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How Much was Donated after 1995 Kobe Earthquake?*

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【Abstract】This paper estimates the share of the 'gift economy' that emerged in the two months immediately following the 1995 Kobe earthquake, by applying and extending the Linear Expenditure System (LES), which is one of the most popular econometric models used in consumer demand analysis. The primary finding of the paper is that the value of the gift economy is estimated at $US 175 million. That is, the value of donations was about 7.5% of the total value of consumption.

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Introduction

The Kobe earthquake that occurred on January 17 1995 was undoubtedly one of the most devastating earthquakes in human history. Public concern was so great that, as with other well-known disasters, many donations for the victims flowed into the disaster area from unaffected areas and from overseas. Undoubtedly, these donations contributed to the prompt relief of the victims. However, in-kind gifts reduced consumer demand for commodities in the disaster area. In fact, in the aftermath of the 1995 Kobe earthquake, many local shopkeepers complained that donations had deprived them of earning opportunities.

Such a dilemma has long been recognized by leading sociologists. R. Dynes has pointed out that material assistance for the victims of a disaster may disrupt the local economy (Dynes 1970). F. Cuny also argued that '… the relief program delayed recovery of the normal economic systems within the community' (Cuny 1983). From an economic point of view, this dilemma is due to the emergence of a 'gift economy' in which, since people can receive goods without paying money for them, there is a suspension of the market economy. Clearly, however, recovery from a major natural disaster should be based on a market economy since neither cities nor urban areas can develop without diversification and innovation promoted by free and continuous commercial trade.

This paper estimates the scale of the 'gift economy' that emerged in the two months immediately following the 1995 Kobe earthquake, by applying and extending the Linear Expenditure System (LES), which is one of the most popular econometric models used in consumer demand analysis. The research is important for two reasons: first, we can determine whether the disruption of the local market economy is serious. If it is, relief and support mechanisms other than the rationing of donations may be appropriate. Second, assistance to victims is provided not only by government benefit programs, but also by donations. Therefore, estimating the size of donations helps in determining the appropriate magnitude of government assistance programs.

Although statistics on donations are directly available, these are not satisfactory for our purposes. For example, according to the Hyogo prefecture government, there are concrete statistics on donations provided to the temporary shelters that housed the victims in the aftermath of the earthquake , that is, 541,485 items of underwear, 125,733 bottles of water, 111,083 packs of instant noodles, 110,121 blankets, 84,423 rolls of toilet paper, and so on. However, these statistics do not account for all donated items, because a large share of the in-kind gifts might have been donated voluntarily. Moreover, it should be noted that some donations are not distributed because they are rotten, broken, or not compatible with the victims' needs. We should not count these donations since they do not affect the victims' consumption. In addition, we do not know if donations are substitutes for, or complements of, the goods provided by the market. If victims consume donations that are complements of other goods, donations are not responsible for the disruption of the market economy. Thus, we base our estimation of donations on the behavior of the consumer.

The results of the analysis are as follows: first, donations are found to be statistically significant for the consumption categories "Food" and "Fuel, light & water", both of which are necessities of life. Second, the value of the gift economy is estimated at $US 175 million.

The scale of the 'gift economy', defined as the ratio of donations to the total value of consumption, was about 7.5%.

The Model

The donee

Let us begin to construct our model from the very basic type of LES developed by Stone (1954). Suppose there is a representative consumer in the disaster-affected market. We henceforth call him/her the 'donee' since he/she can receive in-kind gifts from 'donors', which are consumers in other markets that are not affected by the disaster. The donee has a utility function of the form:

$$U_t = \sum_i a_i \log(X_{it} - g_i) \tag{1}$$

where X_{it} denotes his/her consumption of commodity *i* in the *t* th period, and g_i is a constant parameter, which is usually interpreted as committed minimum consumption, or subsistence. We assume that $X_{it} - g_i > 0$, and normalize $0 \leq a_i \leq 1$, $\sum_i a_i = 1$. Suppose that x_{it} is his/her demand and d_{it} is the donation of commodity *i* that he receives in the *t* th period. Then, his/her consumption, X_{it}, is the sum of his demand and the donation; that is:

$$X_{it} = x_{it} + d_{it} \tag{2}$$

where d_{it} is treated as a constant parameter since it is determined by the donors.

His/Her consumption is subject to a budget constraint:

$$m_t = \sum_i p_{it} x_{it} \tag{3}$$

where m_t denotes the donee's total expenditure in the *t* th period, and p_{it} is the market price of the *i* th commodity. Maximization of Eq. 1 subject to Eq. 3 yields the donee's linear expenditure functions (henceforth referred to as a system) as follows:

$$p_{it} x_{it} = (g_i - d_{it}) p_{it} + a_i \left\{ m_t - \sum_k (g_k - d_{kt}) p_{it} \right\}. \tag{4}$$

The interpretation of Eq. 4 is intuitive. The first term on the right-hand-side (RHS) represents committed expenditure for the *i* th commodity. In other words, it is a minimum consumption component. The second term can be interpreted as a 'supernumerary' expenditure component. Under our assumptions, the existence of donations emerges as changes in commitment expenditure.

The LES is so widely used because it satisfies three conditions that are theoretically required: i) additivity; ii) homogeneity; and iii) symmetry of the substitution effect. These properties of the LES continue to hold in our extended model.

It should be noted that there is no possibility of a corner solution. Eq. 4 is not the optimal solution when his demand equals zero; that is, $X_{it} - d_{it} = x_{it} = 0$. This condition is not necessarily satisfied in all disaster cases, since there are some cases in which material support exceeds emergency needs (Hirshleifer 1987). However, the 1995 Kobe earthquake is not such a case, because a glance at our data confirms that all expenditures are positive.

The Donor

Suppose that there is a representative consumer in the area not affected by the disaster. We henceforth call him/her the 'donor', since we assume that he/her donates some commodities to the donee. In fact, the donor's utility function must be altruistic, which means that it is an increasing function of the amount of the gift that he/her donates, since no egoistic consumer would donate to the victims of disasters. Thus, we formalize the donor's utility function:

$$V_t = V(Y_{it}, g_{it}) = v(Y_{it}) + f(g_{it}) \tag{5}$$

where Y_{it} denotes his/her consumption of the *i* th commodity, g_{it} is the amount of the gift he/she donates, both of which are non-negative. We assume that $v(\bullet)$ and $g(\bullet)$ are both concave.

The donor's budget constraint is $w_{it} = \sum_i q_{it}(Y_{it} + g_{it})$, where w_t denotes his/her total expenditure, and q_{it} is a market price. Let Y_{it}^* and g_{it}^* be the solutions to the maximization problem of Eq. 5 subject to the constraint. Substituting $g_{it} = g_{it}^*$ into Eq. 5 and applying a monotonic transformation yields $v_t = v(Y_{it})$.[1] Optimal consumption Y_{it}^* can be obtained by solving the following maximization problem:

$$\begin{aligned} &\max_{Y_{it}} \quad v_t = v(Y_{it}) \\ &s.t. \quad w_t - \sum_i q_{it} g_{ki}^* = \sum_i q_{it} Y_{ikt}. \end{aligned} \tag{6}$$

This transformation allows us to regard g_{it}^* as a parameter, which can therefore be estimated.

Formally, let $v_t = \sum_i b_i \log(Y_{it} - d_i)$ where $b_i > 0$ for all *i*, $\sum_i b_i = 1$, and d_i is a constant parameter interpreted as subsistence. Solving Eq. 6, accounting for $y_{it} = Y_{it} + g_{it}$, where y_{it} denotes demand for commodity *i*, gives rise to the following linear expenditure system:

$$q_{it} y_{it} = (d_{it} + g_{it}^*) q_{it} + b_i \left\{ w_t - \sum_k (d_k + g_{kt}^*) q_{kt} \right\}. \tag{7}$$

[1] As almost all economic analysis does, we assume that the consumer's utility is ordinal, not cardinal. Therefore, any monotonic transformation of the utility function does not affect the solution to the maximization problem.

Relations Between Donor and Donee.

We assume that donation occurs for n periods after the disaster. Let T be the period in which the disaster occurs. That is:

$$\begin{cases} g_{it}^{*} = g_{i}^{*} \quad (T \le t < T+n) \\ g_{it}^{*} = 0 \quad \textit{otherwise.} \end{cases}$$

The amount donated by the donor is a proportion of the gift received by the donee. That is, we assume that:

$$g_{it}^{*} = q d_{it} \tag{8}$$

where q is a parameter taking a value between zero and one.

Habit Formation of Donor and Donee

Estimation of both systems (Eqs. 4 and 5) yields serial correlation. In order to avoid this problem, we extend the model to consider inertia in the consumption of the donor and the donee. We assume that subsistence expenditure depends on the previous value of total expenditure for the commodity. That is, for the donee:

$$g_{i} p_{it} = g_{i}^{*} p_{it} + \sum_{l=1}^{h} f_{il} p_{it-l} x_{it-l} \tag{9}$$

where $0 < f_{il} < 1$ for all *i* and *l*, and g_{i}^{*} is a constant parameter. Substituting Eq. 9 into Eq. 4 yields:

$$p_{it} x_{it} = \sum_{l=1}^{h} f_{il} p_{it-l} x_{it-l} + (g_{i}^{*} - d_{it}) p_{it} + a_{i} \left\{ m_{t} - \sum_{k} (g_{k}^{*} - d_{kt}) p_{it} - \sum_{l=1}^{h} \sum_{k} f_{kl} p_{it-l} x_{it-l} \right\}. \tag{10}$$

For the donor,

$$d_{i} q_{it} = d_{i}^{*} q_{it} + \sum_{l=1}^{h} j_{il} q_{it-l} y_{it-l} \tag{11}$$

where $0 < j_{il} < 1$ for all *i* and *l*, and d_{i}^{*} is a constant parameter. Substituting Eq.11 and Eq. 8 into Eq7 yields:

$$
\begin{aligned}
q_{it}y_{it} &= \sum_{l=1}^{h} j_{il} q_{it-l} y_{it-l} + (d_i^{*} + qd_{it})q_{it} \\
&\quad + b_i \left\{ w_t - \sum_k (d_k^{*} + qd_{kt})q_{it} - \sum_{l=1}^{h} \sum_k j_{kl} q_{it-l} y_{it-l} \right\}.
\end{aligned} \tag{12}
$$

Eqs. 10 and 12 define the model we estimate. These two systems are originally independent since they relate to different markets. However, in this analysis donation is the only connection between these two systems. If donation exists, the donor's demand may increase whereas that of the donee decreases, and so the subsistence parameters of both systems may change symmetrically. Separate estimation of each system is not appropriate for our purposes, because the donation parameter might absorb all the shocks on the subsistence parameter.

The Data and the Estimation Method

Geographical description of Kobe and Osaka

We suppose that the donee is a consumer in Kobe city, while the donor is a consumer in Osaka city. Osaka, located 30 km east of Kobe city, is one of the most highly populated cities in Japan. The area between Kobe and Osaka is called the Hanshin metropolitan area,[2] which includes the smaller (but still major) cities of Ashiya, Itami, and Nishinomiya, and has a total population, including Kobe and Osaka, of more than 5 million.

The 1995 Kobe earthquake had little effect on the city of Osaka. Figure 1 shows the geographical relationship between Osaka and Kobe. Although most means of transportation between these cities suffered some damage, most donations were delivered from Osaka because of its geographical proximity.

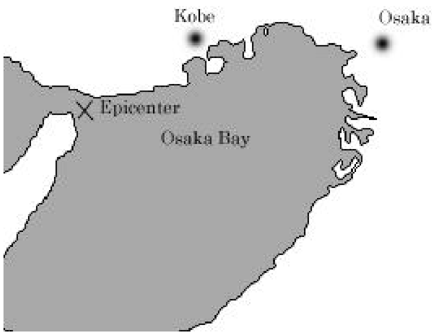

Figure 1. Location of Kobe and Osaka.

Data Description and Estimation Method.

We used the monthly Consumer Price Index of 10 commodity categories as price data, and the Family Income and Expenditure Survey for expenditure data. Since data is from January 1992 to December 1999, the number of observation is 96.

Since donations have been delivered mainly via temporary shelters, it is plausible to

[2] This is why the 1995 Kobe earthquake is sometimes called the Hanshin earthquake, which is in more common usage in Japanese.

equate the period in which donation occurred (n) with that in which temporary shelters existed. Therefore, we assume n =2 because the number of refugees declined sharply in the two months immediately after the earthquake (from a maximum of 209,828 to 77,497). To avoid biased estimation of the parameters as far as possible, data were not seasonally adjusted. Instead, monthly dummy variables were included in all the estimated equations. Estimated coefficients, from Nonlinear Least Square Estimators, were produced by the 'LSQ' command in TSP 4.3 (one of the most popular econometric software packages).

The donation share of Osaka, which is denoted by q in the model, can be estimated statistically. However, after more than 200 iterations, parameter estimates did not converge, due to computational complexity. Given this problem, we set $q = 0.1$ exogenously. This assumption is plausible since, according to the Japan Trucking Association, the number of trucks arriving at Kobe from the Kansai (wider Osaka) area was 904, 12.6% of the total of 7,163. However, the reader may argue that this method is too arbitrary on the grounds that the estimated amount donated is sensitive to the value of q. Although this argument is plausible, as we show later, the results are sufficiently robust that the value of q hardly affects the estimation results as far as the statistical significance of the estimated coefficients of donations is concerned.

Estimation Results

Table1 shows the estimation results. Even if the values of the subsistence parameters (g_i, d_i) are negative, there are no theoretical contradictions in the results. The introduction of habit formation improved the problem of serial correlation remarkably when the second order lagged variables are introduced (h=2). Durbin's h-test shows serial correlation at the 5% level in only in two equations, "Clothes and footwear" in Osaka, and " Food" in Kobe, while in eight equations of the classical LES (represented by Eqs. 4 and 7), results are not shown because of limits on space. The donation parameters d_i are significant at 5% in "Food" and in "Fuel, light & water charges", both of which are necessities of life for victims. Interestingly, there is no donation effect in "Clothes & footwear", which is thought to be one of the most important commodity categories for refugees. This result suggests that demand for clothing was not substituted by donations.

Let us compute the scale of the 'gift economy'. This is defined as donations as a proportion of total consumption (rather than expenditure). That is:

$$Scale = \frac{\sum_i \sum_{t=T}^{T+1} d_{it} p_{it}}{\sum_i \sum_{t=T}^{T+1} p_{it} (x_{it} + d_{it})}. \tag{13}$$

Table 2 shows the value of d_i and the ratio of donations to total consumption as q varies. According to these results, we can conclude that the scale of the gift economy was 7.5%, and that it is valued at $US 175 million, or at $US 302 per household (at prevailing PPP exchange rates). As we indicated earlier, the share of donations is not sensitive to movements in q. It only varies from 4.2% when q =0.4, to 9.0% when q =0.05. Therefore, even if the assumed value of q is biased, the finding that the scale of the gift economy is about 7.5% is robust.

Conclusion

The results of this paper show that donations in the aftermath of the Kobe earthquake were so large that they cannot be ignored in terms of the local economy. These donations might have deprived the market of demand, and thereby partially prevented the prompt recovery of the disaster area's economy. A means of relieving the victims other than the rationing of donations should be explored. For example, the local government might make contracts with retail sellers nationwide, in which sellers promise to concentrate on providing necessary commodities to the disaster area, in return for privileges from the government on the transportation of goods. Relief programs for victims are primarily based on the transfer of money to enable victims to buy anything they need. Local shopkeepers can survive economically in such a situation because the plan itself does not necessarily deprive them of earning opportunities.

Finally, we mention some limitations of our analysis. All data used in this paper are official government statistics, which can be expected to reflect normal circumstances. However, in extreme conditions such as the aftermath of an earthquake, it is possible that those who are most affected are eliminated from the sample. Hence, we should regard the estimated 7.5% donation share as a minimum value. Another limitation is that we do not consider the mechanism through which people decide the amount to donate, and thus we do not forecast how much people *will* donate. Further research on this issue is required.

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Table 1. Estimation results.

	Commodities	θ=0.1	ϕi1	ϕi2	γi	gi	αi	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov		
Osaka	Food	Estimate	0.489	0.336	300.780	12.958	0.048	-41610	-32720.7	-18124.6	-22787.6	-19849	-24441.7	-22151.5	-23323.7	-25650.9	-22440.5	-25155.7	R-squared	0.903
		t-statistic	5.979**	4.1**	4.7164**		3.832**	-13.554**	-10.595**	-11.475**	-13.399**	-11.13**	-13.089**	-14.365**	-13.72**	-15.069**	-13.826**	-13.722**	Durbin's -h	-1.124
	Clothes & footwear	Estimate	0.253	-0.078	92.355	3.535	0.089	-2074.3	-3781.22	-1265.23	-6910.99	-511.731	-1637.78	-548.757	-11920.2	-5379.39	-4726.9	-3294.12	R-squared	0.648
		t-statistic	2.951**	-0.902	1.409		5.623**	-0.786	-1.51	-0.691	-3.411**	-0.225	-0.713	-0.289	-5.838**	-2.382*	-2.261*	-1.424	Durbin's -h	2.097*
	Fuel, light & water charges	Estimate	0.205	0.394	63.393	10.795	0.014	4101.11	2821.7	667.917	-1869.93	-2558.26	-3652.06	-2708.87	1343.1	1415.04	-2962.93	-2968.89	R-squared	0.825
		t-statistic	2.798**	5.428**	3.311**		2.746**	4.692**	3.344**	0.852	-2.293*	-3.181**	-4.728**	-4.089**	1.897	1.903	-4.163**	-3.877**	Durbin's -h	0.590
	House	Estimate	0.124	0.219	86.097	11.469	0.067	452.658	2231.1	1754.53	2350.5	2031.9	3731.76	7300.5	4743.48	2525.01	1412.3	1481	R-squared	0.292
		t-statistic	1.403	2.49*	1.472		2.833**	0.116	0.64	0.625	0.78	0.608	1.078	2.494*	1.471	0.764	0.454	0.427	Durbin's -h	0.512
	Furniture & household utensils	Estimate	0.160	0.101	52.480	0.860	0.043	-3993.71	-3454.9	-2385.58	-3714.98	-3965.58	615.466	3777.93	-1472.3	-3835.79	-1996.36	181.77	R-squared	0.426
		t-statistic	1.771	1.12	1.207		2.665**	-1.487	-1.439	-1.243	-1.809	-1.745	0.26	1.909	-0.68	-1.736	-0.974	0.078	Durbin's -h	-0.770
	Medical care	Estimate	0.042	-0.042	38.673	2.560	0.034	2326.85	1496.47	834.742	-78.9085	1469.21	-983.957	1269.26	2546.9	815.74	1000.98	1365.49	R-squared	0.134
		t-statistic	0.485	-0.477	1.506		3.497**	1.436	1.023	0.703	-0.062	1.049	-0.681	1.036	1.951	0.602	0.772	0.946	Durbin's -h	1.149
	Transportation & communication	Estimate	0.184	-0.072	-185.702	9.084	0.372	15941.8	10125.9	-9497.56	2972	16135.2	10994.4	-416.366	10836.8	6061.62	4850.34	12276.3	R-squared	0.509
		t-statistic	1.528	-0.607	-0.635		7.856**	2.042*	1.421	-1.714	0.494	2.42*	1.603	-0.072	1.755	0.96	0.8	1.803	Durbin's -h	
	Education	Estimate	0.101	0.257	-152.697	5.300	0.138	21203.7	18536.8	20034.5	30688.5	11629.3	9926.95	10768	6569.38	27248.7	25716.3	7887.22	R-squared	0.680
		t-statistic	1.092	2.793**	-2.014*		5.425**	4.935**	4.805**	6.299**	8.682**	2.905**	2.614**	3.303**	1.872	7.612**	6.714**	2.041*	Durbin's -h	-0.421
	Reading & recreation	Estimate	0.385	-0.052	224.029	14.548	0.045	-13765.1	-11528.3	-1968.79	-14234.9	-12947.2	-10678.2	-6267.11	-4195.41	-12825.3	-9957.61	-10442.8	R-squared	0.563
		t-statistic	4.581**	-0.629	4.012**		2.239*	-3.87**	-3.607**	-0.796	-5.097**	-4.29**	-3.497**	-2.429*	-1.509	-4.484**	-3.626**	-3.451**	Durbin's -h	-1.118
	Miscellaneous	Estimate	0.175	0.079	-129.504	18.870	0.150	17416.99	16273.15	9950.071	13586.31	8566.16	16125.12	8976.91	14871.95	9625.27	9104.38	18669.73	R-squared	
		t-statistic	1.903	0.852	-1.171														Durbin's -h	

	Commodities	θ=0.1	ψi1	ψi2	δi	di	βi	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov		
Kobe	Food	Estimate	0.224	0.227	548.676	129.581	0.036	-37607.1	-32417.9	-18532.4	-25156.4	-21205.3	-22492.4	-21950.1	-23013	-24379.8	-21642.3	-26880.8	R-squared	0.885
		t-statistic	2.934**	2.95**	7.097**	2.212*	4.436**	-12.677**	-11.892**	-9.868**	-12.852**	-12.229**	-12.656**	-13.291**	-13.147**	-14.027**	-12.581**	-15.31**	Durbin's -h	2.066*
	Clothes & footwear	Estimate	0.274	-0.123	52.164	35.352	0.045	-1173.75	-8386.74	-631.325	-4889.03	-2018.67	-4020.79	-520.605	-8640.25	-6286.14	-1218.42	-1834.81	R-squared	0.446
		t-statistic	3.254**	-1.377	0.991	0.466	4.111**	-0.487	-3.541**	-0.279	-2.157*	-0.891	-1.826	-0.243	-4.01**	-2.761**	-0.533	-0.805	Durbin's -h	0.646
	Fuel, light & water charges	Estimate	0.229	0.095	23.612	107.951	0.029	4605.57	3660.9	1604.32	517.408	-1276.69	-1856.41	-2586.22	666.09	140.112	-733.247	-1659.18	R-squared	0.729
		t-statistic	3.88**	1.647	0.882	2.275*	7.214**	4.888**	3.853**	1.835	0.57	-1.387	-2.156*	-3.115**	0.782	0.16	-0.853	-1.947	Durbin's -h	-0.144
	House	Estimate	0.055	0.211	-729.094	114.688	0.261	20360.6	19904	11073.3	12585.6	4385.69	14789	3462.26	7379.61	20486.7	11056.3	14613.2	R-squared	0.391
		t-statistic	0.6	2.356*	-3.58**	0.306	6.343**	2.33*	2.292*	1.424	1.594	0.535	1.87	0.447	0.935	2.548*	1.388	1.841	Durbin's -h	0.667
	Furniture & household utensils	Estimate	0.027	0.029	-44.393	8.606	0.058	-6909.52	-2977.78	-7452.57	-4756.08	-2346.07	-3043.72	-2925.63	-1019.83	-4018.37	-6745.32	-4238.37	R-squared	0.310
		t-statistic	0.283	0.301	-0.808	0.093	5.534**	-2.623**	-1.096	-3.294**	-2.073*	-0.987	-1.313	-1.281	-0.434	-1.659	-2.842**	-1.835	Durbin's -h	0.937
	Medical care	Estimate	0.041	0.123	22.889	25.599	0.024	-1526.93	-2504.03	-2563.92	-5039.75	-4686.87	1458.64	-2668.82	-3754.71	-4147.49	-4149.31	-1286.25	R-squared	0.276
		t-statistic	0.479	1.402	0.57	0.697	2.713**	-0.774	-1.256	-1.442	-2.822**	-2.47*	0.795	-1.508	-2.084*	-2.228*	-2.245*	-0.697	Durbin's -h	1.354
	Transportation & communication	Estimate	0.132	0.144	-685.877	90.841	0.236	20171.1	13129.1	9598.49	16618.2	21382.6	16011.7	20002.5	21529.5	10382.3	10562.6	16392.6	R-squared	0.470
		t-statistic	1.448	1.563	-2.957**	0.224	6.939**	2.787**	1.847	1.52	2.568*	3.155**	2.465*	3.169**	3.287**	1.535	1.591	2.518*	Durbin's -h	0.465
	Education	Estimate	0.142	0.095	-335.667	52.998	0.134	9750.43	8093.45	12468.9	18225.8	5234.47	2547.81	-689.697	-2075.24	14806.8	19446.7	412.657	R-squared	0.538
		t-statistic	1.519	1.012	-2.808**	0.269	5.516**	1.946	1.66	2.869**	3.856**	1.094	0.584	-0.158	-0.461	3.206**	4.037**	0.089	Durbin's -h	1.240
	Reading & recreation	Estimate	0.285	0.059	-129.441	145.478	0.107	-7517.8	-3791.48	-889.262	-6884.08	980.347	-122.345	7825.61	7508.4	-7459.54	-5901.72	-53.4238	R-squared	0.513
		t-statistic	3.555**	0.695	-1.25	0.955	5.657**	-1.681	-0.836	-0.22	-1.685	0.23	-0.03	1.954	1.78	-1.686	-1.36	-0.013	Durbin's -h	-1.408
	Miscellaneous	Estimate	0.048	0.307	-120.523	188.697	0.071	-152.6	5290.48	-4675.533	-1221.668	-449.507	-3271.485	-4675.533	1419.43	475.428	-675.283	4534.377	R-squared	
		t-statistic	0.563	2.785**	-1.379	1.568													Durbin's -h	

Note: Sample period is from Mar. 1992 to Dec. 1999.

* and ** denote significance at 5% , 1% level respectively.

Table 2. The value of q and the scale of the gift economy

		θ =0.05	θ =0.08	θ =0.1	θ =0.2	θ =0.3	θ =0.4
d_{it}	Food	158.6	140.8	129.6	102.4	85.9	71.1
	Fuel, light & water charges	133.2	117.8	108.0	83.9	70.1	58.6
Total value of donation for Kobe city ($US)	Food	119,811,006	106,405,827	97,900,946	77,341,755	64,895,406	53,702,463
	Fuel, light & water charges	94,855,769	83,898,246	76,869,994	59,753,174	49,905,076	41,693,913
	Total	214,666,775	190,304,074	174,770,941	137,094,929	114,800,482	95,396,376
Donation Ratio	in Food	20.5%	18.7%	17.4%	14.3%	12.3%	10.4%
	in Fuel, light & water charges	54.0%	50.9%	48.7%	42.5%	38.2%	34.0%
	total (scale of gift economy)	9.0%	8.1%	7.5%	6.0%	5.0%	4.2%

Note: $US 1=￥162.37 (PPP exchange rate as of 1995)