Parental Human Capital Investment and Old-Age Transfers from Children: Is it a loan contract or reciprocity for Indonesian families?*

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Abstract

The paper provides two alternative models of intergenerational transfers linking parental investment in human capital of children to old-age support they receive from their children. The first model views these transfers as a pure loan contract and the second model as reciprocity. Both models predict that transferring a marginal unit of income from children to parents is fully off-set by exactly one unit reduction in old-age support. This is also known as the ”difference in income transfer derivatives property”. These two models, however, yield different testable predictions about the effects of certain economic variables and differ in the effect of intergenerational redistributive policies. The paper uses the Indonesian Family Life Survey data to test these two mechanisms of transfers, and estimate the difference in income transfer derivatives for upstream transfers in Indonesia. The estimates of income transfer derivatives are found to be much higher than what Altonji, Hayashi and Kotlikoff [1997] found for downstream transfers for the US using PSID data.

JEL Classification: J24, O15, I22, D64

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- In LDCs without social security programs, parents invest in children's education, when children are adult, they transfer resources to their old parents (two-way inter-generational transfers). In developed countries, generally resources flow from parents to children.

- To examine the mechanism linking above pattern of intergenerational transfers for a less developed country.

- Two hypotheses regarding the mechanism for two-way transfers:

  (A) An implicit loan contract: parents lending to liquidity constrained children for investment in schooling, and children pay back in the next period. Becker's Rotten Kid Theorem

  (B) Reciprocity in gifts between parents and children: Parents care about children and invest in their human capital; children care about parents and transfer resources to their parents if parents are not financially well-off.

Literature

- Theory:

  Bequest motive or parental altruism- Becker (1974), Becker-Murphy-Tamura (1990).

  Parents have preferences over children's income inequality: Behrman, Pollak and Taubman (1982)

Old-age security motive: Raut (1990)

- Empirical:

  McGarry and Schoeni (1995), Altonji et al (1992, 1997*), Hayashi (1995), Cox and Ranks (1992), Cox (1987, 1990), Lillard and Willis (1996*).

1 Basic Model

Two simplified models of parental investment in their children's education and old-age transfers that they may receive later from their adult children. Overlapping generations.

Utility function of parent: $u(c_{p1}) + \beta U\left(c_{p2}, v_p\left(c_{k2}\right)\right)$

Utility function of child : $V\left(c_{k2}, u_k\left(c_{p2}\right)\right)$

Parental educational expenditures and old-age transfers as pure loan

Principal-$>$ Parent, Agent-$>$ the child is the agent. The parent decides s, T_1 and T_2:

$$\max_{T_1, T_2 \geq 0, s} u(c_{p1}) + \beta U\left(c_{p2}, v_p\left(c_{k2}\right)\right)$$

subject to

$$\begin{aligned} c_{p1} + nT_1 + s &= E_{p1} \\ c_{p2} &= (1+r)s + nT_2 + E_{p2} \end{aligned} \tag{1}$$

$$\text{A child's budget constraint is:} \quad c_{k2} = E_{k2}(T_1, \tau) - T_2 \tag{2}$$

and the following participation constraint of her son:

$$V\left(E_{k2}(T_1, \tau) - T_2, u_k\left(c_{p2}\right)\right) \geq V\left(E_{k2}(0, \tau), u_k\left(c^o_{p2}\right)\right) \tag{3}$$

where c^o_{p2} : optimal consumption of parent if she did not transfer any amount of educational loan to her child.

Optimal solution:

$$\text{w.r.t. } s: \quad \frac{u'(c_{p1})}{\partial U/\partial c_{p2}} = \beta(1+r) \tag{4}$$

$$\text{w.r.t. } T_1 > 0: \quad \frac{u'(c_{p1})}{v_p'(c_{k2})} = \frac{\beta}{n} \cdot \frac{\partial U}{\partial v_p} \cdot \frac{\partial E_{k2}}{\partial T_1} \tag{5}$$

$$\text{w.r.t. } T_2: \quad \frac{\partial U/\partial c_{p2}}{v_p'(c_{k2})} \leq \frac{1}{n} \cdot \frac{\partial U}{\partial v_p}, \ = \text{ holds when } T_2 > 0 \tag{6}$$

$$\frac{\partial E_{k2}(T_1, \tau)}{\partial T_1} = 1 + r \tag{7}$$

to derive optimal T_2:

$$\begin{array}{lll} U(c_{p2}, v_p(c_{k2})) = u(c_{p2}) + \gamma_p v^p(c_{k2}) & \ldots & \text{(U1)} \\ v^p(c_{k2}) = u(c_{k2}) & \ldots & \text{(U2)} \\ u(c) = \alpha \ln c. & \ldots & \text{(U6)} \end{array} \tag{8}$$

We further assume that $\alpha + \alpha\beta + \alpha\beta\gamma^p = 1$, and $0 < \alpha, \beta$, and $\gamma_p \geq 0$.

Under the separability assumption (U1), however, equation (4) can be rewritten as:

$$\frac{u'(c_{p2} \equiv (1+r)s + E_{p2} + nT_2)}{v_p'(c_{k2} \equiv E_{k2} - T_2)} = \frac{\gamma_p}{n} \tag{9}$$

Difference in transfer income derivatives property: for all parent-child pair with $T_2 > 0$:

$$\frac{\partial T_2}{\partial E_{k2}} - n\frac{\partial T_2}{\partial \tilde{E}_{p2}} = 1 \tag{10}$$

We have the following explicit solution for T_2:

$$T_2 = \left[\frac{1}{1+\alpha\beta\gamma^p}\right] E_{k2}(.) + \left[\frac{(1+r)\alpha\beta\gamma^p}{1+\alpha\beta\gamma^p}\right] T_1 - \left[\frac{(1+r)\alpha\beta\gamma^p}{[1+\alpha\beta\gamma^p] \cdot n}\right] \cdot \left[E_{p1} + \frac{E_{p2}}{1+r}\right] \tag{11}$$

Reciprocity as transfer mechanism: Nash Equilibrium

The mother takes her son's transfer decision $T_2 \geq 0$ as given and solves the following

$$\max_{T_1 \geq 0, s} u(c_{p1}) + \beta U\left(c_{p2}, v^p\left(c_{k2}\right)\right)$$

subject to

$$\max_{T_2 \geq 0} V\left(c_{k2}, U^k\left(c_{p2}\right)\right)$$

Not possible anymore to derive solution without further assumptions:

ASSUMPTION:

$$\begin{array}{llll} U\left(c_{p2}, v^p\left(c_{k2}\right)\right) = u\left(c_{p2}\right) + \gamma_p v^p\left(c_{k2}\right) & \ldots & \text{(U1)} \\ V\left(c_{k2}, u_k\left(c_{p2}\right)\right) = v\left(c_{k2}\right) + \gamma_k u_k\left(c_{p2}\right) & \ldots & \text{(U2)} \\ u_k\left(c_{p2}\right) = u\left(c_{p2}\right) & \ldots & \text{(B3)} \\ v^p\left(c_{k2}\right) = v\left(c_{k2}\right) & \ldots & \text{(B4)} \end{array} \tag{12}$$

$$E'_{k2}\left(T_1, \tau\right) = \frac{1+r}{\gamma_k \gamma_p} \tag{13}$$

$$\frac{u'_k\left(c_{p2} \equiv (1+r)s + E_{p2} + nT_2\right)}{v'\left(c_{k2} \equiv E_{k2} - T_2\right)} = \frac{1}{n \cdot \gamma_k} \tag{14}$$

Optimal solution:

$$T_2 = \left[\frac{\gamma_k}{\gamma_k + \alpha\beta}\right] E_{k2}\left(.\right) + \left[\frac{(1+r)\alpha\beta}{\gamma_k + \alpha\beta}\right] T_1 - \left[\frac{(1+r)\alpha\beta}{\left[\gamma_k + \alpha\beta\right] \cdot n}\right] \cdot \left[E_{p1} + \frac{E_{p2}}{1+r}\right] \tag{15}$$

Policy Implications: Income redistribution within family, publicly provided social security transfer program : Are they neutral? Depends ...

In pure-loan contract: parent is always satisfied with the transfers T_2.

In Reciprocity, either parent satisfied with T_2, i.e. (a), or unsatisfied i.e. (b)

$$\text{(a) } \frac{\partial U\left(c_{p2}, v_p\left(c_{k2}\right)\right)}{\partial T_2} \leq 0; \text{ (b) } \frac{\partial U\left(c_{p2}, v_p\left(c_{k2}\right)\right)}{\partial T_2} > 0 \tag{16}$$

Data: each parent-child pair is an obs. $(T_1, \delta T_2, X, \delta)$, $\delta = 1$ if $T_2 > 0$, otherwise $\delta = 0$

Econometric Implementation: Null hypothesis: pure loan model

Schooling investment:

$$\ln T_1 = \beta_0 + \beta_1 Z + \mu \cdot n + \epsilon_1 \tag{17}$$

Excess sensitivity to Z, and n.

Old-age transfers equation: Econometrics depends on the form the function $T_2^* (X, \theta)$ and the interpretation of ϵ_2 in econometric specification of the optimal solution for T_2 : For Cobb-Douglas or CME: $\theta = (\beta, \epsilon_2)$, unobserved heterogeneity

$$T_2^* (X, \theta) = X\beta' + \epsilon_2 \tag{18}$$

standard Tobit model: ϵ_2 all individuals have identical taste , ϵ_2 is measurement error and utility approximation error, and $E(\epsilon_2 | X) = 0$.

Random coefficient Tobit model: $\beta = \bar{\beta}$, $\epsilon_2 = X \cdot (\beta - \bar{\beta})$, $\epsilon_2 \sim (0, \sigma(X))$,

Additively non-separable ϵ_2 : Flexible functional form: full population characterized by $\theta \sim f(\theta)$, population density.

Denote the population with characteristics X self-selected for $T_2 > 0$, as
$\theta^* (X) = \{\theta | T_2^* (X, \theta) > 0\}$,
size of population in $\theta^* (X) = \pi(X)$
distribution of self-selected population is $f_X(\theta) = f(\theta) / \pi(X)$
Regression equation for the self-selected population is:

$$\bar{T}_2 (X) \equiv E(T_2^* (X, \theta) | X, T_2^* > 0) = \int_{\theta^*(X)} T_2^* (X, \theta) f_X(\theta) d\theta. \tag{19}$$

A random sample from the self-selected population has regression representation:

$$T_2^* (X) = \bar{T}_2 (X) + \xi, \text{ where } \xi \text{ is a random variable with } E(\xi|X) = 0$$

Want to estimate the population average of marginal effect, $E\left[\left.\frac{\partial T_2^*(X)}{\partial X_i}\right| X, T_2^* > 0\right]$ Which can be decomposed into direct and indirect effect as follows:

$$E\left[\left.\frac{\partial T_2^* (X)}{\partial X_i}\right| X, T_2 > 0\right] = \frac{\partial \bar{T}_2 (X)}{\partial X_i} + \frac{\partial \pi (X)}{\partial X_i} \cdot \frac{\bar{T}_2 (X)}{\pi (X)}$$

Altonji, Hayashi and Kotlikoff : took $\pi(X) \equiv \Phi(g(X))$, assumed third order polynomials for $\bar{T}_2 (X)$, and $g(X)$. We took second order polynomials.

Table 1: Descriptive Statistics of Income and Assets

Variable	Label	N	Mean
HHEMPINC	total hh incomes from employment	7220	8100146.85
HHFASV	household total farm asset values	7180	2324845.89
HHNFASV	household total non farm asset values	7180	1167245.10
OWN_BUSS	Owns a non farm business	7220	0.27
OWN_FARM	Owns a farm	7220	0.381
OWN_HSE	Owns a house	7220	0.098
TFINC	household total farm income (operating+rental	7180	129139.89
TNFINC	total non farm incomes (operating+rental	7180	174072.70
TOT_INC	Total household incomes	7180	8447674.46

Table 2: Descriptive Statistics of variables

Variable	Description	N	Mean	Std Dev
AGE	Age of person	33032	26.273	19.435
FEMALE	Female gender or not	33106	0.513	0.500
GRADE	Number of schooling years	32888	4.687	4.447
INC_EQ	Average adult hh member earnings	21456	2826948.300	28023034.310
PAGE	Parent's age	19993	61.864	14.164
PGEN_DUM	Parent's gender dummy	27391	0.474	0.499
PGRADE	Parent's educational level	18852	2.248	3.823
TF2P	Money transfer to parent	3221	241339.030	2110593.400
MTFRP	Money transfer from parents	1197	196519.630	1249310.580
POWN_BU	Parent's business ownership (Yes or no)	10346	0.177	0.382
POWN_HS	Parent's house ownership (Yes or no)	10390	0.893	0.309
POWN_FR	Parent's farm ownership (Yes or no)	10348	0.554	0.497
PWORKN	Parent's working status (Yes or no)	27391	0.193	0.394

Table 3: Descriptive Statistics of variables

Variable	Description	N	Mean	Std Dev
PAGE	Parent's age	19993	61.8646526	14.1645452
PGEN_DUM	Parent's gender dummy	27391	0.4740608	0.4993358
PGRADE	Parent's educational level	18852	2.2486739	3.8230878
TF2P	Money transfer to parent	3221	241339.03	2110593.40
MTFRP	Money transfer from parents	1197	196519.63	1249310.58
POWN_BU	Parent's business ownership (Yes or no)	10346	0.1773632	0.3819943
POWN_HS	Parent's house ownership (Yes or no)	10390	0.8932628	0.3087938
POWN_FR	Parent's farm ownership (Yes or no)	10348	0.5541167	0.4970868
PWORKN	Parent's working status (Yes or no)	27391	0.1928371	0.3945334

1.1 Earnings functions and returns to education

Table 4: Estimated earnings function

Regressors	**(a)**	**(b)**
INTERCEP	11.4455 (196.854)	11.5626 (182.105)
FEMALE	0.0945 (5.014)	0.0877 (4.641)
OWN_HSE	0.3758 (12.231)	0.3721 (12.114)
OWN_FARM	−0.4064 (−20.645)	−0.4035 (−20.500)
OWN_BUSS	0.3417 (16.187)	0.3462 (16.393)
GRADE	0.0938 (40.068)	0.0658 (10.052)
GRADE2	()	0.0018 (4.578)
AGE	0.0481 (17.549)	0.0459 (16.529)
AGE2	−0.0005 (−15.959)	−0.0005 (−15.520)
R^2	0.1467	0.1476
Number of obs.	21,165	21,165

Note: t-statistics are in parentheses.

1.2 Parental Investment in children's education (T_1)

$$\text{CGRADE} = \underset{(0.96)}{-0.610} \underset{(28.06)}{-0.571} * \text{GRADE} \underset{(6.58)}{-0.887} * \text{CGEND}$$

$$\underset{(9.93)}{+0.500} * \text{LN\_Y} \underset{(2.74)}{+0.096} * \text{NO\_CHILD} \quad \underset{n = 3459}{R^2 = .248}$$

1.3 Transfers from children to parents (next two slides)

Table 5: Transfers to parents, T_2

Regressors	**OLS:** $\ln T_2$	**OLS:** T_2	**Tobit:** T_2
INTERCEP	5.1742 (1.961)	935.1896 (0.998)	1707.933 (0.728)
POWN_BU	0.0850 (0.934)	16.6341 (0.514)	−6.022 (−0.074)
POWN_HS	0.2727 (2.547)	−19.5766 (−0.515)	61.867 (0.672)
POWN_FR	−0.4313 (−4.623)	−59.1756 (−1.785)	−286.976 (−3.480)
FEMALE	−0.2783 (−5.605)	−33.0439 (−1.873)	−200.921 (−4.672)
GRADE	0.0332 (5.327)	1.7556 (0.792)	1.924 (0.360)
PGRADE	0.0626 (3.461)	7.6074 (1.182)	35.533 (2.224)
P_LN_Y	−0.5434 (−2.788)	−70.5860 (−1.020)	−303.253 (1.760)
AGE	−0.0026 (−0.756)	0.1000 (0.079)	−2.470 (−0.817)
PAGE	0.0129 (3.025)	−1.1569 (−0.760)	9.370 (2.348)
LN_Y	0.1505 (8.164)	9.1779 (1.401)	72.184 (4.444)
NO_CHILD	0.0403 (1.334)	6.5653 (0.610)	30.359 (1.238)
NO_SIBS	−0.0151 (−1.473)	−1.7446 (−0.479)	−13.451 (−1.520)
R^2	0.065	0.0036	λ= 1152.840 (57.640)
Number of obs.	5,581	5,581	5,581

Note: t-statistics are in parenthesis.

Estimates of Difference in Income Transfer Derivatives

Table 6: Probit, Tobit and selected Altonji-Ichimura paramter estimates for T_2

Regressors	**Probit:**	**Tobit**	**Altonji-Ichimura**
INTERCEP	-1.1340 (-7.994)	-241.4670 (-8.289)	()
POWN_BU	-0.1440 (-2.838)	-25.8312 (-2.471)	()
POWN_HS	0.0264 (0.435)	1.4967 (0.123)	()
POWN_FR	-0.2276 (-5.619)	-30.3413 (-3.697)	()
FEMALE	-0.1353 (-3.345)	-18.4906 (-2.242)	()
GRADE	-0.0019 (-0.280)	-0.1475 (-0.110)	-0.9850 (-0.730)
PGRADE	0.0190 (3.233)	3.5614 (3.010)	()
P_Y_P	-0.0048 (-2.165)	-0.6800 (-1.505)	1.4750 (0.403)
AGE	-0.0052 (-1.873)	-1.1444 (-2.046)	()
PAGE	0.0185 (9.342)	2.7446 (6.821)	()
Y_P	0.0013 (1.973)	0.2536 (1.884)	0.4287 (2.440)
NO_CHILD	0.0087 (0.393)	2.0460 (0.468)	()
NO_SIBS	-0.0323 (-3.252)	-6.4001 (-3.173)	-1.4320 (-0.210)
R^2			$\lambda=$ 212.136 (58.97)
Number of obs.	5,257	5,257	5,257

Note 1: t-statistics are in parenthesis.

Note 2: The effects in the last column is an estimate of $\frac{\partial E\left[T_2^*(X,\theta)|X,T_2^*>0\right]}{\partial X}$ as described in the text.

Note 3:The variables T_2, P_Y_P, and Y_P respectively denoting the transfer to parents, parent's permanent income and repondent's permanent income are all measured in '0000.

Regressors	Tobit under normal	Altonji-Ichimura flexible form
E_{p2}: direct effect	-0.680 (1.51)	1.4755 (0.403)
E_{p2} : indirect effect	-0.125 (3.61)	-0.4944 (4.762)
E_{p2} : total effect	-0.125 * (3.61)	-0.4944 * (4.762)
E_{k2} : direct effect	0.254 (1.88)	0.4287 (2.440)
E_{k2} : indirect effect	0.034 (0.17)	0.033 (3.02)
E_{k2} : Total effect	0.254 * (1.88)	0.4620 (2.548)

Note 1: The standard errors and parameter estimates are computed using bootstrapping with 149 bootstrap samples.
Note 2: *'s are based on the significant one of the direct and indirect effects, i.e., we treat an insignificant effect as 0.

Table 7: Differences in income derivatives