prefectures (73 people); we include the population of the reclaimed district of Kojima-wan as a municipality in Okayama prefecture (1,200 people).

⁸ This result is obtained by Nakagawa (2005), who examine the Showa consolidation using rank-size distribution of all municipalities (*shi*, *cho*, and *son*).

⁹ When we construct the data of the 2000 census, we exclude Miyake village because all of its people were evacuated after Mount Oyama erupted in July 2000.

establish that the distribution of the municipal jurisdictions was not leveled during the Great Heisei consolidation.

Year	Value of α_1
1995	-1.216
2000	-1.238
2005	-1.303
2010	-1.329

Table 2. The Value of α_1 from 1995 to 2010

In our analysis of the size distribution of municipal jurisdictions in Japan, we obtain the result that the great mergers of the Showa era in the 1950s leveled the distribution of municipal jurisdictions. In other words, we find that mergers in the second scenario, that is, those on an equal footing between towns of similar scale, were relatively frequent during this period. Furthermore, we find that mergers in the first scenario, that is, those between large cities and small towns, were relatively frequent in the mergers during the Heisei era.

4 Concluding Remarks

In this study, we showed that the Showa era consolidation of municipal jurisdictions immediately eased the population discrepancies between municipalities. In particular, because of the value of the coefficient for 1960, the Municipality Merger Promotion Law of 1953 had an impact on this change of the size distribution of municipalities. This result also suggests a high frequency of mergers of municipalities that are ranked in the middle or lower end of the size distribution. We can also observe our findings in Tables 3 and 4 below, which show the total population of municipalities classified by population size groups. Table 3 shows the total population and the percentage of the total population of municipalities that are included in each population range of a municipality. The total percentage of municipalities in the 10,000–99,999 population range increased to 43.4% in 1965 from 28.3% in 1950. In contrast, Table 4 shows that during the Heisei consolidation, this percentage decreased to 28.7% in 2010 from 33.7% in 1995. We found a tendency toward mergers in the case of towns and villages ranked in the middle or lower ends of the size distribution in the Showa era. In other words, because more municipalities emerged in the middle of the distribution than in the upper end of the distribution, the municipalities in the middle of the distribution extended a stronger influence than those in the upper end. This fact coincides with the results obtained in this study.

Next, we discuss the scope for further research. As mentioned in Section 2, several studies suggest a relationship between economic growth and the formation of city size distribution. These studies focused on cities as defined in economics and discussed Gibrat's law of cities: the mean and variance of the growth rate of a city are independent of its size (e.g., Rossi-Hansberg and Wright, 2007). Eeckhout (2004) used US census data to analyze city size distribution of all cities in the United States, and found that the distribution is log normal. That is, Gibrat's law holds in the city size distribution.

In the same way, we examined whether the whole size distribution of municipalities in Japan is log normal. We tested the size distribution of municipalities in each period. We obtained the result that the size distribution of municipalities is not log normal, except for 2010.¹⁰ This result indicates that Gibrat's law does not hold for the size distribution of municipalities in Japan. Furthermore, Kuninaka and Matsushita (2008) also obtained the result that Zipf's law does not hold with regard to the size distribution of administrative cities (*shi*, which comprise only a part of municipal jurisdictions in Japan) in Japan.¹¹ This result indicates that the moves of the upper tail are restricted by a policy factor, which was also pointed out by Nakagawa (2005). The main cause of this upper tail movement is that Japan's central and local governments cannot control the economies of cities, but possibly can control the size of municipal jurisdiction. This implies that the changes in the size distribution of municipalities need to be examined from a different aspect to either Gibrat's law or Zipf's law. Weese (2008, 2013) analyzed the municipal mergers in the Heisei era associated with a process of coalition formation. He focused on the Heisei consolidation's decentralized mergers and showed that such mergers resulted in a less efficient outcome than the central government had expected before the mergers. His findings are coincidental to our obtained results. These facts indicate that the changes of the municipal size distribution are associated with not only economic growth but also a policy factor. Thus, decomposition of the changes of the municipal size distribution into two factors, namely, economic and policy factors, remains for future research.

Finally, we discuss the implications of our results. Comparing the results of the Showa era with those of the Heisei era, it is easy to establish that Japan faced quite different economic situations in each period. During the 1950s, Japan enjoyed high economic growth. In contrast, during 1995–2010, Japan's economy was in depression, in other words, a maturation period. During this modernization trend, the number of municipalities in Japan decreased. Moreover, the Japanese economy became highly developed while it modernized. These results from Japan lead us to suggest the following hypothesis. When a nation enters a period of high economic growth, the mergers of small towns and villages have an effect on economic growth. However, once the nation has matured, only a few small towns and villages remain, which means that such mergers have a small impact on economic growth.

¹⁰ See Figure 1, which shows the Q-Q plot of 2010, and Figure 2, which shows that of 1950.

¹¹ The authors examined only the distribution of cities (*shi*). They did not examine the whole size distribution of municipal jurisdictions, which means that towns (*cho*) and villages (*son*) were excluded. In addition, they did not consider policy implications of the changes in the size distribution.

Population size groups.	1965	Percentage of the total.	1950	Percentage of the total.
1000,000 or more	19,397,722	19.7	9,473,696	11.4
from 500,000 to 999,999	3,404,817	3.5	1,716,624	2.1
from 300,000 to 499,999	5,581,907	5.7	4,709,917	5.7
from 200,000 to 299,999	6,416,497	6.5		
from 100,000 to 199,999	10,922,451	11.1	5,425,978	6.5
from 50,000 to 99,999	11,430,905	11.6	6,306,855	7.6
from 40,000 to 49,999	4,861,608	4.9	2,268,785	2.7
from 30,000 to 39,999	5,781,354	5.9	2,563,534	3.1
from 20,000 to 29,999	6,606,692	6.7	2,842,658	3.4
from 10,000 to 19,999	13,956,755	14.2	9,597,823	11.5
from 5,000 to 9,999	8,663,132	8.8	17,622,373	21.2
from 2,000 to 4,999	1,181,137	1.2	19,033,128	22.9
under 2,000	69,984	0.1	1,638,266	2.0
Total	98,274,961	100	83,199,637	100

Table 3. Cities, Towns, and Villages by Population Size Groups in 1965 and 1950.

Population size groups.	2010	Percentage of the total.	1995	Percentage of the total.
1000,000 or more	28,826,954	22.5	25,290,095	20.1
from 500,000 to 999,999	11,641,437	9.1	7,137,163	5.7
from 300,000 to 499,999	16,690,828	13.0	16,672,734	13.3
from 200,000 to 299,999	9,775,224	7.6	10,139,015	8.1
from 100,000 to 199,999	21,844,701	17.1	15,609,774	12.4
from 50,000 to 99,999	18,875,361	14.7	15,738,449	12.5
from 40,000 to 49,999	4,388,835	3.4	4,193,991	3.3
from 30,000 to 39,999	5,058,238	3.9	5,821,649	4.6
from 20,000 to 29,999	4,087,262	3.2	6,654,966	5.3
from 10,000 to 19,999	4,400,641	3.4	9,965,425	7.9
from 5,000 to 9,999	1,791,542	1.4	6,247,296	5.0
from 2,000 to 4,999	583,668	0.5	1,906,184	1.5
under 2,000	92,661	0.1	193,505	0.2
Total	128,057,352	100	125,570,246	100

Table 4. Cities, Towns, and Villages by Population Size Groups in 2010 and 1995.

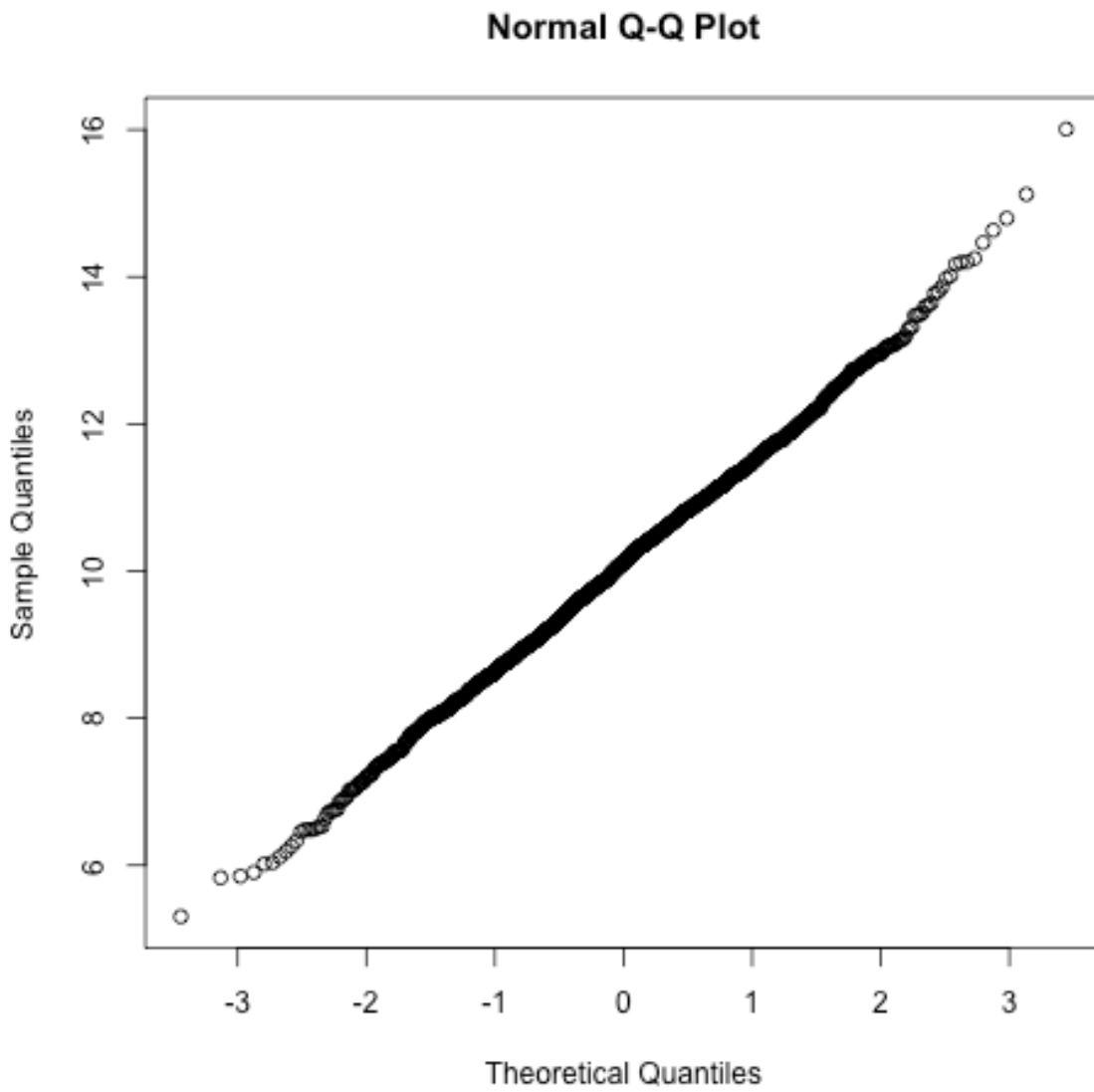


Figure 1. Q-Q plot of the 2010 data.

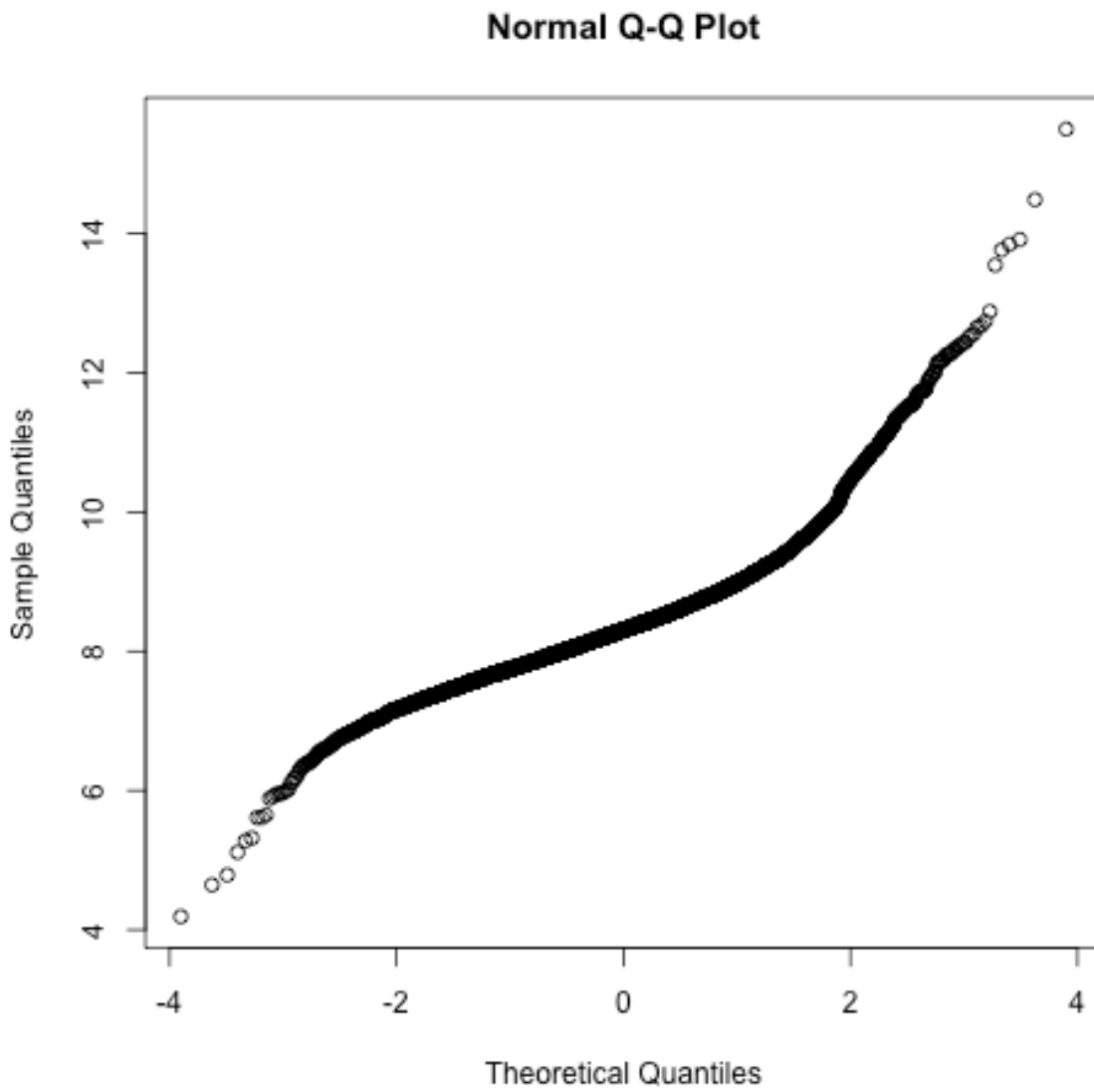


Figure 2. Q-Q plot of the 1950 data.

References

- Berry, B.J.L., (1961) City Size Distributions and Economic Development, *Economic Development and Cultural Change*, Vol. 9, No. 4, pp. 573–588.
- Duranton, G., (2006) Some Foundations for Zipf's Law: Product Proliferation and Local Spillovers, *Regional Science and Urban Economics*, Vol. 36, No. 4, pp. 542–563.
- Eaton, J. and Eckstein, Z., (1997) Cities and Growth: Theory and Evidence from France and Japan, *Regional Science and Urban Economics*, Vol. 27, No. 4–5, pp. 443–474.
- Eeckhout, J., (2004) Gibrat's Law for (All) Cities, *American Economic Review*, Vol. 99, No. 4, pp. 1676–83.
- Gabaix, X., (1999) Zipf's Law for Cities: An Explanation, *Quarterly Journal of Economics*, Vol. 114, No. 3, pp. 739–767.
- Hsu, W-T., (2012) Central Place Theory and City Size Distribution, *Economic Journal*, Vol. 122, No. 563, pp. 903–932.
- Kanemoto, Y. and Tokuoka, K., (2002) Proposal for the Standards of Metropolitan Areas of Japan, *Journal of Applied Regional Science*, No. 7, pp. 1–15, (in Japanese).
- Kuninaka, H. and Matsushita, M., (2008) Why Does Zipf's Law Break Down in Rank-Size Distribution of Cities?, *Journal of the Physical Society of Japan*, Vol. 77, pp. 114801.
- Nakagawa, K., (2005) Analysis of the municipal mergers by using the rank-size distribution, *Annual Report of Japan Society for Urbanology*, Vol. 38, pp. 43–47, (in Japanese).
- Nishiyama, Y., Osada, S., and Sato, Y., (2008) OLS Estimation and the T Test Revisited in Rank-Size Rule Regression, *Journal of Regional Science*, Vol. 48, No. 4, pp. 691–716.
- Parr, J.B., (1985) A Note on the Size Distribution of Cities over Time, *Journal of Urban Economics*, Vol. 18, No. 2, pp. 199–212.
- Rosen, K.T. and Resnick, M., (1980) The Size Distribution of Cities: An Examination of the Pareto Law and Primacy, *Journal of Urban Economics*, Vol. 8, No. 2, pp. 165–186.
- Rossi-Hansberg, E. and Wright, M.L.J., (2007) Urban Structure and Growth, *Review of Economic Studies*, Vol. 74, No. 2, pp. 597–624.
- Soo, K.T., (2005) Zipf's Law for Cities: A Cross-Country Investigation, *Regional Science and Urban Economics*, Vol. 35, No. 3, pp. 239–263.
- Weese, E., (2008) Political Mergers as Coalition Formation: Evidence from Japanese Municipal Amalgamations, *Global Centers of Excellence Hi-Stat Discussion Paper Series*, No. 17, Hitotsubashi University.
- Weese, E., (2013) Political Mergers as Coalition Formation: An Analysis of the Heisei Municipal Amalgamations, *Economic Growth Center Discussion Paper*, No. 1022, Yale University.
- Yokomichi, K., (2007) The Development of Municipal Mergers in Japan, *Up-to-date Documents on Local Autonomy in Japan*, No. 1, National Graduate Institute for Policy Studies (GRIPS).
- Zipf, G., (1949) *Human Behavior and the Principle of Least Effort*. Addison-Wesley Press, Cambridge, MA.