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Determinants of the Upsurge in M1 Demand in Japan:
Evidence from Household-Level Analysis

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Abstract

This paper investigates why M1 demand rose rapidly in Japan between 1996 and 2002 by applying household analysis. We find that: (1) aging and a widening income gap are responsible for around 10－30% of the overall rise in household M1 demand; (2) the growth in M1 demand in households whose head is aged 50 or over and that in poor households account for 70－90% of overall growth in M1 demand; and (3) households in which M1 demand rises significantly have relatively high interest elasticities of M1 demand.

JEL Classification Numbers: E2, E4

Key Words: M1 demand, interest elasticity, household analysis

1. Introduction

The long and painful economic slump has lasted for nearly 15 years in Japan. During this period, the Japanese government and the Bank of Japan (BOJ) have implemented significant and aggressive fiscal and monetary policies to pull the Japanese economy out of the slump. These anticyclical measures, especially monetary policy, are considered as social experiments unparalleled in Japan and elsewhere.

Specifically, the BOJ first lowered policy interest rates, namely the overnight call rate, from its peak of 8.3% (in March 1991) to a historic low of 0.5% in September 1995, and then to 0% in February 1999 (see Figure 1). Adding to this unprecedented zero interest rate policy, the BOJ also substantially eased the money supply by releasing BOJ current deposits in March 2001. Unfortunately, both the zero interest rate policy and the easing of money supply have had only a limited effect on economic recovery; more-

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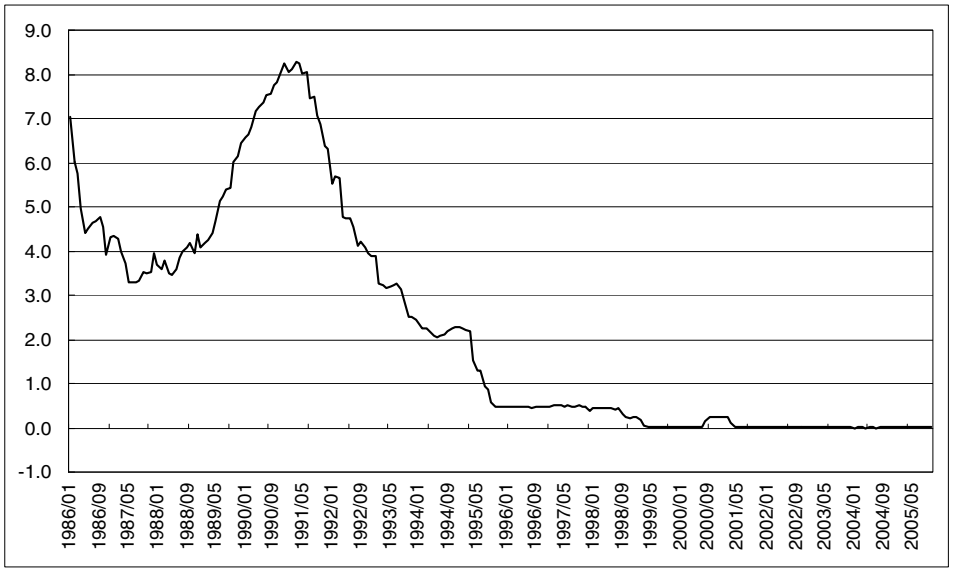
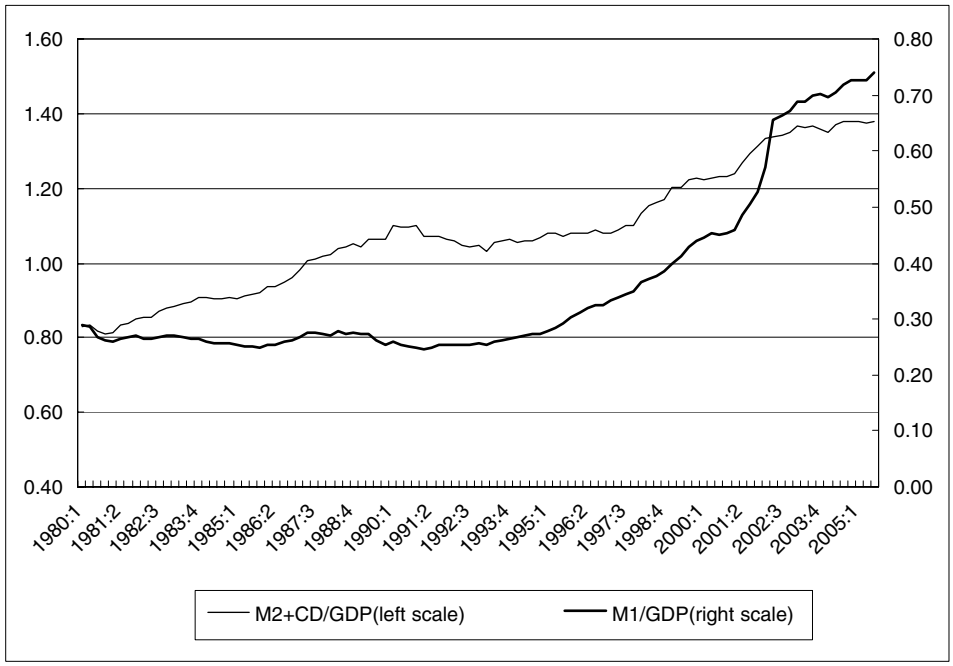
over, there was no expected inflation. However, the liquidity trap is considered a major reason for the failure of the BOJ's monetary polices. The hypothesis that the Japanese economy has fallen into a liquidity trap was initially proposed by Kruguman (1999, 2000), with whom many other researchers agree. Hondroyiannis et al. (2000), Hosono et al. (2000), Fujiki (2002), Fujiki et al. (2002), Miyao (2002), Nakashima and Saito (2002), Fujiki and Watanabe (2004), have tried to empirically confirm the hypothesis that Japan is in a liquidity trap.

Figure 1 Overnight Call Rates (Overnight Interbank Rates)



Note: Monthly data from January 1986 to May 2005.

Figure 2 The Ratio of M1 or (M2 + CD) to Nominal GDP



Note: Seasonally adjusted quarterly data from 1980/I to 2005/I.

In summary, in the existing literature, concern has been expressed about the upsurge in money demand in conjunction with the low interest rate policy. It is true that both the ratio of M1 to GDP and the ratio of M2 plus cash deposits (CD) to GDP rose dramatically in the late 1990s (see Figure 2). In particular, the change in M1/GDP seems closely linked to shifts in monetary policy. For example, M1/GDP experienced two large increases in 1996 and 1999, soon after the announcement of a large cut in the overnight call rate. Hence, the validity of the liquidity trap hypothesis depends heavily on whether the interest elasticity of M1 or of (M2 + CD) has risen in the past few years.

However, the empirical results relating to the liquidity trap hypothesis are inconclusive. Using time-series data to estimate a semi-log money demand function, Nakashima and Saito (2002) find that the interest elasticity of M1 demand has increased in Japan since 1995. Fujiki (2002) draws a similar conclusion about the demand elasticity of M1 by using prefecture-level cross-section data from the Household Expenditure Survey to estimate a log-log money demand function. [1]Fujiki et al. (2002) use prefecture-level data on deposits to estimate semi-log money demand functions for M1 and M2. They find that the interest elasticities are quite stable and, hence, conclude that Japan's economy was not in a liquidity trap.

1 The data set was based on the aggregate statistics of the Household Expenditure Survey (Kakei Chosa), which is an extensive survey conducted annually by the Statistics Bureau and the Statistics Center, Ministry of Internal Affairs and Communications.

Using time-series data from 1995 onwards to estimate a log-log money demand function for M1, Miyao (2002) also finds a stable relationship between the interest rate and M1 demand, which represents further evidence against the liquidity trap hypothesis. [2]Fujiki and Watanabe (2004) and Hosono et al. (2000) also find no evidence that Japan has fallen into a liquidity trap. [3]Hondroyiannis et al. (2000) even find a decreasing interest elasticity of (M2 + CD) demand from time-series data.

While there are many time-series studies and prefecture-(state) level cross-sectional studies of monetary demand, [4]household-level studies are rare. Exceptions are the pioneering US studies (including those of Mulligan and Sala-i-Martin, 2000, and Attanasio et al., 2002), but there have been no such studies for Japan. Using the 1989 Survey of Consumer Finances, Mulligan and Sala-i-Martin (2000) find that the interest elasticity of household money demand is minimal when the interest rate is low. Attanasio et al. (2002) use household-level data, and find that the interest elasticities of cash demand are similar to the theoretical values implied by standard inventory models.

In this paper, we use a unique microdata set on Japanese households, namely the *Public Opinion Surveys on Household Financial Assets and Liabilities* (POSHFAL), to investigate the microlevel factors responsible for the rapid rise in household M1 demand in Japan since 1996. The POSHFAL is a survey conducted by the Central Council for Financial Services Information (CCFSI) [5]annually under a unified and scientific sampling process. Hence, the data are repeated cross-section data with which unbiased time-series comparison is possible. For instance, Figure 3 shows the time-series movement in household M1/Income implied by the microdata from POSHFAL. It shows that the ratio of M1 to income has been rising rapidly since 1996, [6]which is consistent with the macrodata.

In brief, the main conclusions of this paper are as follows. (1) The proportion of elderly households and low-income households, which have traditionally had a relatively high demand for M1, has increased significantly since 1996. In other words, transitions in the population structure that incorporate aging and a widening of the income gap are responsible for 10－30% of the rise in M1/Income between 1996 and 2002. (2) M1 demand among elderly households and low-income households has increased significantly since 1996. This change is responsible for 70－90% of the rise in M1/Income between 1996 and 2002. (3) Increases in M1/Income depend on household attributes; that is, M1/Income has not

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2 Note that Miyao (2002) also finds that the interest elasticity of M1 demand increased significantly when using a *semi-log* money demand function. However, as Miyao emphasized in his paper, this finding is not necessarily inconsistent with his other findings because of the following numerical relationship between the two elasticity indexes:
Elasticity derived from the semi-log function = elasticity derived from the log-log function / nominal interest rate.

3 Fujiki and Watanabe (2004) contribute to the literature by using the most up-to-date data set, while Hosono et al. (2000) specialize by performing various forms of tests of the nonlinearity hypothesis in the context of the interest elasticity of (M2 + CD) demand.

4 Examples of prefecture-(state) level cross-sectional studies include Mulligan and Sala-i-Martin (1992), Fujiki and Mulligan (1996), Fujiki (2002), Fujiki et al. (2002).

5 The CCFSI was established in April 1952 primarily to enlighten the public about the importance of basic financial and economic knowledge related to daily life. The BOJ has been working as its secretariat.

6 M1 excludes the checking accounts of enterprises but includes households' cash-in-hand and bank deposits (ordinary accounts plus checking accounts). Since household bank deposits account for 50－60% of M1, household-based M1 analysis is meaningful.

increased for all households in response to the low interest rate. In addition, households with high interest elasticities are more likely to demand more M1/Income. In summary, although we cannot determine whether Japan was in a liquidity trap, our discussion of household behavior does contribute to an understanding of the macrophenomenon of monetary demand and the liquidity trap in Japan.

This paper is organized as follows. The data used in the analysis are set out in Section 2. The statistical methods and the main results from the Blinder－Oaxaca decompositions relating to the rise in M1/Income between 1996 and 2002 are described in Section 3. The estimation results from the M1 demand function are reported in Section 4. Conclusions are summarized in Section 5.

2. Data and Descriptive Statistics

2-1 Data

In this study, we use data on 33,944 households taken from the POSHFAL survey, which has been conducted annually since 1953 by the CCFSI. The sample is representative of the Japanese population. The sample is selected on the basis of a two-stage stratified random-sampling procedure. In the first stage, the country is divided into 400 investigation areas. In the second stage, 15 households with at least two members are selected on the basis of a random-sampling procedure from the list of all resident households in a given area. Six thousand households were selected from throughout Japan each year, and of these 6000 households, about 70% responded to the questionnaire. [7]The CCFSI distributed the questionnaires and those conducting the survey explained the questions to the respondents in June or July, and after several days, collected the questionnaires. These consistent cross-section observations are sometimes pooled together as repeated cross-section data in our analysis. Descriptive statistics of the main variables (such as income, [8]profession, age, district, city size, home ownership, employment) are presented in Table 1.

In this paper, M1 is defined as the CPI deflated quantity of cash in hand and bank deposits (from ordinary accounts and checking accounts). [9] To analyze the changes in M1/Income, we primarily use data from 1996 and 2002, because in these benchmark years, M1/Income was at its minimum and maximum, respectively (see Figure 3). [10]In addition, to check the robustness of our results, data from 1998 and 2003 are used in some analyses. [11]

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7 Although the response rate differs slightly from year to year, it is generally around 70%.

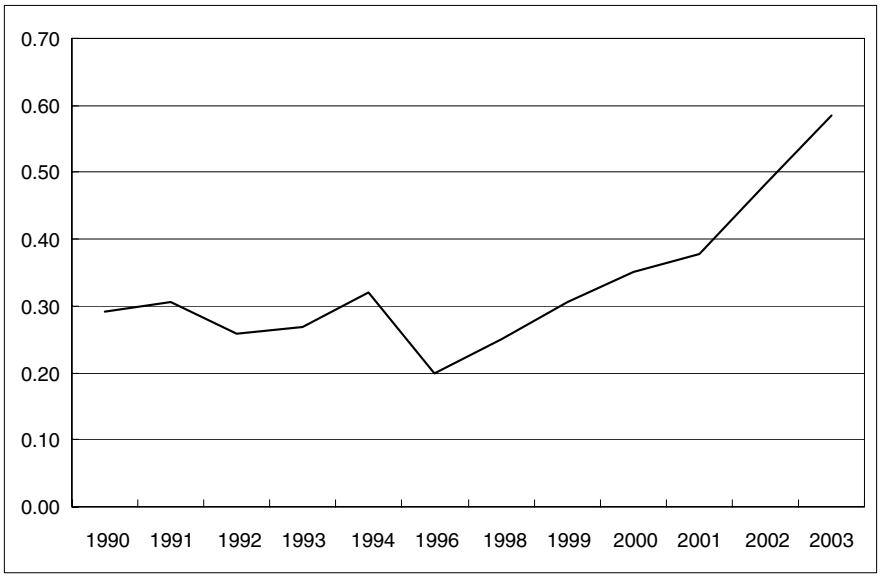
8 Henceforth, income refers to CPI (2000) deflated post-tax income.

9 The 2000 CPI is used.

10 Strictly speaking, of the available data sets, the one for 2003 has the highest ratio of M1 to income (0.584). However, possibly because a new research company was used, the 2003 data set has an unusually high number of missing values for cash and income. Thus, we used the 2002 data set for comparison because its data quality is closer to that of other years.

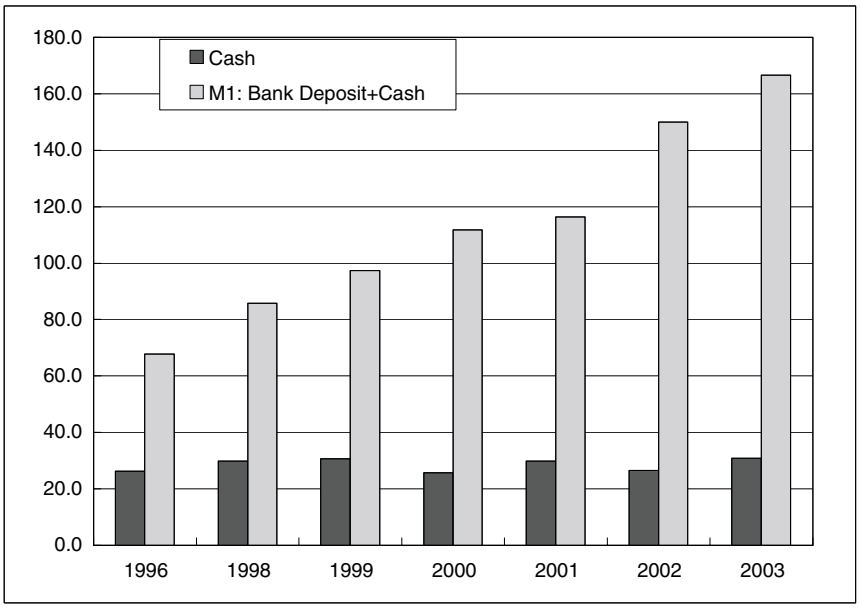
11 Data for the neighboring years of 1997 and 1995 are not used because the 1995 and 1997 surveys did not collect information on cash holdings.

Figure 3 Ratio of M1 to Nominal Income



Note: Author's own calculations based on microdata from the *Public Opinion Surveys on Household Financial Assets and Liabilities* (POSHFAL).

Figure 4 Average Holdings of Cash and M1 in (CPI-deflated Values)
(Unit: 10 thousand yen)



Note: Data from 1997 is missing because the 1997 survey does not include information on cash.

Table1　Descriptive Statistics

	1996			2002			1996·1998			2002·2003		
	obs.	Mean	Std. Dev.	obs.	Mean	Std. Dev.	obs.	Mean	Std. Dev.	obs.	Mean	Std. Dev.
M1/income	3233	0.2001	0.4784	2863	0.4819	1.7091	6300	0.2243	0.5145	5176	0.5014	1.5285
income1 (Under 1.5 million yen)	3233	0.0139	0.1172	2863	0.0377	0.1906	6300	0.0179	0.1327	5176	0.0429	0.2026
income2 (1.5 - 2.5 million yen)	3233	0.0566	0.2311	2863	0.0908	0.2874	6300	0.0530	0.2241	5176	0.0989	0.2986
income3 (2.5 - 3.5 million yen)	3233	0.1194	0.3243	2863	0.1799	0.3842	6300	0.1106	0.3137	5176	0.1830	0.3867
income4 (3.5 - 4.5 million yen)	3233	0.1655	0.3717	2863	0.1603	0.3670	6300	0.1557	0.3626	5176	0.1650	0.3712
income5 (4.5 - 6.0 million yen)	3233	0.2072	0.4054	2863	0.2019	0.4015	6300	0.1941	0.3956	5176	0.1880	0.3907
income6 (6.0 - 8.0 million yen)	3233	0.2261	0.4184	2863	0.1694	0.3752	6300	0.1857	0.3889	5176	0.1716	0.3770
income7 (8.0 - 10.0 million yen)	3233	0.1064	0.3084	2863	0.0866	0.2813	6300	0.0833	0.2764	5176	0.0794	0.2704
income8 (Over 10.0 million yen)	3233	0.1049	0.3064	2863	0.0733	0.2608	6300	0.0808	0.2725	5176	0.0713	0.2573
prof1 (Farmer & fisher)	3233	0.0591	0.2358	2863	0.0479	0.2135	6300	0.0548	0.2275	5176	0.0440	0.2052
prof2 (Business proprietor)	3233	0.1837	0.3873	2863	0.1401	0.3471	6300	0.1744	0.3795	5176	0.1476	0.3547
prof3 (White-collar worker)	3233	0.1531	0.3601	2863	0.1429	0.3500	6300	0.1522	0.3593	5176	0.1640	0.3703
prof4 (Blue-collar worker)	3233	0.2004	0.4004	2863	0.1652	0.3714	6300	0.2044	0.4033	5176	0.1801	0.3843
prof5 (Manager)	3233	0.1460	0.3532	2863	0.1170	0.3215	6300	0.1454	0.3525	5176	0.1196	0.3245
prof6 (Professional worker)	3233	0.0368	0.1883	2863	0.0356	0.1854	6300	0.0349	0.1836	5176	0.0321	0.1762
prof7 (Other)	3233	0.2144	0.4104	2863	0.3437	0.4750	6300	0.2284	0.4198	5176	0.3066	0.4611
age1 (20s)	3233	0.0322	0.1765	2863	0.0304	0.1717	6300	0.0357	0.1856	5176	0.0286	0.1667
age2 (30s)	3233	0.1451	0.3522	2863	0.1331	0.3397	6300	0.1430	0.3501	5176	0.1316	0.3381
age3 (40s)	3233	0.2645	0.4411	2863	0.1841	0.3876	6300	0.2570	0.4370	5176	0.1828	0.3865
age4 (50s)	3233	0.2524	0.4345	2863	0.2564	0.4367	6300	0.2567	0.4368	5176	0.2591	0.4382
age5 (60s)	3233	0.2236	0.4167	2863	0.2379	0.4258	6300	0.2246	0.4174	5176	0.2390	0.4265
age6 (70s or older)	3233	0.0823	0.2748	2863	0.1582	0.3650	6300	0.0830	0.2759	5176	0.1590	0.3657
district1 (Hokkaido)	3233	0.0520	0.2220	2863	0.0524	0.2229	6300	0.0532	0.2244	5176	0.0493	0.2164
district2 (Tohoku)	3233	0.0820	0.2744	2863	0.0807	0.2724	6300	0.0814	0.2735	5176	0.0775	0.2674
district3 (Kanto)	3233	0.3127	0.4637	2863	0.2927	0.4551	6300	0.3163	0.4651	5176	0.3000	0.4583
district4 (Hokuriku)	3233	0.0479	0.2137	2863	0.0405	0.1972	6300	0.0456	0.2085	5176	0.0433	0.2035
district5 (Chubu)	3233	0.1265	0.3325	2863	0.1491	0.3563	6300	0.1317	0.3382	5176	0.1464	0.3536
district6 (Kinki)	3233	0.1540	0.3610	2863	0.1432	0.3503	6300	0.1440	0.3511	5176	0.1549	0.3619
district7 (Chugoku)	3233	0.0767	0.2662	2863	0.0751	0.2636	6300	0.0743	0.2623	5176	0.0719	0.2583
district8 (Shikoku)	3233	0.0337	0.1805	2863	0.0356	0.1854	6300	0.0356	0.1852	5176	0.0361	0.1866
district9 (Kyushu)	3233	0.1144	0.3184	2863	0.1306	0.3371	6300	0.1179	0.3226	5176	0.1206	0.3256
citysize1	3233	0.2134	0.4098	2863	0.2012	0.4010	6300	0.2111	0.4081	5176	0.2046	0.4034
citysize2	3233	0.3282	0.4696	2863	0.3601	0.4801	6300	0.3421	0.4744	5176	0.3723	0.4835
citysize3	3233	0.1104	0.3135	2863	0.1083	0.3108	6300	0.1132	0.3168	5176	0.1144	0.3183
citysize4	3233	0.0956	0.2941	2863	0.0891	0.2849	6300	0.0870	0.2818	5176	0.0786	0.2692
citysize5	3233	0.0232	0.1506	2863	0.0196	0.1385	6300	0.0229	0.1495	5176	0.0174	0.1307
citysize6	3233	0.2292	0.4204	2863	0.2218	0.4155	6300	0.2238	0.4168	5176	0.2127	0.4093
myhome dummy (1 if own a home)	3233	0.7074	0.4550	2863	0.7618	0.4261	6300	0.7194	0.4493	5176	0.7531	0.4313
jobless dummy (1 if jobless)	3233	0.2555	0.4362	2863	0.3681	0.4824	6300	0.2629	0.4402	5176	0.3342	0.4718

Note: The definitions of the citysize dummies are unknown.

2-2 Descriptive Statistics

Let Y denote M1/Income. Table 2 reports Y by household attributes and for different years. Since the shaded numbers in parentheses represent ratios of means in 2002 to means in 1996, they convey rates of increase in M1 demand from 1996 to 2002.

The main findings to emerge from Table 2 are as follows. First, the lower the income class, the higher the ratio of M1 to Income. For example, average M1/Income was 0.52 for the poorest income class in 1996, which is about 2.5 times higher than that of the two wealthiest income classes. This gap increased in 2002 because of the spectacular growth in M1 demand among the poorest households. Specifically, the average M1/Income of the poorest income class in 2002 was 0.52, which is 3.5 times its 1996 level, which implies a growth rate far exceeding those of wealthier households. This spectacular growth in M1 demand among poor households may be an important source of aggregate growth in household M1 demand. Furthermore, the tables also suggest that the proportion of low-income households increased substantially from 1996 to 2002. [12]This change could also be important in explaining aggregate growth in household M1 demand.

Second, the older the household head, the higher the ratio of M1 to Income. To be specific, in 1996, at 0.32, average M1/Income was much higher in households whose heads were in their seventies than in households whose heads were in their twenties (Y= 0.100) or thirties (Y = 0.145). Furthermore, although average M1/Income increased for all age groups from 1996 to 2002, the growth rate was particularly high in households with elderly heads (over 50). In addition to the relatively high growth of M1 demand within elderly households, the proportion of the elderly in the population also increased substantially from 1996 to 2002. Both of these changes may, in part, account for the aggregate growth in household M1 demand.

Third, Y varies by profession. In 1996, average M1/Income was relatively high in households whose heads were professional workers (Y = 0.305) or farmers or fishermen (Y = 0.326). The growth rate of M1/Income was particularly high for households headed by managers and professional workers.

Fourth, although average M1/Income depends on district and city size, these effects diminished between 1996 and 2002. In addition, average M1/Income is relatively high for owner-occupied households and those headed by the jobless. [13]

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12 Table 2 only shows the change in the absolute number in each income class. See Table 1 for a comparison of changes in the proportions in each income class. For example, the proportion in the lowest income class increased from 1.39% (in 1996) to 3.77% (in 2002).

13 Since there is no information in the data set to distinguish retirees from the unemployed, the jobless includes both.

Table 2 Comparison of M1/Income by Household Attributes

(1) By income class

	1996			2002		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
income1 (Under 1.5 million yen)	45	0.520	0.930	108	1.839 (3.5)	6.870
income2 (1.5 - 2.5 million yen)	183	0.306	0.608	260	0.590 (1.9)	2.372
income3 (2.5 - 3.5 million yen)	386	0.260	0.646	515	0.511 (2.0)	1.137
income4 (3.5 - 4.5 million yen)	535	0.196	0.457	459	0.463 (2.4)	0.928
income5 (4.5 - 6.0 million yen)	670	0.206	0.558	578	0.396 (1.9)	0.659
income6 (6.0 - 8.0 million yen)	731	0.177	0.366	485	0.334 (1.9)	0.609
income7 (8.0 - 10.0 million yen)	344	0.139	0.225	248	0.347 (2.5)	0.567
income8 (Over 10.0 million yen)	339	0.141	0.287	210	0.357 (2 5)	0.530

(2) By age

	1996			2002		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
age1 (20s)	104	0.100	0.154	87	0.144 (1.4)	0.253
age2 (30s)	469	0.145	0.313	381	0.244 (1.7)	0.380
age3 (40s)	855	0.146	0.298	527	0.235 (1.6)	0.408
age4 (50s)	816	0.204	0.468	734	0.458 (2.2)	2.006
age5 (60s)	723	0.266	0.640	681	0.738 (2.8)	2.383
age6 (70s or older)	266	0.320	0.699	453	0.689 (2.2)	1.678

(3) By profession

	1996			2002		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
prof1 (Farmer & fisher)	191	0.326	0.575	137	0.531 (1.6)	0.889
prof2 (Business proprietor)	594	0.186	0.432	401	0.439 (2.4)	1.464
prof3 (White-collar worker)	495	0.151	0.281	409	0.287 (1.9)	0.469
prof4 (Blue-collar worker)	648	0.153	0.396	473	0.339 (2.2)	0.681
prof5 (Manager)	472	0.165	0.301	335	0.496 (3.0)	2.791
prof6 (Professional worker)	119	0.305	0.709	102	0.928 (3.0)	2.771
prof7 (Other)	693	0.261	0.671	984	0 594 (2 3)	1.926

(4) By district

	1996			2002		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
district1 (Hokkaido)	168	0.126	0.228	150	0.353 (2.8)	0.787
district2 (Tohoku)	265	0.161	0.249	231	0.322 (2.0)	0.531
district3 (Kanto)	1011	0.208	0.506	838	0.592 (2.9)	2.200
district4 (Hokuriku)	155	0.278	0.465	116	0.404 (1.5)	0.713
district5 (Chubu)	409	0.279	0.697	427	0.521 (1.9)	1.027
district6 (Kinki)	498	0.188	0.453	410	0.463 (2.5)	1.445
district7 (Chugoku)	248	0.141	0.287	215	0.323 (2.3)	0.587
district8 (Shikoku)	109	0.141	0.194	102	0.390 (2.8)	0.687
district9 (Kyushu)	370	0.196	0.498	374	0.501 (2.6)	2.661

(5) By city size

	1996			2002		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
citysize1	690	0.177	0.537	576	0.471 (2.7)	0.957
citysize2	1061	0.191	0.397	1031	0.460 (2.4)	1.889
citysize3	357	0.177	0.363	310	0.634 (3.6)	1.896
citysize4	309	0.261	0.630	255	0.401 (1.5)	0.688
citysize5	75	0.345	0.927	56	0.361 (1.0)	0.626
citysize6	741	0.206	0.432	635	0.496 (2.4)	2.137

(6) By other attributes

	1996			2002		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Households with home ownership	2287	0.212	0.479	2181	0.538 (2.5)	1.916
other households	946	0.170	0.477	682	0.304 (1.8)	0.695
Households whose head is jobless	826	0.270	0.693	1054	0.587 (2.2)	1.875
other households	2407	0.176	0.375	1809	0.420 (2.4)	1.602

Notes: (1) Definitions of the citysize dummies are unknown.
(2) The shaded numbers in parentheses are ratios of 2002 means to 1996 means.

3. Decomposition Factors for the Rise in M1/Income

3-1 Estimation Results for the M1/Income Ratio Function

Before proceeding to a factor decomposition of the rise in M1 demand, we first need to estimate the M1/Income ratio function. The estimation results for the M1/Income ratio function for 1996 and 2002 are reported in the left half of Table 3 (Cases 1 and 2).

The following main findings emerge from Table 3. First, treating the wealthiest income class (comprising those earning 10 million yen or more) as a benchmark, households from lower income classes have significantly higher M1 demand. For example, the M1/Income ratios of the poorest and second poorest income classes are, respectively, 0.38 and 0.17 points higher than that of the wealthiest income class. Second, treating households with the youngest heads (in their twenties) as a benchmark, households with older heads have significantly higher M1/Income ratios, and the higher the age, the greater the difference. Note also that the age dummies have greater effects in 2002 than in 1996. However, variables such as profession, district, [14]city size, home ownership, [15]and the jobless dummy, are either sometimes significant or insignificant.

To test the robustness of these estimation results, the right half of Table 3 (Cases 3 and 4) reports the estimation results based on pooled data sets. The years 1996 and 1998 represent years of low M1 demand, [16]whereas M1 demand peaked in 2002 and 2003. Clearly, the estimation results from the pooled data are similar to those based on data from single years.

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14 The 1996 estimates for some district dummies are statistically significant, but none of the 2002 estimates are significant.

15 Although the 2002 estimated effect of the home ownership dummy (0.149) is significant and is substantially larger than the 1996 estimate, the comparison is meaningless because the 1996 estimate is not statistically significantly.

16 We chose to pool the 1996 and 1998 surveys because the 1995 and 1997 surveys lack information on cash holdings.

Table 3 Estimation Results of the M1/Income Ratio Function

	Case 1: 1996		Case 2: 2002		Case 3: 1996&1998		Case 4: 2002&2003	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
income1 (Under 1.5 million yen)	0.3804 ***	2.72	1.5648 **	2.19	0.4294 ***	2.66	1.4835 ***	3.74
income2 (1.5 - 2.5 million yen)	0.1705 ***	3.30	0.3185 *	1.74	0.0796 **	2.18	0.1615	1.50
income3 (2.5 - 3.5 million yen)	0.1433 ***	3.93	0.2667 ***	2.69	0.0835 ***	3.01	0.1639 **	2.33
income4 (3.5 - 4.5 million yen)	0.0976 ***	3.46	0.2539 ***	2.74	0.0359 *	1.87	0.1081	1.63
income5 (4.5 - 6.0 million yen)	0.0966 ***	3.63	0.1951 ***	2.75	0.0400 **	2.15	0.0447	0.81
income6 (6.0 - 8.0 million yen)	0.0570 ***	2.79	0.0903	1.58	0.0034	0.22	-0.0156	-0.32
income7 (8.0 - 10.0 million yen)	0.0137	0.69	0.0431	0.80	-0.0278 *	-1.79	-0.0273	-0.53
prof1 (Farmer & fisher)	0.0925 *	1.95	-0.0422	-0.38	0.0937 **	2.38	-0.0797	-0.95
prof2 (Business proprietor)	0.0041	0.19	-0.0170	-0.24	0.0215	1.11	-0.0666	-1.24
prof4 (Blue-collar worker)	-0.0266	-1.38	0.0076	0.18	0.0020	0.14	-0.0552	-1.38
prof5 (Manager)	0.0146	0.73	0.1862	1.15	0.0267 *	1.87	0.1365	1.48
prof6 (Professional worker)	0.1283 **	2.06	0.3263	1.19	0.0884 **	2.22	0.3234	1.51
prof7 (Other)	-0.0281	-0.40	0.1703	1.25	-0.0215	-0.38	-0.3300 *	-1.72
age2 (30s)	0.0615 **	2.45	0.1459 **	2.42	0.0342	1.62	0.1359 ***	2.86
age3 (40s)	0.0759 ***	2.88	0.1498 **	2.48	0.0335	1.47	0.1078 **	2.24
age4 (50s)	0.1306 ***	4.16	0.3458 ***	3.86	0.0677 ***	2.76	0.2944 ***	4.71
age5 (60s)	0.1349 ***	3.44	0.5801 ***	5.89	0.1385 ***	4.73	0.4889 ***	7.25
age6 (70s or older)	0.1533 ***	3.07	0.4923 ***	4.59	0.1721 ***	3.58	0.4576 ***	5.47
district1 (Hokkaido)	-0.0335	-1.08	-0.1171	-0.83	0.0052	0.18	-0.0524	-0.56
district2 (Tohoku)	-0.0428	-1.40	-0.1622	-1.23	-0.0094	-0.40	-0.1023	-1.09
district3 (Kanto)	0.0709 **	2.30	0.1789	1.26	0.0724 ***	3.07	0.1854 **	2.09
district4 (Hokuriku)	0.1014 **	2.16	-0.0533	-0.37	0.1012 ***	2.61	0.0329	0.33
district5 (Chubu)	0.1205 ***	2.79	0.0682	0.54	0.0761 ***	2.83	0.1387 *	1.66
district6 (Kinki)	0.0348	1.12	0.0199	0.17	0.0457 *	1.87	0.1807 *	1.91
district7 (Chugoku)	-0.0203	-0.65	-0.0571	-0.53	0.0139	0.57	0.0917	1.15
district8 (Shikoku)	-0.0603 *	-1.80	-0.0883	-0.63	-0.0182	-0.59	-0.0174	-0.18
citysize1	-0.0133	-0.47	0.0492	0.65	-0.0348 *	-1.79	0.0591	0.96
citysize2	-0.0071	-0.35	0.0338	0.38	-0.0034	-0.19	0.0418	0.72
citysize3	-0.0281	-1.12	0.1678	1.29	-0.0219	-1.07	0.0998	1.26
citysize4	0.0545	1.41	-0.0568	-0.69	0.0164	0.63	-0.0096	-0.15
citysize5	0.1572	1.46	-0.0604	-0.50	0.0399	0.65	-0.0702	-0.77
myhome dummy	0.0144	0.65	0.1490 **	2.49	0.0337 **	2.20	0.1250 ***	2.83
jobless dummy	0.0747	1.04	-0.1599	-1.21	0.0609	1.03	0.3555 *	1.91
constant	-0.0575	-1.27	-0.3188 **	-2.05	0.0282	0.80	-0.1862 *	-1.77
Number of obs		3233		2863		6300		5176
R-squared		0.048		0.048		0.042		0.063

Notes: (1) The dependent variable is M1/Income.
(2) The equations are estimated by OLS. The Huber-White Sandwich estimator is used to adjust the variances for heteroskedasticity in the residuals.
(3) The wealthiest households (earning 10 million yen or more) are treated as the benchmark for the income class dummies; households whose head is a white-collar worker are treated as the benchmark for the profession dummies; the youngest households (with heads in their twenties) are used as the benchmark for the age dummies.
(4) ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

3-2 The Blinder－Oaxaca Decomposition

In this paper, we use the Blinder－Oaxaca decomposition to explain the rise in M1/Income between 1996 and 2002. The Blinder－Oaxaca decomposition is a well in the context of analyzing income differentials by gender (Blinder, 1973, and Oaxaca, 1973). Analogously, we decompose the difference in M1/Income between 1996 and 2002 on the basis of the following equation:

$$\overline{Y}_{2002} - \overline{Y}_{1996} = (\overline{X}_{2002} - \overline{X}_{1996})\,\beta_{1996} + \overline{X}_{2002}(\beta_{2002} - \beta_{1996}) \qquad (1)$$

where $\overline{X}$ is a row vector of average values of the independent variables (factors), β s a vector of coefficient estimates of the M1/Income ratio function, and 1996 and 2002 are year subscripts. The first term on the right-hand side of equation (1) represents the component of the M1/Income rise that is due to group differences in the distributions of *X*, which we term the 'factor amount effect'. The second term represents the part that is due to differences in the group processes determining the levels of *Y*, which we term the 'factor price effect'.

An equally valid expression for the decomposition is:

$$\overline{Y}_{2002} - \overline{Y}_{1996} = (\overline{X}_{2002} - \overline{X}_{1996})\,\beta_{2002} + \overline{X}_{1996}(\beta_{2002} - \beta_{1996}) \qquad (2)$$

In this case, the coefficient estimates for 2002, β_{2002}, are used to weight the first term in the decomposition, and the 1996 distribution of the independent variables, $\overline{X}_{1996}$, is used to weight the second term.

Table 4 presents the decomposition results. Cases 1 and 2 of Table 4 show the percentage contribution of each factor to the total increase in M1/Income between 1996 and 2002 (0.384 to 0.584, or 0.2). First, 13.2% of the increase is due to the increase in the lowest income class proportion, or the widening of the income gap (Case 1). Rises due to the increased population share of the second and third lowest income classes are also high (3.9% and 5.9% respectively). Rises due to coefficient changes are prominent for low and middle income classes. For instance, 5.9% of the overall rise in M1 demand is due to the increase in the coefficient on the lowest income class dummy, which reflects the rapid growth of M1 demand among the poorest households.

Case 1 of Table 4 shows that 13.3% and 2.9% respectively of the total increase in M1/Income is due to the increased proportions of the most elderly households (headed by those over seventy) and of the second most elderly households. In other words, aging is a major determinant of the increase in the M1/Income ratio. Furthermore, the increase in the coefficients representing the effects of fifty-, sixty- and seventy-year-old household heads is responsible for 19.3%, 35.3% and 9.9% of the increase, respectively. In other words, a substantial amount of the rise in then M1/Income ratio is due to relatively high growth in M1 demand among the middle-aged and elderly households.

The contributions of district and city size to the overall rise in the M1/Income ratio seem minimal. Although the contribution of home ownership and joblessness is greater, it is risky to draw statistical inferences because the associated estimates are not statistically significant (see Table 3). However, the change in the constant term can be interpreted as a common shift for all factors because it is the sum of

all benchmarks for the dummy variables. [17]Case 1 of Table 4 shows that －92.7% of the overall rise is due to the common shift. Since its contribution is negative, this common shift reduced the M1/Income ratio.

However, using alternative weights in the calculation (as in Case 2 of Table 4) yields different decomposition results. For example, the contribution made by the increase in the share of the lowest income class is 3.2%, which is much lower than the 13.2% of Case 1. The contribution that is due to the increase in the coefficient on the lowest income class dummy variable is 15.9%, which is substantially larger than the 5.9% of Case 1. Similar differences apply to the contribution of eldest age dummy (representing seventy and over). The contributions made by the other two age dummies (fifties and sixties) are similar to before.

To test the robustness of the decomposition results, Case 3 of Table 4 uses the pooled estimates. The decomposition results based on the pooled data are similar to those of Case 1.

In summary, the main findings of this section are as follows.

(1) The proportions of elderly households and low-income households, which traditionally have relatively high M1 demand, have increased significantly since 1996. These changes in the population structure, which reflect aging and a widening of income gap, are responsible for around 10－30% of the rise in M1/Income between 1996 and 2002. [18]

(2) The M1 demand of middle-aged people (in their fifties and sixties) and that of the elderly (in their seventies) and the M1 demand of low-income households have increased significantly since 1996. This change is responsible for around 70－90% of the rise in M1/Income between 1996 and 2002. [19]

(3) －92.7% of the overall M1/Income rise is due to the constant term, which reflects common shifts among all households. Hence, not all households have responded to low interest rates by raising their M1/Income ratios.

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17 A typical example of a common shift is the lowering of the interest rate, because the interest rate is common for all households. However, it is surprising that lowering the interest rate has a negative effect on the M1/Income ratio.

18 The total 'factor amount effect' for the lowest income-class dummy, the age5 dummy (sixties) and the age6 dummy (seventies and over) is 29.4% in Case 1 and 8.0% in Case 2.

19 The total 'factor price effect' for the lowest income-class dummy, the age4 dummy (fifties), the age5 dummy the age6 dummy is 70.4% in Case 1 and 92.1% in Case 2.

Table 4　Factor Decomposition for the Rise of M1/Income Ratio

	Case1: 1996 vs 2002 (weight=β_{02},X_{96})		Case1: 1996 vs 2002 (weight=β_{96},X_{02})		Case1: 1996&1998 vs 2002&2003	
	Factor amount effect β_{02} *(X_{02}-X_{96})	Factor price effect (β_{02}-β_{96}) *X_{96}	Factor amount effect β_{96} *(X_{02}-X_{96})	Factor price effect (β_{02}-β_{96}) *X_{02}	Factor amount effect $\beta_{02\cdot03}$ *($X_{02\cdot03}$-$X_{96\cdot98}$)	Factor price effect ($\beta_{02\cdot03}$-$X_{96\cdot98}$) *$X_{96\cdot98}$
income1 (Under 1.5 million yen)	13.2	5.9	3.2	15.9	13.4	6.8
income2 (1.5 - 2.5 million yen)	3.9	3.0	2.1	4.8	2.7	1.6
income3 (2.5 - 3.5 million yen)	5.7	5.2	3.1	7.9	4.3	3.2
income4 (3.5 - 4.5 million yen)	-0.5	9.2	-0.2	8.9	0.4	4.1
income5 (4.5 - 6.0 million yen)	-0.4	7.2	-0.2	7.1	-0.1	0.3
income6 (6.0 - 8.0 million yen)	-1.8	2.7	-1.1	2.0	0.1	-1.3
income7 (8.0 - 10.0 million yen)	-0.3	1.1	-0.1	0.9	0.0	0.0
prof1 (Farmer & fisher)	0.2	-2.8	-0.4	-2.3	0.3	-3.4
prof2 (Business proprietor)	0.3	-1.4	-0.1	-1.0	0.6	-5.6
prof4 (Blue-collar worker)	-0.1	2.4	0.3	2.0	0.5	-4.2
prof5 (Manager)	-1.9	8.9	-0.1	7.1	-1.3	5.8
prof6 (Professional worker)	-0.1	2.6	-0.1	2.5	-0.3	3.0
prof7 (Other)	7.8	15.1	-1.3	24.2	-9.3	-25.4
age2 (30s)	-0.6	4.3	-0.3	4.0	-0.6	5.3
age3 (40s)	-4.3	6.9	-2.2	4.8	-2.9	6.9
age4 (50s)	0.5	19.3	0.2	19.6	0.3	21.0
age5 (60s)	2.9	35.3	0.7	37.6	2.5	28.4
age6 (70s or older)	13.3	9.9	4.1	19.0	12.5	8.6
district1 (Hokkaido)	0.0	-1.5	0.0	-1.6	0.1	-1.1
district2 (Tohoku)	0.1	-3.5	0.0	-3.4	0.1	-2.7
district3 (Kanto)	-1.3	12.0	-0.5	11.2	-1.1	12.9
district4 (Hokuriku)	0.1	-2.6	-0.3	-2.2	0.0	-1.1
district5 (Chubu)	0.5	-2.3	1.0	-2.8	0.7	3.0
district6 (Kinki)	-0.1	-0.8	-0.1	-0.8	0.7	7.0
district7 (Chugoku)	0.0	-1.0	0.0	-1.0	-0.1	2.1
district8 (Shikoku)	-0.1	-0.3	0.0	-0.4	0.0	0.0
citysize1	-0.2	4.7	0.1	4.5	-0.1	7.2
citysize2	0.4	4.8	-0.1	5.2	0.5	5.6
citysize3	-0.1	7.7	0.0	7.5	0.0	5.0
citysize4	0.1	-3.8	-0.1	-3.5	0.0	-0.8
citysize5	0.1	-1.8	-0.2	-1.5	0.1	-0.9
myhome dummy	2.9	33.8	0.3	36.4	1.5	23.7
jobless dummy	-6.4	-21.3	3.0	-30.6	9.2	27.9
constant	-92.7		-92.7		-77.4	

Note: Calculations based on the estimates from Table 3.

4. The Interest Elasticity of Household M1 Demand

As the analysis of Section 3-2 suggests, not all households responded to a lower interest rate by raising M1/Income ratio. This suggests that households have different interest elasticities. In particular, the interest elasticities of elderly households and low-income households, whose coefficient estimates increased substantially between 1996 and 2002, are thought to be high. To investigate this, we re-estimate the M1 demand function by adding the interest rate as an explanatory variable. The following standard log-log money demand function is estimated by using repeated cross-section data over the eight-year period from 1996 to 2003:

$$\ln(M_{i,t}) = \beta_0 + \beta_R \ln(R_t) + \beta_I \ln(I_{i,t}) + \sum_j \beta_{Xj} X_{i,t,j} + u_{i,t} \qquad (3)$$

The dependent variable is the logarithm of the CPI deflated quantity of M1, [20]and the independent variables include a vector of household attributes (X), the logarithm of the call rate (R) and the CPI deflated level of household income (I). Descriptive statistics for these variables are presented in Table 5. Since the dependent variable is only observed when it is positive, the tobit model is used for estimation.

Note that although M1 should include both bank deposits (ordinary accounts plus checking accounts) and cash, the latter is excluded because information on this is missing from the 1997 survey. [21]Figure 4 shows that cash held by households is essentially constant from 1996 to 2002, which suggests that the rise in M1 demand is primarily due to the increase in bank deposits. Hence, excluding cash from M1 in equation 3 should not cause a problem.

Table 6 reports the estimation results for equation (3). Case 2 includes interaction terms between the call rate and age and the call rate and the income class dummies (which are not included in Case 1). First, Case 1 shows that both the coefficients of the call rate and income are statistically significant. To be specific, the coefficient of income, which represents the income elasticity of M1 demand, is close to unity, as are the estimates of Fujiki (2002), Fujiki and Mulligan (1996) and Fujiki and Watanabe (2004). The coefficient of the call rate, which is the interest elasticity of M1 demand, is around －0.24, which is a little higher than the Miyao's (2002) estimate of －0.131 and Fujiki and Watanabe's (2004) estimate of －0.1. The difference is not surprising because our data set is more recent than that used by Miyao (2002) and Fujiki and Watanabe's (2004).

To determine whether low- and middle-income households (those with incomes below 1.5 million yen, those with incomes of between 3.5 and 4.5 million yen, [22]and those with incomes of between 4.5

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20 Households with no financial assets and households that only partially reported their financial assets are excluded from the estimation samples. Households who reported some financial assets but no bank deposits (M1) were retained for estimation. This is because, strictly speaking, even households that report no M1 holdings may not be absolutely penniless since the survey only enquires about the approximate amount. To estimate an equation for log(M1), the amount of M1 for households that reported no holdings of bank deposits is taken as unity for convenience.

21 We also estimated an M1 demand function after excluding the observations from 1997 and using the definition of M1 as the sum of cash and bank deposits. However, the results were similar to those in Table 6.

22 Income class 2 (1.5?2.5 million yen) is missing because its contribution to the overall rise in M1 demand is small (see Table 4).

and 6.0 million yen) and elderly households (headed by persons who are at least sixty) have higher interest elasticities, Case 2 interacts the call rate with the corresponding income class and age dummies.

The coefficients of the interaction terms are negative, as expected. In particular, the estimated effect of the interaction between the sixty-years-of-age dummy and the lowest income class is statistically significant. In other words, behind the relatively high factor price effects of low income and old age implied by the decomposition analysis, low-income and elderly households also have relatively high interest elasticities.

Table5　Descriptive Statistics

	obs	Mean	Std. Dev.
log (M1)	24317	2.8669	2.5290
log (income)	25100	6.1673	0.5764
log (call)	33944	-3.1188	2.3313
log4 (50s)*log (call)	33944	-0.8227	1.8174
age5 (60s)*log (call)	33944	-0.7194	1.7249
age5 (70s or older)*log (call)	33944	-0.4196	1.4162
income1 (Under 1.5 million yen)*log (call)	33944	-0.0882	0.6967
income4 (3.5 - 4.5 million yen)*log (call)	33944	-0.3808	1.3249
income5 (4.5 - 6.0 million yen)*log (call)	33944	-0.4294	1.3807
prof1 (Farmer & fisher)	33944	0.0484	0.2146
prof2 (Business proprietor)	33944	0.1754	0.3803
prof3 (White-collar worker)	33944	0.1455	0.3526
prof4 (Blue-collar worker)	33944	0.1857	0.3888
prof5 (Manager)	33944	0.1237	0.3292
prof6 (Professional worker)	33944	0.0345	0.1824
prof7 (Other)	33944	0.2792	0.4486
age1 (20s)	33944	0.0310	0.1734
age2 (30s)	33944	0.1380	0.3449
age3 (40s)	33944	0.2207	0.4147
age4 (50s)	33944	0.2641	0.4409
age5 (60s)	33944	0.2289	0.4201
age6 (70s or older)	33944	0.1173	0.3218
district1 (Hokkaido)	33944	0.0508	0.2196
district2 (Tohoku)	33944	0.0746	0.2627
district3 (Kanto)	33944	0.3020	0.4591
district4 (Hokuriku)	33944	0.0473	0.2124
district5 (Chubu)	33944	0.1402	0.3472
district6 (Kinki)	33944	0.1639	0.3702
district7 (Chugoku)	33944	0.0654	0.2473
district8 (Shikoku)	33944	0.0402	0.1965
district9 (Kyushu)	33944	0.1156	0.3197
citysize1	33944	0.2110	0.4080
citysize2	33944	0.3592	0.4798
citysize3	33944	0.1122	0.3157
citysize4	33944	0.0835	0.2766
citysize5	33944	0.0183	0.1339
citysize6	33944	0.2159	0.4114
myhome dummy	33944	0.7322	0.4428
jobless dummy	33944	0.3089	0.4620

Notes: (1) Statistics based on pooled data from 1996 to 2003.
(2) M1 includes bank deposits (ordinary accounts plus checking accounts) but excludes cash.

Table 6　Estimation Results of the M1 Demand Function (Tobit Model)

	case1			case2		
	Coeff.		t-value	Coeff.		t-value
log (income)	1.0100	***	17.96	1.0553	***	17.10
log (call)	-0.2421	***	-19.89	-0.2032	***	-9.55
log4 (50s)*log (call)				-0.0275		-0.89
age5 (60s)*log (call)				-0.0656	**	-2.06
age6 (70s or older)*log (call)				-0.0612		-1.56
income1 (Under 1.5 million yen)*log (call)				-0.0905	*	-1.87
income4 (3.5 - 4.5 million yen)*log (call)				-0.0022		-0.10
income5 (4.5 - 6.0 million yen)*log (call)				-0.0258		-1.35
prof1 (Farmer & fisher)	-0.1150		-0.74	-0.1060		-0.68
prof2 (Business proprietor)	0.0676		0.68	0.0621		0.63
prof4 (Blue-collar worker)	0.0209		0.22	0.0234		0.25
prof5 (Manager)	0.1748	*	1.70	0.1704	*	1.65
prof6 (Professional worker)	-0.1440		-0.82	-0.1481		-0.84
prof7 (Other)	-0.4228	**	-2.27	-0.4235	**	-2.27
age2 (30s)	-0.2584		-1.39	-0.2643		-1.42
age3 (40s)	-0.6363	***	-3.44	-0.6509	***	-3.52
age4 (50s)	-0.3477	*	-1.87	-0.4352	**	-2.11
age5 (60s)	-0.0765		-0.40	-0.2695		-1.28
age6 (70s or older)	-0.2776		-1.38	-0.4708	**	-1.96
district1 (Hokkaido)	0.1765		1.18	0.1716		1.15
district2 (Tohoku)	0.4102	***	3.14	0.4078	***	3.12
district3 (Kanto)	0.5629	***	5.58	0.5556	***	5.51
district4 (Hokuriku)	0.4617	***	3.05	0.4557	***	3.01
district5 (Chubu)	0.3430	***	3.04	0.3384	***	3.00
district6 (Kinki)	0.0724		0.64	0.0702		0.62
district7 (Chugoku)	0.3016	**	2.26	0.3013	**	2.25
district8 (Shikoku)	0.1394		0.83	0.1393		0.83
citysize1	-0.1362		-1.50	-0.1363		-1.50
citysize2	0.0641		0.82	0.0651		0.84
citysize3	-0.0278		-0.27	-0.0277		-0.27
citysize4	0.2258	**	2.01	0.2234	**	1.99
citysize5	0.2565		1.22	0.2519		1.20
myhome dummy	0.0042		0.06	-0.0008		-0.01
jobless dummy	0.5087	***	3.00	0.5139	***	3.03
constant	-5.0918	***	-13.09	-5.2724	***	-12.57
Number of obs			20504(7899)			20504(7899)
Pseudo R2			0.01			0.0101

Notes: (1) The dependent variable is log(M1); cash is excluded from M1.
(2) Data from 1996 to 2003 are pooled for estimation.
(3) ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

5. Concluding Remarks

To pull the Japanese economy out of its chronic slump, the Bank of Japan (BOJ) has pursued significant and aggressive anticyclical monetary policies since the late 1990s. Around the same time, money demand increased rapidly. Hence, concerns emerged about whether the rapid rise in M1 demand after 1996 signaled the existence of a liquidity trap, whether money supply measures remain effective instruments of economic policy, and why the BOJ's zero interest-rate policy did not cause inflation. Since the change in aggregate M1 demand was closely linked to the BOJ's monetary policies, it is assumed that the rise in M1 demand was due to the low interest rate. However, perhaps this is not the full story.

Most discussion of money demand is based on macrodata and aggregate statistics. Nevertheless, existing studies based on macrodata are inconclusive on, for example, whether there is a stable relationship between the interest rate and M1 demand and whether the liquidity trap explains Japan's rising M1 demand. Analysis based on micro(household-level) data may overcome these limitations by identifying shifts in the composition and behavior patterns of individual economic agents under different monetary conditions.

Hence, in this paper, we have used household analysis to investigate the potential determinants of the rise in M1 demand. Specifically, we estimated equations for the ratio of M1 to income by using data from 1996 and 2002, which are, respectively, trough and peak years for the overnight call rate. The estimates were used to decompose the M1/Income increase between 1996 and 2002 by using the Blinder－Oaxaca method. The decomposition analysis indicates the following. (1) The proportions of elderly households and low-income households, which have traditionally had relatively high demand for M1, have increased significantly since 1996. These changes in the population structure, which reflect aging and a widening of the income gap, are responsible for around 10－30% of the rise in household M1 demand. (2) Not all households responded to the low interest rate by raising their M1/Income ratios. The increases in M1 demand among households headed by persons aged fifty or over and those among low-income households are responsible for around 70－90% of the overall rise in M1 demand. In addition, a re-estimation of the M1 demand function suggests that (3) Older and lower-income households, whose ratios of M1 to Income rose substantially, also have relatively high interest elasticities of M1 demand.

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