Chapter 2
Population Prospects in Japanese Society

Abstract Although there were some interruptions at wartimes, the growth of Japanese population reached its peak in 2008, and then began to decrease. There are two basic factors: first, rising longevity up to 90 years; second, a below replacement fertility. Both factors affect the age structure. The share of young population (aged under 15 years) has fallen from 35.4 % (1950) to 13.1 % (2010) and it continues to shrink to 9.1 % by 2060. In contrast, the share of aged population (aged 65 years or older) has risen from 4.9 % (1950) to 23.0 % (2010) and will increase further to 39.9 % (2060). The demographic care cost (dependency ratio) begins to rise continuously since 1990 and is predicted to increase from 0.57, 2010 to 0.96 by 2060. The effect of rising longevity indicates only a gradual trend. It begins to rise smoothly from 0.58 in 1975 to 0.71 in 2010 and is expected to reach 0.79 by 2060. Comparatively, the additional effect of below replacement fertility starts to go beyond the former from 1980s and is expected to increase from 0.83 in 2010 to 0.94 by 2060. The situations in local communities are more critical because of outmigration among young population.

Keywords Population prospects • Age structure • Rising longevity • Below replacement fertility • Intergenerational contract • Demographic care cost • Actual value • Minimum value • Optimal value • Dependency ratio • Outmigration

2.1 From Population Growth to Decline

Since the end of nineteenth century, Japan's total population has grown steadily (with the exception of a slight interruption during the Second World War); however, after its peak in 2008, the population has begun to decline steadily (Fig. 2.1).[1]

According to the 2010 Population Census, Japan's total population (including non-Japanese residents) was 128.06 million. Based on a medium-fertility and mor-

[1] *Source*: from 1872 to 2005, Statistics Bureau (2006, pp. 88–90), from 2010 to 2110 (NIPSSR 2012a). According to the Population Estimates of Japan, Inter-census Adjustment of Current Population Estimates (as of October 1 of each year) by Statistics Bureau of Japan, the peak population was 128.084 million in 2008 (NIPSSR 2012b).

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tality projection (NIPSSR 2012a, pp. 1–2), Japan was expected to enter a long period of population decline to 86.7 million by 2060. This projection represents a 32.2 % decrease (41.26 million) compare to 2010. Auxiliary projections up to 2110 showed an expected decrease to 42.86 million, a 66.5 % reduction (85.20 million) of the present stage.

This projected drastic population decline could be attributed to increasing life expectancy and below-replacement fertility. Japan's life expectancy increased from Meiji period (1891/1898) 44.3 years for men and 42.8 years for women to post-war Shōwa period (1950) 57.7 years for men and 61.0 years for women. The life expectancy continues to increase steadily until now. According to the Medium-Mortality Assumption (NIPSSR 2012a, p. 12), life expectancy was expected to grow from 79.64 years for men and 86.39 years for women in 2010 to 84.19 years for men and 90.93 years for women in 2060 (Fig. 2.2).

Meanwhile, Japan's total fertility rate (TFR) has decreased from 5.10 in 1925 to 3.65 in 1950, and starts falling below replacement level in 1975 (1.90). The TFR was 1.39 in 2010, and according to Medium-fertility Assumption it was expected to decrease gradually to 1.33 by 2024, and then increase slightly to 1.35 in 2060 (Fig. 2.3),[2] (NIPSSR 2012a, p. 7).

Population aging and fertility decline have drastically changed the age structure of Japanese society (Fig. 2.4).[3]

Influenced by fertility decline, the proportion of the young population (aged under 15 years) in the total population fell from 35.4 % in 1950 to 13.1 % in 2010. According to the medium-fertility projection (NIPSSR 2012a), this share would continue to shrink to 9.1 % by 2060. In contrast, together with increasing life expectancy, the share of the aged population (aged 65 years or older) in the total population rose from 4.9 % in 1950 to 23.0 % in 2010. The same projection predicted this share would continue to increase to 39.9 % by 2060. Meanwhile, the share of the working age group (aged 15 to 64 years) remained relatively stable, from 69.0 % in 1970 to 69.5 % in 1995. Yet, it had decreased to 63.8 % in 2010 and was expected to shrink to 50.9 % by 2060.

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[2] In auxiliary projection for 2110, the value of fertility and the life expectancy were fixed at TFR = 1.35 and average span of life was 84.19 years for men and 90.93 years for women in 2060. The period TFR of Japan showed a recovery from 1.26 in 2005 and to 1.39 in 2010 (NIPSSR 2013; see also and see also http://www.ipss.go.jp/pp-shicyoson/e/shicyoson13/t-page.asp). However, there is no substantial increase in the cohort TFR to the replacement level at present.

[3] *Source*: (NIPSSR 2012b) from 1888 to 2005, (NIPSSR 2012a) from 2010 to 2110. The proportions are obtained by calculations.

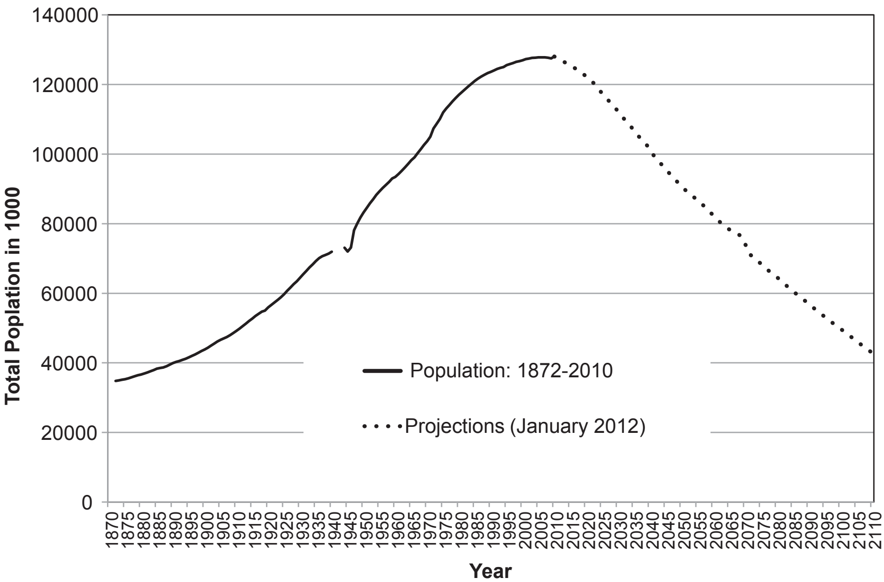

Fig. 2.1 Total population trends: 1872–2110. (Statistics Bureau 2006; NIPSSR 2012a)

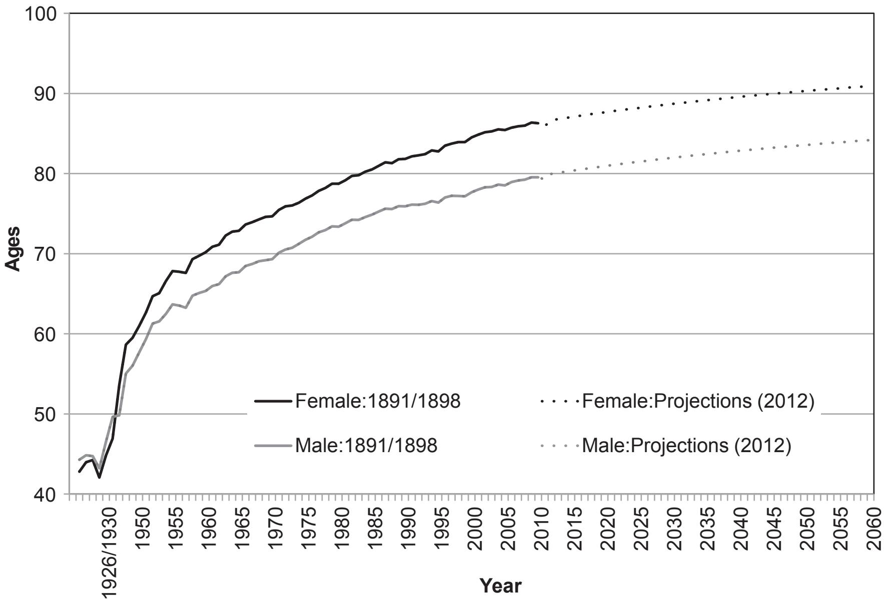

Fig. 2.2 Life expectancy at birth: 1891/1898–2060. (Statistics Bureau 2006; NIPSSR 2012a)

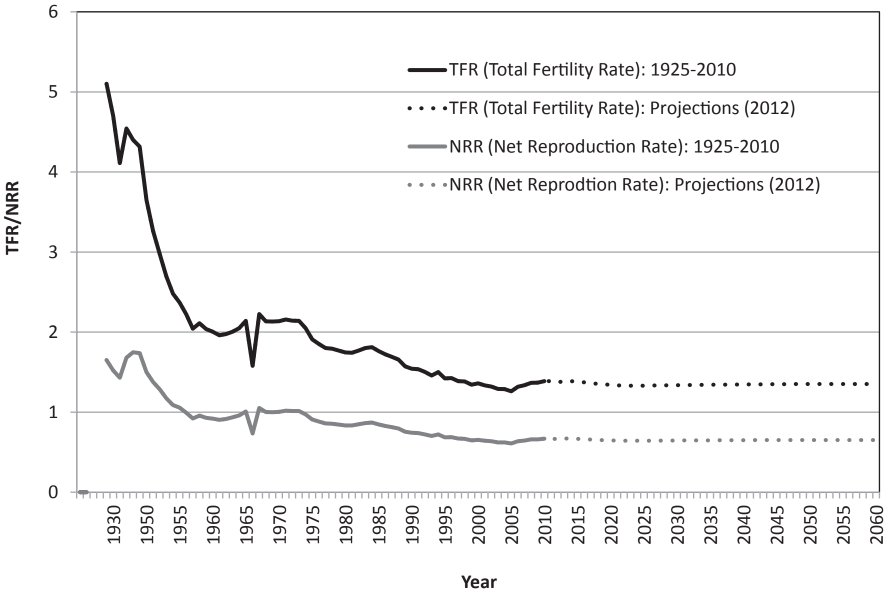

Fig. 2.3 Fertility trends: 1925–2060. (NIPSSR 2012a)

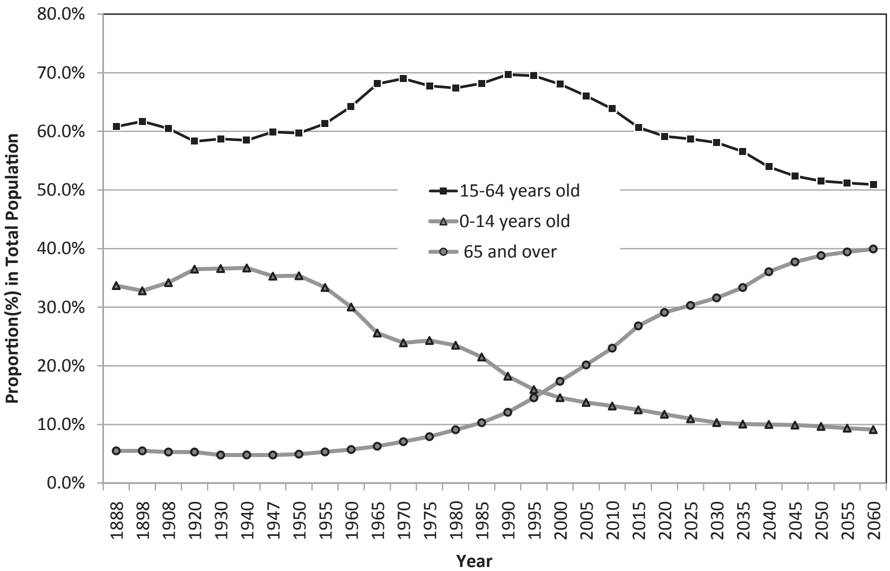

Fig. 2.4 Indicators on age structure by major three age groups: 1888–2060. (NIPSSR 2012a, b)

2.2 Changing Dependency Ratios as Indicators of Child/Elder Care Costs

Since the basic trend from population growth to decline seems to be the historical consequence of a demographic transition from high to low fertility and mortality. This not only affects the total population number, but also the society's age structure and intergenerational care cost.

The concept of intergenerational care cost is borrowed from Kaufmann's (2005, pp. 204–209) idea of an intergenerational contract (*Generationenvertrag*). This notion assumes the existence of a social contract that obliges the working age generation to rise the following generation and care for the preceding generation. From a demographic perspective, the accountability for this intergenerational care could be regarded as the ratio of the working age population to the pre- and post- working age populations. In this way, dependency ratios could be used as indicators of child/elder care costs incurred by the working age generation.

2.2.1 Actual Value of Demographic Care Cost (Dependency Ratio)[4]

The total demographic care cost could be expressed in the same number with the total dependency ratio (not a percentage). This directly reflects the age structure in a given year and illustrates the care burden incurred by the working age generation.

$$\text{Total Care Cost}_{\text{actual}} = \text{Child Care Cost}_{\text{actual}} + \text{Elder Care Cost}_{\text{actual}}$$

$$\text{Child Care Cost}_{\text{actual}} = \frac{\text{Number of People aged under 0-14}}{\text{Number of People aged under 15-64}}$$

$$\text{Elder Care Cost}_{\text{actual}} = \frac{\text{Number of people aged 65 and over}}{\text{Number of people aged 15-64}}$$

[4] Kaufmann (2005, p. 209) used the different age categories, namely, the population aged 0–19 as pre-working generation, the population aged 20–60 as working generation, the population aged 60 and over as post working generation. He considered the life stages of modern German society to get into job and to be retired. For the convenience to use the historical data and the population projection, this chapter used the same age categories as Kaufmann did with those of the usual dependency ratio. Certainly, the exact value of care cost depends on age categories (especially on practical earning period) and relative living cost to the one of working generation. Furthermore, the basic care relation between the generations is proportional to the demographic age structure.

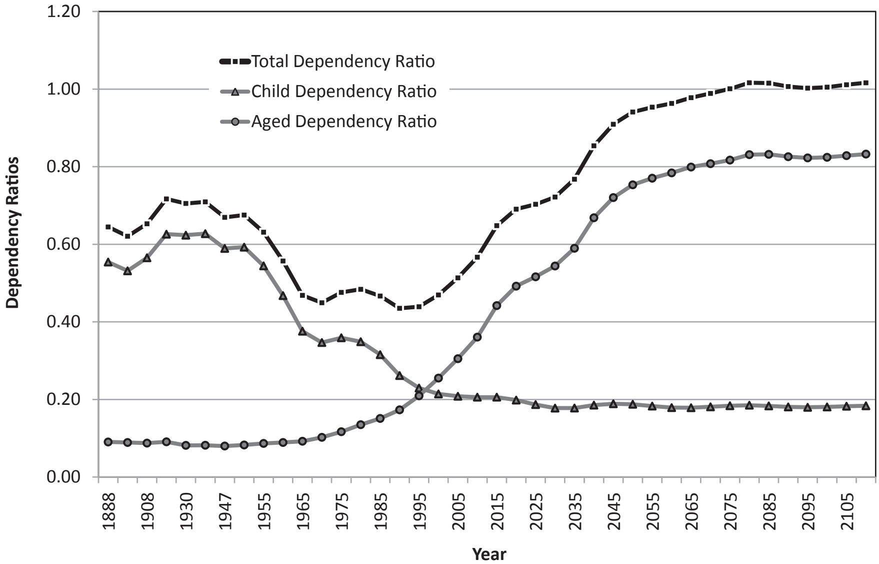

Fig. 2.5 Dependency ratios: 1888–2060. (NIPSSR 2012a, b)

Figure 2.5[5] illustrates historical changes in the demographic care cost (total dependency ratio) on the working age population. The value rose from 0.64 in 1888 to 0.72 in 1920, and then began to decrease to 0.44 in 1990 (with the exception of a slight increase around 1980). After 1990, the demographic care cost began to increase steadily. According to the medium-fertility projection (NIPSSR 2012a), this figure was expected to increase from 0.57 in 2010 to 0.96 by 2060. By 2110, it would reach 1.02 (in auxiliary projection).

By observing the shift of child care cost (child dependency ratio) and the elder care cost (aged dependency ratio) separately, it suggests that the former was very high from 1888 in the Meiji Period to 1930 in the early Shōwa period, while the latter was relatively stable and low until around 1975. It is because of the large proportion of children to the total population. However, around 2000, elder care cost have increased disproportionately to the decreasing childcare cost. It leads to an unprecedented care burden on the working population.

2.2.2 Minimum Value of Demographic Care Cost (NRR = 1.00, The Effect of Life Expectancy)

The long-term minimum demographic care cost could also be evaluated by assuming a stable population in terms of fertility at replacement level (NRR: net reproduc-

[5] *Source*: (NIPSSR 2012b) from 1888 to 2005, (NIPSSR 2012a) from 2010 to 2110. The ratios are obtained in calculations.

tion rate = 1.00)[6] and mortality rates of the life table[7] for a given year. While this model depends directly on life expectancy, it shows the influence of rising longevity on the working population's demographic care burden over time (assuming a ca. 30-year generational interval).[8]

$$\text{Total Care Cost}_{\text{minimum}} = \text{Child Care Cost}_{\text{minimum}} + \text{Elder Care Cost}_{\text{minimum}}$$

$$\text{Child Care Cost}_{\text{minimum}} = \frac{\text{Stable population aged 0-14}}{\text{Stable population aged 15-64}}$$

$$\text{Elder Care Cost}_{\text{minimum}} = \frac{\text{Stable population aged 65 and over}}{\text{Stable population aged 15-64}}$$

Unlike the actual value of demographic care cost (dependency ratio), this minimum value is based on the stable population structure of the life tables at replacement fertility. It shows an upward demographic care cost trend increases proportionally to life expectancy (Fig. 2.6).[9] This value was almost constant at 0.54 between 1891/1898 and 1965. It began to rise smoothly from 0.58 in 1975 to 0.71 in 2010, and then it was expected to increases consistently to 0.79 by 2060 (NIPSSR 2012a).[10] As a result, the effect of rising longevity on the actual value of demographic care cost would stay at or near 0.80.

The actual value of total care cost reached its lowest level (recently referred as 'demographic bonus') in 1990, at 0.44. However, the minimum value of total care cost in the same year was much higher than the actual value, at 0.65 due to below-replacement fertility. In Germany, Kaufmann (2005, p. 213) had referred this gap

[6] Population with a constant birth rate (fertility) and death rate (life table), along with no migration would reach stable population in long term. In this state the percentage of people in every age group remains constant and the population pyramid would remain unchanged. Therefore, the dependency ratio would also be stable. However, a stable population could expand or shrink. In the case of this chapter, fertility is assumed to be at replacement level. Therefore, the age structure of stable population of the life table in a given year would be unchanged in size. In other word, it is called "stationary population."

[7] To calculate the demographic care cost, the sum total of stable population is being added to both male's and female's life tables to keep the consistency with the usual dependency ratio. On the other hand, the net reproduction rate (NRR) indicates the average number of daughters that would be born to a female. Thus, there is some inconsistency in the calculation of the optimal value (by using the $NRR < 1$or $NRR > 1$).

[8] According to the original model (Kaufmann 2005), the average interval of the generations is assumed as 30 years for reproduction. That means this minimum cost should be taken by the next generation within 30 years.

[9] *Source*: Complete Life Tables of Statistics Bureau (2006, pp. 202–203) from 1891/1898 to 2000, Future Life Tables at the Medium-Mortality Assumption (NIPSSR 2012a) from 2010 to 2110. As for 2005, Life Table 2005 (NIPSSR 2007).The values of indicators are obtained by calculations.

[10] The value remain unchanged until 2110 because the auxiliary projection made an assumption that there is a constant life expectancy (84.13 years for males and 90.87 years for females in 2060).

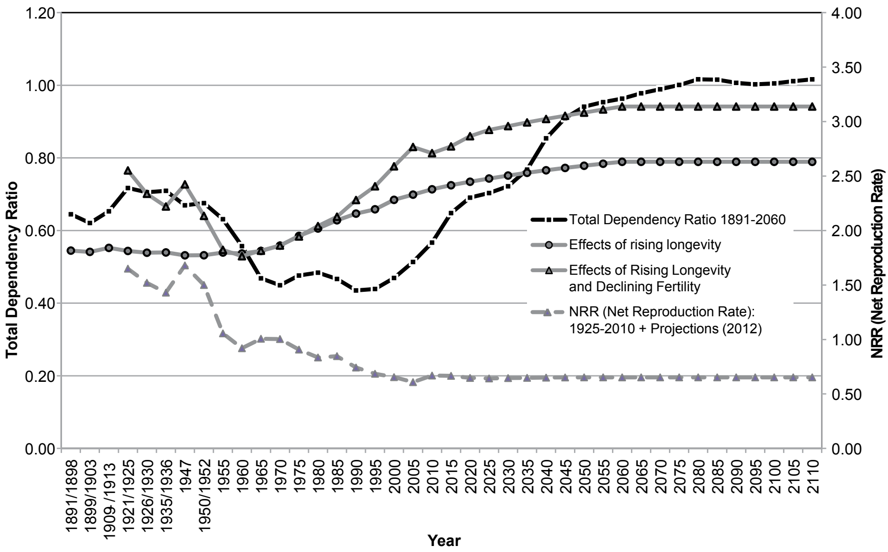

Fig. 2.6 Effect of rising longevity and declining fertility on dependency ratio 1891/1898–2060. (Statistics Bureau 2006; NIPSSR 2012a)

as the preceding generation's "saving (*Ersparnis*)" on child care costs as a result of fertility decline. Besides, it is found that the current high actual care cost (0.57 in 2010) is below the current minimum cost (0.71), and is far below the record high actual care cost (0.72 as of 1921/1925 during Taishō period). This suggests that the demographic impacts of such figures on the Japanese economy are relatively limited until now.

2.2.3 Optimal Value of Demographic Care Cost (NRR < 1 or NRR > 1, The Effect of Fertility)

In addition to this minimum value, it is possible to evaluate the optimal value of the demographic care cost in the long term by assuming a stable population at any given fertility level (NRR < 1 or NRR > 1). This calculation depends on both life expectancy and the net reproduction rate (NRR). It reflects the age structure of a life table and fertility in a given year. And it also shows the effects of decreasing fertility on the demographic care cost at any given life expectancy.

$$\text{Total Care Cost}_{\text{optimal}} = \text{Child Care Cost}_{\text{optimal}} + \text{Elder Care Cost}_{\text{optimal}}$$

$$\text{Child Care Cost}_{\text{optimal}} = \frac{\text{Stable population aged 0-14}}{\text{Stable population aged 15-64}} \times NRR$$

$$\text{Elder Care Cost}_{\text{optimal}} = \left[\frac{\text{Stable population aged 65 and over}}{\text{Stable population aged 15-64}}\right] \div NRR$$

Kaufmann argued that, under the hypothetical condition of a closed national economy (neither imports nor exports) this indicator showed the optimal total care cost would be incurred by the working age generation. The segmentation of the pre-/post- working age generations and the productivity of the working population could vary over time. However, under the same conditions, Kaufmann's definition is true.

From Fig. 2.6, the optimal value of total care cost remained almost equal to the minimum value from 1955 (0.54) to 1980 (0.63). However, it began to exceed the minimum in 1985. According to the author's calculation based on the medium-fertility projection (NIPSSR 2012a), this figure was expected to increase from 0.83 in 2010 to 0.94 by 2060.

The optimal value is essentially the leading practical indicator of the level of total care cost, which would be sustained by the next working age generation. At the same time, it depends on the former generation's life expectancy and fertility level. In this context, the actual value is expected to reach the optimal value by 2045. After that, the actual value would exceed the optimal value. Yet, historical population momentum[11] might have certain influence on it.

Ultimately, it is clear that with the current fertility rate, which is far below replacement level (NRR = 0.668 in 2010), will shift the burden of total care cost to the future generation.

2.3 Depopulation at Sub-national Level: Shrinking Regions

2.3.1 Population Decline at Sub-national Level

As mentioned in Chap. 1, most of the regional communities in Japan confront depopulation and rapid aging. Comparing 2005 and 2010 Census, the depopulation areas had covered 75.2 % of the municipalities (766 cities, 23 wards in Tokyo

[11] Momentum can be caused by the differences in absolute size among the age cohorts through historical events.

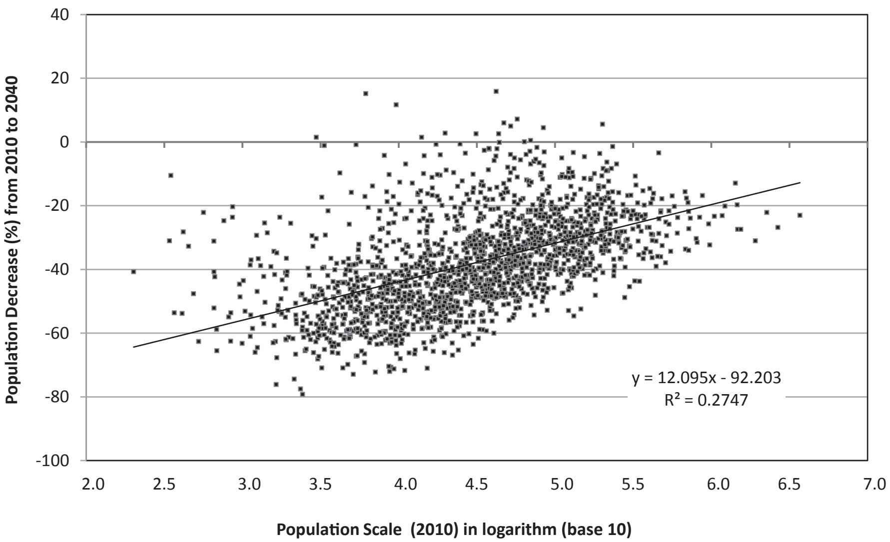

Fig. 2.7 Population decrease at sub-national level. (NIPSSR (2013))

prefecture, 715 towns, 169 villages, as of March 2013). And according to the newest regional population projections (NIPSSR 2013), the proportion of depopulation area would expanded to 95.2% by 2040.

Figure 2.7 shows 46.6% of the municipalities would lose 20–40% of the residents in 2010. By 2040, 22.9% of the municipalities (385 municipalities) would lose more than 20–40%, and 6.3% of the municipalities (106 municipalities) would lose more than half.

At the national level, the total population would decrease 19.4% by 2040, 32.2% by 2060 and 66.5% by 2110 from the present (NIPSSR 2012a). As a result, the depopulation at sub-national level serves as an early warning to the future development of this country.

The horizontal axis of the scatter diagram (Fig. 2.7) is the population scale logarithm (base 10) and the vertical axis is the population decrease in percentage (%) by 2040. This diagram shows there is a positive correlation (r=0.524) between the population scale and the population decrease clearly. This suggests that the smaller the community was in 2010, the more population it would lose by 2040.

2.3.2 Dependency Ratios at Sub-national Level

As for population aging, the local communities also represent the future stages of this country.

At the national level, the proportion of the aged population (65 years or older) in the total population was expected to rise from 23.0% in 2010 to 36.1% by 2040 and to 39.9% by 2060 (NIPSSR 2012a). At the community level, 5.2% of 1,683

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