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Did Public Transfers Crowd Out Private Transfers in Korea During the Financial Crisis?

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ABSTRACT *How effective are public transfers in protecting households facing financial crisis-induced negative shocks? Existing studies have not yet carefully considered the inter-relationship between public transfers and the existing private transfer network. In the context of the financial crisis in Korea, this paper investigates the possible crowding-out effect of public transfers on private transfers by explicitly considering the endogenous responses of private transfers against public transfers. By using two Korean household-level panel data sets for the periods of 1995–1998 and 1998–2003, we found a post-crisis, but not pre-crisis crowding-out effect of public transfers; more importantly, a crowding-in effect is observed during the crisis. The results suggest that private transfer networks were strengthened under the initial phase of the financial crisis, which possibly complemented public transfers due to the lack of effective formal safety nets, while public transfers became effective after the crisis, thereby replacing private transfers. Our results suggest that particularly at the initial stage of the crisis, the government could have played an important role in assisting households to weather the negative impacts of the crisis.*

I. Introduction

The Korean financial crisis that began in November 1997 caused unprecedented losses to the economy and hardships for the people. As a reaction to the crisis-induced negative shocks, Korean households were compelled to adopt drastic measures in order to protect their living standards. For example, Goh et al. (2005) found that households substantially reduced their expenditure on non-essential luxury items in order to protect the minimum standard of living. World Bank (2000), however, reported that the distributional impacts of the crisis were smaller than originally expected because Korean households were able to weather the crisis through effective coping policies such as dissavings, asset sales, and private transfers. Moreover, government responses through public transfers appear to have played an important role in protecting those households which faced the crisis.[1] On the other hand,

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a decrease in income during the financial crisis led to shrinkage of private transfers among households. Hence, an important task is to evaluate the effectiveness of public transfers as a risk-coping device in tandem with the pre-existing private transfer networks of inter- or intra-households. This study attempts to accomplish such a task by carefully investigating the inter-relationship between private and public transfers.

Specifically, we investigate endogenous responses of private transfer behaviours by examining whether public support programmes crowd out private transfers; as we acknowledge, this is empirically a very difficult task, so the results, whilst indicative, must be interpreted with caution. The answer depends on the motives of private transfer behaviour. Existing studies on the role of private transfers have identified two motives: altruism and self-interested exchange (Cox, 1987). The distinction between the two motives has an important policy implication because altruistic private transfers will be mitigated after the introduction of effective public transfer programmes, thereby weakening the net effectiveness of these programmes. On the other hand, in the case of exchange-motivated private transfers, public transfers will not necessarily undermine private donors desire to provide transfers because the donors expect a quid pro quo (Cox, 1987; Cox and Jimenez, 1990; Morduch, 1999; Cox and Fafchamps, 2007).

Recent empirical findings support exchange-motivated transfers (e.g., Cox, 1987; Cox and Rank, 1992; Altonji et al., 1997; Cox et al., 1998). However, existing studies on the extent and magnitude of the crowding-out effect of public transfers provide mixed evidence. Some studies find that public transfers have little effect on private transfers (see Rosenzweig and Wolpin, 1994; Cox and Jakubson, 1995), while other studies by Cox and Jimenez (1992, 1995), Cox et al. (1998), Jensen (2004), Kang and Lee (2003), and Kang and Sawada (2003) indicate a high possibility of a crowding-out effect.

Many of the aforementioned empirical studies on the determination of private transfers assume that public transfers are exogenously determined. Hence, they may suffer from a serious endogeneity bias. In reality, the unobserved factors of a recipient that affect the donor's decision on private transfers are likely to be correlated with the government criteria for providing public transfers. Under the rules of most means-tested public assistance programmes, public transfers are expected to be inversely related to the income including private transfers. To the best of our knowledge, Cox and Jakubson (1995) and Altonji et al. (1997) are the only studies that have investigated the endogeneity bias of transfers. Moreover, no paper in this field of study has investigated the effectiveness of private and public transfers during a large macro-shock.

This paper aims to fill this gap by examining the Korean financial crisis. We employ a bivariate probit model to explicitly consider the possible endogeneity of the decision on public transfer. We used two household-level panel data sets – the Korean Household Panel Survey (KHPS) and the Korean Labour and Income Panel Study (KLIPS) – which cover the periods 1993–1998 and 1998–2003, respectively. This study departs from the previous studies employing the KHPS data, such as Kang and Sawada (2003) and Kang and Lee (2003), by extending the data sets to the post-crisis period and using a more appropriate econometric methodology; Kang and Sawada (2003) and Kang and Lee (2003) focused on the omitted variable bias due to unobserved heterogeneity and on the decision on and amounts of private

transfers. The former followed the conditional logit estimation method with fixed effects, while the latter investigated the determinants of private transfer amounts by considering the fixed effects in the Tobit model. Thus, the possible endogeneity bias continues to be a problem that has not been investigated by these two studies explicitly. Furthermore, by extending data to the period after the crisis, we can examine the real impacts of the insurance policies that were initiated by the Korean government after the crisis.

Our empirical results show crowding-in effects for the entire period and contrast strongly with the estimation results that treat public transfer as an exogenous variable. First, our estimation results show that private and public transfers seemed to be jointly determined during and after the crisis. Moreover, a strong crowding-out relation between private and public transfers was observed only after the crisis, which is contrary to the estimation results based on the univariate probit model. These empirical findings indicate the existence of a serious endogeneity bias when estimating the transfer functions. These results also suggest that effective formal safety net programmes were not yet in place during the initial phase of the financial crisis and thus, private transfer networks were strengthened, complementing the lack of effective public schemes. On the other hand, newly introduced public support programmes became effective after the crisis, thereby replacing private transfers at a later stage.

The remainder of this paper is organised as follows: section II describes the responses of the Korean government and the data. After presenting descriptive evidence in section III, section IV discusses the empirical model specification. Section V presents the estimation results, and the final section concludes the paper.

II. Government Responses and the Data

At the onset of the financial crisis, the Korean government provided immediate policy measures to minimise the adverse impacts of the crisis. It introduced comprehensive unemployment packages, which included expansion of unemployment insurance, the Wage Claim Guarantee Fund, public works programmes, temporary livelihood protection programmes, and loan programmes for the unemployed and venture businesses.[2] After the government allocated a budget of approximately US$3.5 billion in 1998 (approximately 1.3% of the GDP) for social safety nets and unemployment-related expenditures, it further increased social security budget allocations by 34.3 per cent in 1999 (Ministry of Labor, 1999). The modes of assistance were diversified and included cash benefits, in-kind transfers, subsidised loans, financial aid for education, medical expense supports, food provision for school children, and livelihood protection and income support programmes. These programmes covered approximately 1.5 million people, who constituted about 3.3 per cent of the total population, and the coverage was increased by 5.3 per cent in 1999, with the inclusion of an additional 0.31 million people from the original government target.

Even during as late as 1999, nearly 2 million individuals were receiving social assistance benefits. However, this figure represents only about half the estimated number of people living in poverty that year. The evident weakness of the social assistance system that was in place – the Livelihood Aid Law (LAL) – prompted the Korean authorities to establish a new system known as the National Basic Living Security Law (NBLS), which became effective on 1 October 2000. Even though LAL

and NBLS differ slightly in terms of eligibility requirements, they have common targeting criteria such as whether an individual or a family has statutory supporters and the level of total income, including property income. The statutory supporters are defined as the recipient's spouse, parents and children.

For empirical analyses, we employed two household-level panel survey data: KHPS and KLIPS. Unfortunately, KHPS only covers the period until 1998, which includes the initial phase of the Korean financial crisis. The new data set, KLIPS, covers the period after the crisis from 1998–2003. These two data sets are nationally representative household-level panel data constructed through household- and individual-level multipurpose surveys.

After carefully examining these two data sets, we have decided to use four rounds of KHPS and five rounds of KLIPS, which include a reasonably consistent list of variables. We then implemented the estimations for the three periods separately, that is, before, during, and after the crisis; we employed the 1995–1997 rounds of KHPS for analysing the 'pre-crisis' period. The 1998 round of KHPS was considered to reflect the 'during the crisis' period since the survey period spanned from August 1997 to July 1998, while the 1999–2003 rounds of KLIPS were used for the 'after the crisis' period. We utilise two sets of balanced panel households from these two data sets: 1,978 households for KHPS and 3,158 households for KLIPS.[3]

The basic structures and contained information of two data sets are almost the same. The two data sets include slightly different variable definitions applied to different sets of households. A main difference is in the number of questions on income and consumption variables (the number of questions is greater in the KHPS than in the KLIPS). The income variable in the two data sets is defined as a sum of the same four main categories: labour, assets, transfer and other incomes. The difference in the income question between the two data sets is in the subcategories of each income variable. For example, the labour income of the KHPS is subcategorised into five questions (salaried workers, own business, agricultural and fisheries, temporary or part-time worker, side business), while that of the KLIPS has only one question. We believe this difference will not make a major difference in actual data, which is explained in more detail in the next section. Other variables used in the study are defined identically in each survey.

III. Descriptive Evidence and Crowding-out Effects

In order to investigate the relation between private and public transfers, the descriptive statistics on the changes of household characteristics and per capita household incomes are represented by the private transfer receipt status in Table 1. Several observations can be made. First, the households that had an older household head tended to receive more private transfers; the average age of household heads with positive private transfers was 58.5 years and that of household heads with no private transfers was 47.8 years in 1998. Second, female-headed households tended to receive more private transfers than male-headed households. In 1998, there were 7.3 per cent female-headed households among the non-recipients and 24.9 per cent female-headed households among the recipients of private transfers.

Third, rural households comprised a higher share of recipients of private transfers (about two-thirds) than of non-recipients (about half or less). Fourth, with regard to

Table 1. Descriptive statistics by private transfer receipt status

	1995		1997		1998		2001		2003	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Age of head	46.7	57.5	47.3	59.0	47.8	58.5	48.6	58.4	51.2	56.9
Household size	3.9	3.0	4.0	2.9	4.0	2.9	3.7	2.8	3.5	2.9
Region (%)										
Urban	46.1	36.5	47.4	34.0	49.4	34.0	55.8	46.7	54.8	49.9
Rural	53.9	63.5	52.6	66.0	50.6	66.0	44.2	53.3	45.2	50.1
Gender (%)										
Female	6.9	21.7	7.1	24.0	7.3	24.9	11.9	30.5	13.4	26.7
Male	93.1	78.3	92.9	76.0	92.7	75.1	88.1	69.5	86.6	73.3
Education (%)										
Primary or less	23.4	47.7	19.9	50.1	18.9	48.6	21.0	46.6	21.6	36.7
Secondary school	55.6	35.7	56.3	35.5	56.1	34.7	56.3	36.8	60.0	42.7
College and above	20.0	15.1	22.3	12.4	22.5	16.0	22.7	16.7	22.4	20.6
Occupation (%)										
Salaried	37.0	15.9	38.4	14.1	34.7	13.5	48.6	22.8	47.1	28.6
Self-employed	28.2	13.0	31.2	10.1	30.9	9.1	29.8	22.5	29.3	22.5
Farmers and fishers	24.6	31.4	19.0	37.3	20.3	34.0	–	–	–	–
Unemployed and unpaid	10.1	39.7	11.4	38.5	14.0	43.8	21.7	54.6	23.6	48.9
Total income	6,848	5,415	8,233	5,896	6,347	4,349	5,010	3,338	6,205	5,233
Pre-transfer income	6,780	4,329	8,157	4,684	6,265	3,314	4,976	2,214	6,166	3,899
Labour income	5,142	2,939	5,944	3,277	4,628	2,151	4,409	1,817	5,375	3,121
Asset income	1,218	987	1,592	949	890	694	965	103	99	66
Transfer income	66	1,069	65	1,210	81	1,067	34	1,124	39	1,334
Private transfers	0.0	1,015	0.0	1,145	0.0	973	0.0	1,055	0.0	1,262
Public transfers	66	54	65	65	81	94	34	69	39	72
Other income	473	404	641	567	765	483	470	294	692	712
Number of households	1,701	277	1,581	397	1,548	430	2,636	522	2,439	719
(%)	(86.0)	(14.0)	(79.9)	(20.1)	(78.3)	(21.7)	(83.5)	(16.5)	(77.2)	(22.8)

Note: Income values are in 1,000 Korean won per capita household at constant 1995 prices.

the education level, the households with less educated household heads tended to receive more private transfers. Interestingly, however, the share of highly educated household heads among the recipients of private transfer increased from 12.4 per cent in 1997 to 16.0 per cent during the crisis. It might be interpreted that the highly educated group has better access to the informal insurance network.

Fifth, with regard to occupation, households with unemployed or unpaid household heads constituted the highest share among the recipients of private transfers. This was reflected in the average per capita income of recipients of private transfers, which was consistently lower than that of the non-recipients. Accordingly, the after-transfer income gap between these two groups was clearly smaller than the gap in the pre-transfer income. This suggests that the transfer income contributed to the equalisation of income distribution.

Sixth, with the onset of the crisis, the pre-transfer income per capita of non-recipients and recipients decreased by 23.2 per cent and 29.3 per cent, respectively, between 1997 and 1998.[4] During the same period, the post-transfer income per capita decreased by 22.9 per cent and 26.2 per cent, respectively. Thus, transfer incomes played a role in protecting the living standards of the recipients. The two major income categories – labour and asset income – declined by 22.1 and 44.0 per cent, respectively, for non-recipients and by 34.4 and 26.9 per cent, respectively, for recipients.

Finally, before and during the crisis, there was an increasing trend in the proportion of households receiving private transfers, which increased from 20.1 per cent in 1997 to 21.7 per cent in 1998,[5] suggesting that private transfers served as an important risk-managing device over these periods. However, in 1998, private transfers decreased by 15.0 per cent while public transfers increased by 44.6 per cent. Hence, the shrinkage of private transfers suggests that the informal transfer network was negatively affected by the crisis, which was partially offset by an expansion of public transfers.

Table 2 presents the transition matrices of household per capita private and public transfers between adjacent years. In each row and column, '0' indicates that a household did not receive transfers, whereas '1' indicates that a household received transfers. For example, the first entry of 1,447 (0.88) implies that there were 1,447 households with no-private transfers both in 1996 and 1997, and that the sample probability of continuing in the no-private transfer status conditional on the status of non-transfer in 1996 was 0.88 (because there was a total of 1,632 households in the no-private transfer status in 1996, out of which the status of 185 households changed in 1997).

Table 2 indicates that the number of households that did not receive private or public transfers in year t but received them in year $t+1$ tended to increase. For example, 11.3 per cent (185 households) of the households that did not receive private transfers in 1996, received them in 1997. During the crisis, 13.0 per cent (206 households) of the households that did not receive private transfers in 1997, received them in 1998. Even after the crisis, 16.5 per cent (436 households) of the households that did not receive private transfers in 2002 began to receive them in 2003. Similarly, the number of households with positive public transfers that did not receive them in the previous year increased significantly during the crisis. For example, 6.1 per cent (112 households) of the households that did not receive public

Table 2. Transition matrices of private and public transfers

(a) Before the crisis

	Private transfers 1997				Public transfers 1997		
	0	1	Total		0	1	Total
1996				1996			
0	1,447 (0.88)	185 (0.11)	1,632 (1)	0	1,721 (0.93)	112 (0.06)	1,843 (1)
1	134 (0.39)	212 (0.61)	346 (1)	1	55 (0.38)	90 (0.62)	145 (1)
Total	1,581 (0.80)	397 (0.20)	1,978 (1)	Total	1,776 (0.90)	202 (0.10)	1,978 (1)

(b) During the crisis

	Private transfers 1998				Public transfers 1998		
	0	1	Total		0	1	Total
1997				1997			
0	1,375 (0.87)	206 (0.13)	1,581 (1)	0	1,599 (0.90)	177 (0.10)	1,776 (1)
1	173 (0.44)	224 (0.56)	397 (1)	1	49 (0.24)	153 (0.76)	202 (1)
Total	1,548 (0.78)	430 (0.22)	1,978 (1)	Total	1,648 (0.83)	330 (0.17)	1,978 (1)

(c) After the crisis

	Private transfers 2003				Public transfers 2003		
	0	1	Total		0	1	Total
2001				2001			
0	2,200 (0.83)	436 (0.17)	2,636 (1)	0	2,326 (0.88)	323 (0.12)	2,649 (1)
1	239 (0.46)	283 (0.54)	522 (1)	1	123 (0.24)	386 (0.76)	509 (1)
Total	2,439 (0.77)	719 (0.23)	3,158 (1)	Total	2,449 (0.78)	709 (0.22)	3,158 (1)

transfers in 1996 received them in 1997. However, the number of households that received public transfers in 1998 but had not received them in 1997 was 177 (10.0%). Furthermore, this number increased to 323 households (12%) between 2001–2003. These figures indicate that the coverage of private and public transfers has increased significantly.

Table 3 reports the descriptive statistics of income variables by the transition status shown in Table 2. For the pre-crisis period, it is shown that the average total and pre-transfer incomes increased by 2.0 and 1.5 per cent, respectively. In addition, the average public and private transfers increased by 1.2 and 19.2 per cent, respectively. During the financial crisis, the total and pre-transfer incomes decreased by 23.8 and 24.5 per cent, respectively. Public transfers increased by 29.2 per cent, while private transfers decreased by 8.3 per cent. After the crisis, the total and pre-transfer incomes increased by 13.2 and 12.5 per cent, per year respectively, between 2001–2003.

In Table 3, we define the cases (0,0) and (1,1) to represent the households that did not and did receive public transfers, respectively, in two adjacent years. The cases of

Table 3. Descriptive statistics by transition status of public transfers

		1996–1997				1997–1998			
	Average	(0,0)	(0,1)	(1,0)	(1,1)	(0,0)	(0,1)	(1,0)	(1,1)
1996									
Age	48.8	47.2	60.7	55.6	60.0				
Total income	7,604	7,971	4,066	4,779	6,748				
Pre-transfer income	7,344	7,808	3,507	3,972	5,375				
Public transfers	64	0	0	417	1,160				
Private transfers	193	163	548	389	213				
1997									
Age	49.6	48.0	62.5	56.5	60.8	47.2	57.4	55.3	63.8
Total income	7,757	8,093	5,421	5,865	5,494	8,225	6,243	6,916	4,989
Pre-transfer income	7,451	7,888	4,759	5,140	4,006	8,038	5,718	6,174	3,856
Public transfers	65	0	175	0	1,211	0	0	315	739
Private transfers	230	194	482	698	311	176	516	354	422
1998									
Age	50.2					47.9	58.1	55.7	63.0
Total income	5,915					6,351	3,739	5,022	4,200
Pre-transfer income	5,625					6,187	3,298	4,610	2,791
Public transfers	84					0	178	0	875
Private transfers	212					170	263	412	524

(0,1) and (1,0) represent the situations in which households transit from the non-recipient to the recipient status and from the recipient to the non-recipient status, respectively. Two important findings emerge from Table 3.

First, the group categorised by (1,1) represents the largest recipient group of public transfers, while the amount of total transfers was smaller for the 1997–1998 period than for the 1996–1997 period. Second, the two groups, (0,1) and (1,0), show the manner in which the private transfers responded to a change in public transfers. Between 1996–1997, the first group (0,1) received 175,000 and 482,000 won of public and private transfers, respectively. This shows that when public transfers increased by 175,000 won, private transfers decreased by 66,000 won. According to the case of the second group (1,0) for the years 1996 and 1997, when public transfers decreased by 417,000 won, private transfers responded to the decline by an increase from 389,000 to 698,000 won. Between 1997 and 1998, similar responses of private transfers against changes in public transfers were observed. This is suggestive of the possible substitutability between public and private transfers.

Table 4 presents the trends of age and income variables for the 2001–2003 period by public transfer status. For the groups (0,1) and (1,0), an increase (decrease) of public transfers led to a decrease (increase) of private transfers; the public transfers received by the (0,1) group increased from 0 in 2001 to 567,000 won in 2003, while the private transfers decreased from 419,000 to 124,000 won during the same period. Again, this is suggestive of the possible substitutability between public and private transfers. Finally, Tables 3 and 4 show that the recipients are older than non-recipients for all the periods.

IV. The Econometric Model

Following Cox (1987) and Cox et al. (1998), we postulate the latent equation for private transfers of household i at time t as follows:

$$PRT_{it} = \alpha_1 y_{it} + \alpha_2 PUT_{it} + X_{it}\beta + u_t + \varepsilon_{it}, \quad (1)$$

Table 4. Descriptive statistics by transition status of public transfers

		2001–2003			
	Average	(0,0)	(0,1)	(1,0)	(1,1)
2001					
Age	50.2	45.9	61.1	57.6	65.0
Total income	4,734	5,241	3,670	3,545	2,950
Pre-transfer income	4,520	5,155	3,251	2,953	2,254
Public transfers	40	0	0	401	265
Private transfers	174	86	419	191	431
2003					
Age	52.5	48.2	63.4	59.3	67.0
Total income	5,984	6,697	4,290	3,799	3,800
Pre-transfer income	5,650	6,486	3,599	3,655	2,966
Public transfers	46	0	567	0	558
Private transfers	287	211	124	144	276

where PRT and PUT are the latent variables of private and public transfers, respectively, which are observed only when they take positive values. The per capita pre-transfer income is represented by y. The matrix, X, includes various household characteristics that determine the amount of private transfer income. α_1, α_2 and β are the parameters to be estimated. The last term, ε, represents an error term. In order to control for unobserved effects of the aggregate shocks, we also include a year dummy, u_t.

Note that per capita pre-transfer income is included as an independent variable. The key to identify transfer motives is the sign on a coefficient for income in the decision versus amount equation (Cox, 1987; Cox and Rank, 1992). In order to differentiate our paper from Kang and Lee (2003) and Kang and Sawada (2008), we do not investigate the motive behind transfers. Rather, we focus on analysing whether public transfers crowd out private transfers or not. If the estimated coefficient on public transfers, α_2, is negative, this indicates the crowding-out effect of public transfers. If the estimated coefficient is positive, it is called a crowding-in effect of public transfers.

The amounts of private transfers are not necessarily comparable in our data sets because we employed two different data sets. Therefore, we treat the dependent variable of Equation (1) as a latent variable that can only be observed when positive. Accordingly, we estimate the binary transfer function by defining the following binary variable:

$$\begin{aligned} r_{it} &= 1 \quad \text{if } PRT_{it} > 0, \\ &= 0 \quad \text{otherwise} \end{aligned} \tag{2}$$

The standard approach postulated in Equation (1) assumes that public transfers are exogenous. However, public transfers may also be affected by various household characteristics because of the government's mean-tested targeting, such as providing more public transfers to its target – for example, the poor or vulnerable groups – as part of its social safety net programmes. This implies the endogeneity problem of public transfers. Another possible source of the endogeneity problem is that the receipt of public welfare benefits involves serious social stigma.[6]

Hence, there will be a pecking order of transfers. First of all, a household will seek private transfers, and only in the event of absolute helplessness will it depend on public transfers. This is likely to apply to the Korean case where welfare programmes are regarded as programmes for impoverished people. If public transfers are found to be systematically correlated with the unobserved stochastic term, ε_{it}, which also influences the receipts of private transfers, the estimated coefficients α_1 and α_2, which are produced through a simple binary dependent variable model, become inconsistent (Wooldridge, 2002: 477).

In order to mitigate the potential endogeneity problem of public transfers in estimating Equation (1), we postulate the following linear function of determining public transfers:

$$PUT_{it} = \alpha_3 y_{it} + X_{it}\gamma_1 + Z_{it}\gamma_2 + v_t + \eta_{it}, \tag{3}$$

where v_t indicates time specific effects and η_{it} is the stochastic error term. It should be noted that private transfers are not considered to be an independent variable in this

equation since the government is not well informed about the status of private transfers. However, we will allow a possible correlation between ε in Equation (1) and η in Equation (3).

As seen in Equation (1), the amount of public transfers in this case is not necessarily comparable because we employed two different data sets. To deal with this data problem, we estimate the binary transfer function by defining the following binary public transfer functions:

$$\begin{aligned} p_{it} &= 1 \quad \text{if } PUT_{it} > 0, \\ &= 0 \quad \text{otherwise.} \end{aligned} \tag{4}$$

Accordingly, we revise the latent equation for private transfers as follows:

$$PRT_{it} = \alpha_1 y_{it} + \alpha_3 p_{it} + X_{it}\beta + u_t + \varepsilon_{it}. \tag{5}$$

In Equations (3) and (5), we include a set of various household-level variables, X, as other control variables. First, we include education variables as proxies of permanent income. Second, we also consider age of the household head and its square. As seen in Cox et al. (1998), the timing of the transfers over the life cycle is important, particularly for households facing credit constraints. For example, if households are subject to binding credit constraints, the transfer receipts will be concentrated at an early age when current resources are low.

Third, we include a set of household demographic characteristics such as residential area, gender of household head, household size, and number of children and elderly persons. Each of these variables is supposed to determine the size and effectiveness of the private transfer network. Households with more elderly people and larger households, for example, are expected to be targets of private and public transfers since they have more members to support.

In order to achieve identification of the two decision Equations (3) and (5), the public transfer Equation (3) included additional identifying instrumental variables Z. With regard to these variables, we include a dummy variable for no statutory supporters, a dummy variable for the households belonging to the category of the NBLS law (after the crisis only due to data availability), no statutory support dummy variable interacted with the pre-transfer income, age and female-head dummies multiplied by the pre-transfer income, and female-head dummy multiplied by age. As explained in section II, whether a household has statutory supporters is an essential factor for attaining eligibility for social assistance benefits but not necessarily for private transfers. Hence, we believe that the statutory supporter variable is a reasonable identifying instrumental variable (but we acknowledge that it is imperfect; for example, it is always possible that non-statutory supporters provide lower private transfers if they believe a household has statutory supporters). Whether a household has statutory supporters is identified by the number of individuals between 20–55 years within the household. If there is no individual within this age range, the household is regarded as one without statutory supporters.

In general, statutory supporters can affect private transfers. Private transfers in this study are amounts given by relatives and friends, that is, inter-household

transfers. Private transfers among members of the same household are not recorded in the data used in this study. This implies that the private transfer data we are using is inter-household rather than intra-household transfers, so that the private transfers from statutory families who are living together, that is intra-household transfers, are not included. Transfers from statutory supporters might affect intra-household private transfers but the private 'inter-household' transfers we are using should not be affected (or, at least, we must assume they are not affected).

With respect to the estimation method, we employed the bivariate models composed of the first probit model for private transfers consisting of variables represented by Equations (5) and (2), and the second probit model for public transfers consisting of variables represented by Equations (3) and (4). We assume that ε_{it} and η_{it} follow the standard bivariate normal distribution. In order to estimate the parameters with $\text{cov}(\varepsilon_{it}, \eta_{it}) = \rho \neq 0$, a bivariate probit method is used (Greene, 2000: 849–856). The bivariate probit model will provide us with consistent estimates of α_1 and α_3 in Equation (5) even if there are unexplained parts remaining in error terms which are correlated with each other. Hence, we believe the remaining endogeneity problem does not necessarily generate serious bias. Accordingly, the determinants of the decisions on public and private transfers before and during the crisis, respectively, can be compared appropriately.

V. Estimation Results

The univariate probit estimation results of the private transfer equations are reported in Table 5, while the bivariate probit estimation results are reported in Tables 6, 7 and 8, which represent the before, during and after the crisis period, respectively. In Table 5, the coefficients for pre-transfer income were negative and significant for all periods with an increasing trend of magnitude over the periods.

The results suggest that poorer households tended to have a higher probability of receiving private transfers. For observing the effect of public transfers, we obtain positive coefficients for the dummy for public transfers in Table 5. These results imply a crowding-in effect, although the coefficient for the period during the crisis was not significant at the 5 per cent significance level.

By using the estimation results of the bivariate probit model, a null hypothesis of zero correlation of the error terms of the private and public transfer equations is tested. Although the hypothesis that this correlation is zero was not rejected for the observation made for the period before the crisis (Table 6), we rejected the null hypothesis for the 'during' and 'after' the crisis periods (Tables 7 and 8). This suggests that private and public transfers were jointly determined during and after, but not before the crisis. These results indicate that public transfers are endogenously determined.

As we discussed in section II, the Korean government before the crisis was not well equipped to cope with the sharp decrease in income of the households. Thus, there was no significant correlation between public and private transfers. Facing the crisis, the government provided immediate policy measures to minimise the adverse impacts. These policies have been continued even after the crisis. Since shocks generated by the financial crisis were non-negligible and devastating, people became aware of their seriousness. Accordingly, through expansion of government

Table 5. Univariate probit estimation of private transfers

	Before the crisis	During the crisis	After the crisis
Pre-transfer income/10^3	−0.149	−0.290	−0.342
	(3.74)**	(2.25)*	(5.88)**
Dummy = 1 if recipient	0.207	0.194	0.085
of public transfers	(2.66)**	(1.88)	(2.05)**
Dummy = 1 if employee	−0.762	−0.641	−0.381
	(9.86)**	(5.15)**	(9.85)**
Dummy = 1 if owns a business	−0.674	−0.749	−0.311
	(8.59)**	(5.74)**	(8.04)**
Dummy = 1 if involved in	−0.251	−0.17	
agriculture/fishery	(3.83)**	(1.64)	
Household size	−0.071	−0.158	−0.162
	(3.00)**	(3.86)**	(11.10)**
Number of children	−0.07	0.055	0.166
below 15 years	(2.11)*	(1.03)	(7.51)**
Number of elderly	0.204	0.185	0.214
persons above 60 years	(6.87)**	(3.76)**	(7.77)**
Age of head	−0.059	−0.048	−0.060
	(4.41)**	(2.03)*	(7.03)**
Age squared/10^3	0.607	0.513	0.617
	(4.74)**	(2.29)*	(7.62)**
Dummy = 1 if the head is a	−0.086	−0.052	−0.041
secondary school graduate	(1.38)	(0.49)	(1.05)
Dummy = 1 if the head is a	0.155	0.304	0.066
college graduate or above	−1.87	(2.16)*	(1.34)
Dummy = 1 if the head is a female	0.245	0.216	0.189
	(3.31)**	(1.80)	(4.50)**
Dummy = 1 if the head in urban	−0.045	−0.172	−0.075
	(0.96)	(2.26)*	(2.66)**
Dummy = 1 for year 1996	0.165		
	(2.99)**		
Dummy = 1 for year 1997	0.244		
	(4.43)**		
Dummy = 1 for year 2000			0.091
			(0.77)
Dummy = 1 for year 2001			0.113
			(2.53)*
Dummy = 1 for year 2002			0.460
			(10.02)**
Dummy = 1 for year 2003			0.368
			(7.82)**
Constant	0.967	1.136	0.92
	(2.74)**	(1.81)	(4.21)**
Number of observations	5,696	1,905	12,459

Notes: Absolute values of robust z statistics are in parentheses. *Significant at 5 per cent; **significant at 1 per cent. The occupation of households in the estimation of the period after the crisis does not identify the involvement of the head in agriculture/fishery/part-time.

support, people started considering the role of safety nets provided by the public sectors carefully when they decide the amount of aid for the suffering relatives and friends.

Table 6. Bivariate probit estimation: before the crisis

	Private transfers		Public transfers	
	Coef.	*z*-value	Coef.	*z*-value
Pre-transfer income/10^3	−0.156	(3.63)**	0.332	(1.27)
Dummy = 1 if a recipient of public transfers	−0.058	(0.15)		
Dummy = 1 if employee	−0.792	(8.15)**	−0.619	(5.20)**
Dummy = 1 if owns a business	−0.707	(7.19)**	−0.823	(6.11)**
Dummy = 1 if involved in agriculture/fishery	−0.272	(3.39)**	−0.335	(3.72)**
Household size	−0.065	(2.30)*	0.173	(4.48)**
Number of children below 15 years	−0.071	(1.92)	−0.087	(1.81)
Number of elderly persons above 60 years	0.209	(6.11)**	0.106	(2.39)*
Age of head	−0.062	(3.82)**	−0.017	(0.76)
Age squared/10^3	0.639	(4.04)**	0.328	(1.69)
Dummy = 1 if the head is a secondary school graduate	−0.076	(1.05)	0.163	(1.71)
Dummy = 1 if the head is a college graduate or above	0.17	(1.80)	0.257	(1.97)*
Dummy = 1 if the head is a female	0.261	(2.87)**	0.518	(3.79)**
Dummy = 1 if the head in urban	−0.055	(0.95)	−0.19	(2.59)**
Dummy = 1 for year 1996	0.167	(3.34)**	0.063	(1.13)
Dummy = 1 for year 1997	0.253	(4.69)**	0.217	(3.64)**
Dummy = 1 if no statutory supporters			0.151	(0.88)
No statutory supporter*income			0.138	(1.4)
Age*income			−0.009	(1.89)
Female*income			1.446	(1.7)
Age*female			−0.037	(2.12)*
Constant	1.03	(2.48)*	−1.892	(2.85)**
Number of observations	5,696			
Log-likelihood value	−3,392.04			
Disturbance correlation (Rho)	0.144			
Chi^2 (prob.)	0.530 (0.466)			

Notes: Absolute values of robust *z* statistics are in parentheses. *Significant at 5 per cent; **significant at 1 per cent. Chi^2 and prob. represent Wald test statistics and probability as. higher than Chi^2 for Rho = 0 hypothesis, respectively.

We then focus on the results of pre-transfer income and public transfers. Similar to the univariate probit estimation results, the coefficients for pre-transfer income were negative and significant for private transfers with an increasing magnitude. However, the crowding-out effect of public transfers on private transfers before the crisis disappears when we utilise the bivariate probit model. Interestingly, we found a significant crowding-in effect during the crisis and a significant crowding-out effect after the crisis. These results are in sharp contrast with those of the univariate probit estimation, suggesting the seriousness of the endogeneity bias. These results imply that altruistically linked private transfer networks were strengthened during the initial phase of the financial crisis possibly because the formal safety nets were not yet in place; public support became effective after the crisis, thereby replacing private transfers.

These results can be explained as follows. Due to expansion of government programmes, public transfers were increased during the initial phase of the crisis.

Table 7. Bivariate probit estimation: during the crisis

	Private transfers		Public transfers	
	Coef.	*z*-value	Coef.	*z*-value
Pre-transfer income/10^3	−0.247	(1.97)*	−0.112	(0.22)
Dummy = 1 if a recipient of public transfers	0.696	(2.75)**		
Dummy = 1 if employee	−0.587	(4.74)**	−0.467	(3.37)**
Dummy = 1 if owns a business	−0.705	(5.41)**	−0.241	(1.77)
Dummy = 1 if involved in agriculture/fishery	−0.158	(1.53)	−0.029	(0.27)
Household size	−0.17	(4.26)**	0.309	(6.35)**
Number of children below 15 years	0.064	(1.22)	−0.197	(3.65)**
Number of elderly persons above 60 years	0.16	(3.15)**	0.103	(1.95)
Age of head	−0.029	(1.11)	−0.123	(4.66)**
Age squared/10^3	0.301	(1.21)	1.274	(5.37)**
Dummy = 1 if the head is a secondary school graduate	−0.071	(0.68)	0.143	(1.23)
Dummy = 1 if the head is a college graduate or above	0.266	(1.88)	0.328	(2.07)*
Dummy = 1 if the head is a female	0.162	(1.3)	0.611	(3.64)**
Dummy = 1 if the head in urban	−0.123	(1.56)	−0.433	(5.03)**
Dummy = 1 if no statutory supporters			0.749	(3.80)**
No statutory supporter*income			−0.229	(0.78)
Age*income			−0.006	(0.63)
Female*income			−1.471	(1.22)
Age*female			0.014	(0.66)
Constant	0.653	(0.96)	0.747	(1.01)
Number of observations	1,905			
Log-likelihood value	−1,410.53			
Disturbance correlation (Rho)	0.292			
Chi^2 (prob.)	4.164 (0.041)			

Notes: Absolute values of robust *z* statistics are in parentheses. *Significant at 5 per cent; **significant at 1 per cent. Chi^2 and prob. represent Wald test statistics and probability to be higher than Chi^2 for Rho = 0 hypothesis, respectively.

However, effective formal safety net programmes were not sufficient during the initial phase of the financial crisis. Thus, private transfers possibly complemented public transfers. Newly introduced public support programmes became effective after the crisis, as social safety nets were well established, replacing private transfers gradually. Altruistically motivated donors who realised there were well-established safety nets might have reduced their transfers (the perceived need diminished).

The results of other variables are summarised as follows (Tables 6, 7 and 8). Households with more elderly persons tended to have a higher probability of receiving private transfers over all the periods, indicating the role of private transfers as informal old-age insurance. Controlling for the number of children and elderly persons, the tendency for larger households to have a lower probability of receiving private transfers suggests the importance of intra-household risk-sharing.

Table 8. Bivariate probit estimation: after the crisis

	Private transfers		Public transfers	
	Coef.	*z*-value	Coef.	*z*-value
Pre transfer income/10^3	−0.369	(5.79)**	−0.835	(3.07)**
Dummy = 1 if public transfers recipient	−0.375	(2.47)*		
Dummy = 1 if employee	−0.381	(8.49)**	−0.015	(0.24)
Dummy = 1 if own business	−0.304	(6.46)**	0.095	(1.60)
Household size	−0.15	(8.04)**	0.155	(5.35)**
Number of children below 15	0.16	(6.29)**	−0.127	(3.27)**
Number of elderly above 60	0.311	(6.40)**	0.95	(21.80)**
Age of the head	−0.074	(6.57)**	−0.119	(8.52)**
Age squared/10^3	0.757	(6.98)**	1.105	(8.46)**
Dummy = 1 if the head is a secondary school graduate	−0.056	(1.13)	−0.112	(1.90)
Dummy = 1 if the head is a college graduate or above	0.043	(0.69)	−0.18	(2.15)*
Dummy = 1 if the head is female	0.245	(4.51)**	−0.342	(0.98)
Dummy = 1 if the head in urban	−0.092	(2.64)**	−0.183	(3.91)**
Dummy = 1 if belong to NBLSP			2.65	(13.49)**
Dummy = 1 if no statutory supporters			0.048	(0.50)
No statutory supporter*income			0.201	(1.63)
Age*income			0.011	(2.17)*
Female*income			−0.39	(2.05)*
Age*female			0.017	(3.09)**
Dummy = 1 if year 2000	0.112	(0.98)	0.202	(1.48)
Dummy = 1 if year 2001	0.136	(3.27)**	0.083	(1.71)
Dummy = 1 if year 2002	0.475	(10.46)**	0.052	(0.96)
Dummy = 1 if year 2003	0.419	(8.66)**	0.436	(7.79)**
Constant	1.222	(4.41)**	0.653	(1.81)
Number of observation	12,459			
Log likelihood value	−8,545.41			
Disturbance correlation (Rho)	0.297			
Chi^2 (prob.)	9.084 (0.003)			

Notes: Absolute values of robust *z* statistics are in parentheses. *Significant at 5 per cent; **significant at 1 per cent. Chi^2 and prob. represent Wald test statistics and probability to be higher than Chi^2 for Rho = 0 hypothesis, respectively.

Education variables, on the other hand, did not show significant effects on the probability of receiving private transfers. Furthermore, the results for other characteristics of household heads, gender and residential area, support the findings of existing studies (Cox and Jimenez, 1992, 1995; Cox et al., 1998) and the results of the studies on Korean households obtained by using a traditional estimation method, i.e. fixed effect logit model, with KHPS (Kang and Sawada, 2003). Female-headed and rural households had a higher probability of receiving more private transfers, although the coefficients were not significant for female-headed households in the period during the crisis or for the urban households in the period before the crisis.

In order to investigate the robustness of the instruments, we considered two types of validity check: first, the nature of IVs we employed and second, the econometric

Table 9. Robustness test results

	Conditional logit		
	Before	During	After
Dummy = 1 if recipient of public transfers	0.538 (2.44)**	0.274 (1.61)	−0.068 (0.62)
	First difference estimation		
	Before and during		After
Dummy = 1 if recipient of public transfers	0.061 (3.30)**		−0.016 (1.24)

Note: The estimation for 'During' is a simple logit estimation result due to one year data.

investigation of their validity. To use the panel nature of the data, we tried conditional logit, that is, logit with household-fixed effects, and first difference estimation. This could control for household-level unobserved time-invariant variables, mitigating endogeneity bias arising from unobserved household characteristics.

The estimation results of conditional logit estimation with household-fixed effect are consistent with the univariate estimation results. The coefficient for the dummy of public transfers was positive and significant for the period before the crisis, while it was negative but insignificant for the period after the crisis. In addition, the first difference estimation results for 'before' and 'after' periods are consistent with univariate estimation results (the 'during' case is not estimated as it is only one year). Any remaining endogeneity problem arising from unobserved household characteristics does not lead to different results for the three estimation methods we employ, that is, IV, logit with fixed effects and the first difference estimation, so we may conclude that the remaining endogeneity bias is not serious and the IVs we employ are valid. The robustness test results are summarised in Table 9 (only the coefficients for public transfer dummy are reported).

VI. Conclusion

Using two household panel data sets from Korea for 1995–2003, this paper investigates the inter-relationship between private and public transfers. The estimation of the bivariate probit model of private and public transfer functions yields several important findings (subject to the caveat that the instruments are imperfect, although they are supported by reasonable statistical tests).

First, we find that the provisions of the two types of transfers, private and public, were jointly determined during and after the crisis. Second, the univariate probit estimation results showed a *crowding-in* relation between private and public transfers. However, a *crowding-out* relation between these transfers was observed after taking into account the endogeneity of public transfers before and after the crisis, even though the coefficient was not significant before the crisis. These empirical results suggest that the conventional econometric specification of private

transfers by using a univariate probit model may suffer from a serious endogeneity bias. Finally, the crowding-out relation that was observed before the crisis, disappeared during the crisis and was replaced by crowding-in effects of government transfers during the crisis.

These estimation results suggest that effective formal safety net programmes were not yet in place during the initial phase of the financial crisis. However, newly introduced public support programmes became effective after the crisis, thereby replacing private transfers gradually. Therefore, particularly at the initial stage of the financial crisis, the government could have played an important role assisting households to weather the negative impacts of the crisis. Further investigation on the effectiveness of public transfer as a coping device will be more beneficial in designing social safety nets for any future financial crisis.

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Notes

1. These public transfers included an expansion of the unemployment insurance system, subsidised loan programmes to the unemployed and venture businesses, public work programmes, and temporary livelihood protection and income support programmes.
2. Overall, the social security systems in Korea can be categorised into three parts: social insurance programmes, public assistance, and social welfare services. Social insurance programmes include public pension, health insurance, industrial accident compensation insurance and employment insurance. The Public Assistance Scheme is designed to provide a minimum standard of livelihood for those who cannot maintain their livelihood by themselves owing to physical disability, disease, old age or other reasons. The Public Assistance Scheme includes the National Basic Living Security Law, Medical Aid, Disaster Relief, and Aid for the Disabled Veterans, and so forth. Finally, social welfare services provide those in need of social protection with admissions to special welfare institutions, free meals, occupational training, employment service and counselling. Social welfare services have been provided largely for the socially vulnerable such as the disabled, the elderly, children and women.
3. The KHPS has a high attrition rate with the 1,978 balanced sample for the 1994–1998 period, starting from the sample size 2,985 in the year 1994 without replacement. The KLIPS, however, show a low attrition rate with the 3,158 balanced households for 1999–2003 starting from 4,509 households in 1999 with replacement. If replacement is ignored, the sample size in 2003 was 3,705. The estimation with full sample does not affect estimation results with balanced sample.
4. Transfer income in the KHPS is defined as a sum of public transfers (national pension, private/civil servant/military pension, veteran's pension, employment insurance) and private transfers (support from relatives and friends). Transfer income in the KLIPS is a sum of public transfers (government and social association) and private transfers (support from relatives and friends).
5. Using the KLIPS data from 2001, the share of households with private transfers is shown to have increased from 16.5 to 22.8 per cent in 2001 and 2003, respectively.
6. We tested the possible endogeneity of public transfers through instrumental variable estimation with the same set of instrumental variables used in this study. As a standard endogeneity test, the Durbin-Wu-Hausman (DWH) test statistics for all models for all periods, that is, 'before, during and

after the crisis,' reject the null hypothesis that the decision of public transfer is exogenous. Thus, it is concluded that endogenous regressor's effects on the estimates are meaningful. The estimation results are available on request.

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