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Physica A 347 (2005) 575–582
PHYSICA A
www.elsevier.com/locate/physa

Spatial distribution of large income earners: an empirical study on the formation of exclusive residential districts

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Available online 4 November 2004

Abstract

The aim of this paper is to investigate the statistical properties of the spatial distribution for each of the towns in Japan, of the number of large income earners living in them and their total income. Using a Japanese database of high-income taxpayers for two consecutive years, 1997 and 1998, we found that the complementary cumulative distribution functions of the number of large income earners and the total income of all of them for each of the towns is well described by a power-law distribution with an exponent close to 2. Our results show that large income earners tend to gravitate to a small number of towns, leading to the evolution of so-called high-class residential streets and neighborhoods.

PACS: 87.23.Ge; 89.90.+n; 02.50.−r

Keywords: Power-law distribution; Large income earners; Exclusive residential districts; Econophysics

1. Introduction

There is a long tradition of studies on power-law scaling in distributions of income and wealth [1]. The power-law of income distribution was first reported by Vilfredo

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0378-4371/$ - see front matter © 2004 Published by Elsevier B.V.
doi:10.1016/j.physa.2004.09.022

Pareto in 1897 [2]. Since Pareto, numerous studies have been made by scholars to test and demonstrate the power-law of income distribution, the so-called Pareto distribution. It has been realized that the Pareto distribution provides a poor fit to the observed frequency data in the lower and middle income classes, but it is generally accepted that it provides a good fit to the distribution of the upper ranges of income. Recently Aoyama et al. [3] used personal income data in Japan and found a clear power-law with an exponent very close to 2 for high ranges of income. Souma [4,5] showed that the personal income distribution is well approximated by a lognormal distribution with a power-law tail over the whole range of incomes.[1] On the contrary, Dragulescu and Yakovenko [8,9] found that personal income distribution is described by an exponential distribution, whereas the high-end tail follows a power-law. Borges [10] analyzed the cumulative distribution of total personal income of USA counties, and the gross domestic product of Brazilian, German and United Kingdom counties, and also of the countries of the world. He verified that generalized exponential distributions, related to non-extensive statistical mechanics, described almost the whole spectrum of the distributions (within a range of acceptable error), ranging from the low region to the middle region, and in some cases, up to the power-law tail. There have also been some theoretical attempts to explain this power-law tail [10–18].

Our previous work [11] examined the fluctuations in personal income of about 80,000 high-income taxpayers in Japan for two consecutive years, 1997 and 1998, when the economy was relatively stable, and found that the distribution of the growth rate in one year was independent of income in the previous year. In this paper we will analyze quantitatively the database of high-income taxpayers in Japan that was studied in Ref. [11] from a slightly different angle. We investigated the statistical properties of spatial distributions of the number of large income earners and the total income of such people in each of the towns in Japan. We found that (i) the complementary cumulative distribution of the number of large income earners and the total income of such people for each of the towns were well described by a power-law distribution with an exponent close to 2, and that (ii) the number of large income earners living in a town was estimated from the number of large income earners living in the town, and that (iii) the relative change in the total income of the large income earners living in a town was positively correlated with the number of them living in the town. These empirical results show that large income earners tend to gravitate to a small number of towns, and suggest that this concentration of such people in a small number of towns results in the so-called high-class residential streets and neighborhoods.

The paper is organized as follows. The following section presents the details of the database we used and our empirical results for the distribution of large income

[1]Okuyama et al. [6], and Mizuno et al. [7] analyzed huge databases of Japanese companies' financial figures and confirmed that Zipf's law, a power law distribution with the exponent 1, has been maintained over 30 years in the income distribution of Japanese companies with very high precision. Similar power laws are found not only in the income distribution of a company's income, but also in the distributions of capital, sales and the number of employees within the company.