



Is the wealth of the Forbes 400 lists really Pareto distributed?

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HIGHLIGHTS

- The Pareto type I distribution is shown not to provide an adequate fit for Forbes 400 lists.
- The beta Pareto distribution is shown to provide an adequate fit for Forbes 400 lists.
- Adequacy is assessed using probability plots, quantile plots and rank–wealth relationships.

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ABSTRACT

A number of researchers have studied the wealth distribution of the Forbes 400 lists (for example, Klass et al. (2006)). They argue that the wealth is Pareto distributed. We ask the question: does the Pareto distribution really give a statistically adequate fit? We find other distributions giving statistically adequate fits.

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1. Introduction

The wealth distribution of the Forbes 400 lists have been investigated by a number of researchers. Using the Forbes 400 lists for 1988–2003, Klass et al. (2006) showed that wealth is distributed according to a Pareto type I distribution with an average exponent of 1.49. A similar conclusion is given in Klass et al. (2007).

The Pareto type I distribution has its probability density function (pdf) and cumulative distribution function (cdf) specified by

$$f(x) = \frac{aK^a}{x^{a+1}} \quad (1)$$

and

$$F(x) = 1 - \frac{K^a}{x^a}, \quad (2)$$

respectively, for $x > K > 0$ and $a > 0$. The parameter a is referred to as the exponent. The parameter K represents the lower end point or the minimum wealth (for the application considered in this note).

The purpose of this note is two folded: (i) does the Pareto type I distribution provide a statistically adequate fit to the wealth distribution of the Forbes 400 lists? (ii) if not, are there distributions

providing statistically adequate fits to the wealth distribution of the Forbes 400 lists? The adequacy is tested using the well known Anderson Darling test for goodness of fit (Anderson and Darling, 1952, 1954).

The contents of this note are organized as follows: Section 2 provides a description of the data used; Section 3 answers the two questions; some conclusions are noted in Section 4. All computations for this note were performed using the R software (R Development Core Team, 2016).

2. Data

The data are the wealth in billions of dollars of the 400 richest individuals in the United States for the years from 1988 to 2016. The data were extracted from the website www.forbes.com. The following summary statistics of the data are given in Table 1: minimum (Min), first quartile (Q1), median (Med), mean, third quartile (Q3), maximum (Max), variance (Var), coefficient of variation (CV), skewness (Skew) and kurtosis (Kurt).

The rich are getting richer. So, it is not surprising that the minimum, first quartile, median, mean, third quartile and the maximum are increasing with the increasing year. The variance is also increasing with the increasing year. The coefficient of variation, skewness and kurtosis initially increase and then decrease. They appear to reach their largest values around the year 2000. The wealth distribution for each year is positively skewed and its peakedness is sharper than that of the normal distribution.

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Table 1
Some summary statistics of the data.

Year	Min	Q1	Med	Mean	Q3	Max	Var	CV	Skew	Kurt
2016	1.600	2.400	3.300	5.946	5.000	81.700	82.690	1.529	4.682	29.089
2015	1.700	2.300	3.300	5.844	5.000	76.000	69.227	1.424	4.315	26.019
2014	1.550	2.200	3.000	5.779	4.900	81.000	72.665	1.475	4.472	28.826
2013	1.300	1.900	2.600	4.850	3.400	72.000	55.231	1.532	4.613	30.452
2012	1.050	1.500	2.100	3.813	3.400	59.000	29.427	1.423	4.960	37.471
2011	1.000	1.500	2.000	3.779	3.400	56.000	30.947	1.472	5.227	39.042
2010	1.000	1.400	1.900	3.366	3.225	53.000	23.957	1.454	5.691	47.081
2009	0.950	1.300	1.800	3.172	3.000	50.000	20.268	1.419	5.597	45.913
2008	1.300	1.675	2.300	3.932	3.700	57.000	27.619	1.336	5.476	44.975
2007	1.300	1.600	2.300	3.850	3.500	59.000	27.607	1.365	5.898	51.683
2006	1.000	1.300	1.800	3.136	2.800	53.000	20.747	1.452	6.297	58.398
2005	0.900	1.000	2.000	2.855	3.000	51.000	18.366	1.501	6.275	57.807
2004	0.750	1.000	1.500	2.505	2.200	48.000	17.018	1.647	6.586	60.312
2003	0.600	0.900	1.200	2.389	2.000	46.000	17.367	1.745	5.864	47.516
2002	0.600	0.865	1.200	2.366	2.000	54.000	18.342	1.810	6.886	66.695
2001	0.725	0.980	1.500	2.994	2.600	63.000	31.208	1.866	6.823	62.815
2000	0.700	1.000	1.500	2.808	2.700	85.000	31.008	1.983	9.633	127.275
1999	0.560	0.810	1.100	2.054	1.900	58.400	14.609	1.861	9.704	128.064
1998	0.540	0.724	1.000	1.754	1.800	39.800	7.478	1.559	8.591	104.396
1997	0.520	0.650	0.920	1.369	1.300	18.500	2.537	1.164	5.906	52.018
1996	0.435	0.534	0.750	1.154	1.100	14.800	1.894	1.192	5.197	40.373
1995	0.395	0.500	0.640	1.033	1.000	10.000	1.363	1.130	4.212	25.560
1994	0.360	0.470	0.600	0.959	1.000	9.000	1.086	1.087	4.030	23.118
1993	0.350	0.430	0.575	0.897	0.950	8.600	0.918	1.068	3.972	22.359
1992	0.350	0.430	0.575	0.897	0.950	8.600	0.918	1.068	3.972	22.359
1991	0.340	0.425	0.565	0.828	0.853	8.600	0.587	0.926	4.579	35.860
1990	0.340	0.425	0.565	0.828	0.853	8.600	0.587	0.926	4.579	35.860
1989	0.350	0.429	0.550	0.826	0.887	8.000	0.573	0.916	4.272	30.320
1988	0.290	0.350	0.453	0.686	0.750	6.800	0.456	0.984	5.021	38.686

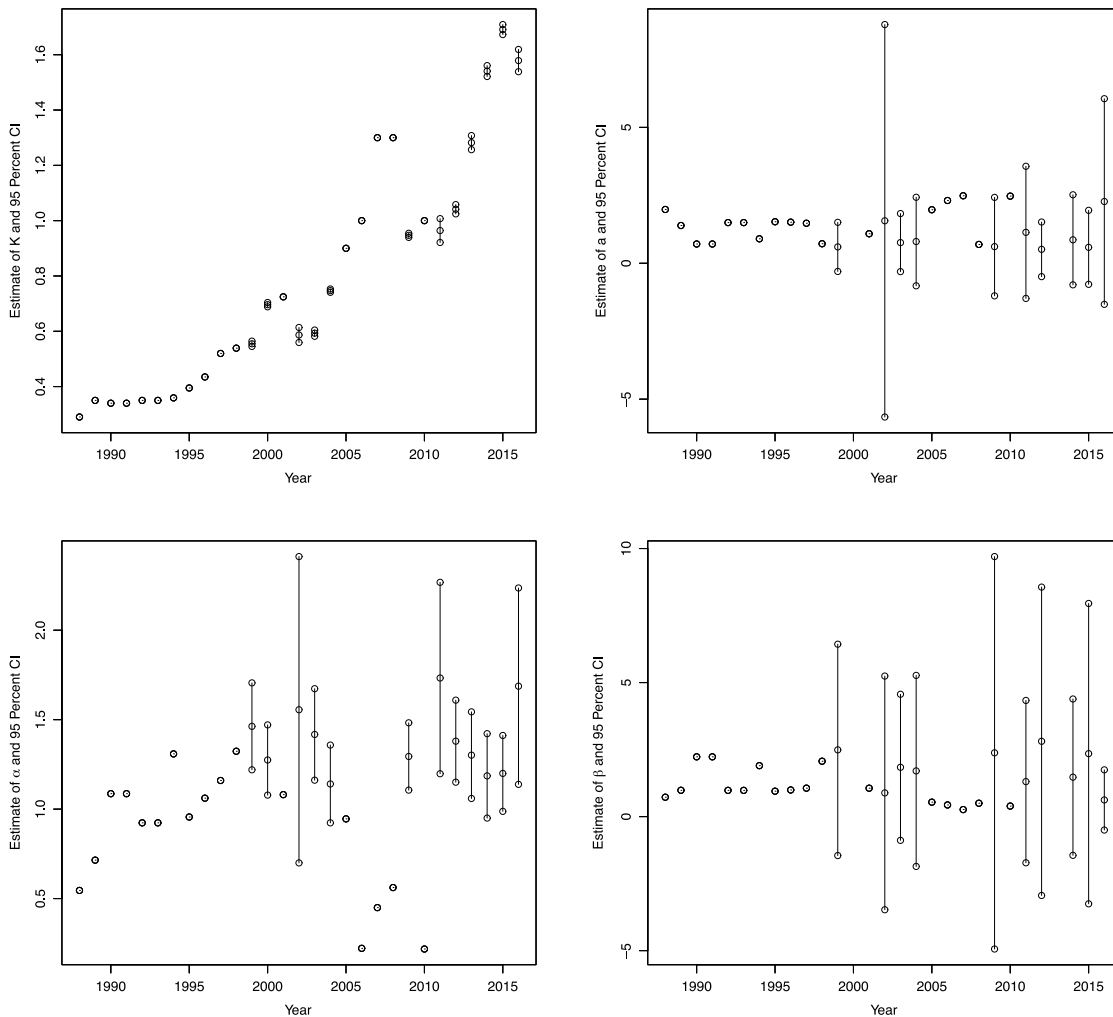


Fig. 1. Parameter estimates and their 95% confidence intervals for the fitted beta Pareto distribution.

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