Economic Returns of Childrearing and Fertility Transition

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Abstract

Empirical assessments of the economic returns to childrearing have shaky foundations, despite extensive literature on the value of children following Caldwell's wealth flow theory. Our objective is to examine the economic returns to childrearing during fertility transition. In doing so, we describe a new method for measuring familial transfers, and assessing the economic returns from the average parent over the entire parental lifecycle. The method is then applied to detailed household economic data of Taiwan. Results show that children are net economic benefits for parents of high fertility cohorts, and children are net economic costs for parents of low fertility cohorts. Our results shed light on the significance of familial transfers in countries where social welfare for old-age is less established.

Keywords: Aging, intergenerational transfers, fertility

JEL classification: J1, I22, O15

1. Introduction

Familial transfers are important. Universally, children depend on familial transfers for food and sustenance. In countries where public welfare programs are not well-established, the elderly depend on families for income support and old-age care. These transfers flow across age groups and time; their magnitudes are important, yet there have not been many comprehensive studies on this topic.

The transfers between parents and children may affect several decisions: fertility, human capital investment, etc. Caldwell's wealth flow theory (1976) proposes that the economic value of children and thus the direction of transfer flows determine one incentive for childbearing.

The objective of this paper is to examine the economic returns to childrearing during the fertility transition. We investigate the net familial transfer flows to parents in both high cohort fertility and low cohort fertility. Fertility and the net direction of transfers are used to empirically test Caldwell's theory. If net direction of transfers is from parent to children (or from children to parents) in high cohort fertility (or low), Caldwell's theory is not supported. We also analyze whether the net transfer flows change during the fertility transition.

We construct a comprehensive measure of familial transfers across time at individual level. Micro level data from the household income and expenditure survey of Taiwan (1978-2003) and historical data on consumption (1951-1977) are used. Future upward transfers are projected (2003-2030). Data on familial transfers through co-residency (intra-household transfers) are rare, and therefore have been often ignored in empirical measurements. Despite extensive discussions on the value of children, empirical assessments of economic returns to childrearing are scarce and poorly measured. In measuring economic returns, direct economic data should be used not qualitative data. Qualitative data provide subjective expectations of the future. The measurement of economic returns should include the lifecycle of the parent. Parents give and receive transfers throughout their lifecycle. Previous empirical analyses focus on the returns to child production. Transfers received from children during parents' old age are not measured. Empirical work explicitly concerned with the relationship of fertility to old-age security is limited.

This paper describes a new method for assessing the economic returns to the average parent over the entire parental lifecycle. The relationship between fertility and the net familial transfer flows are analyzed. Our estimates are comprehensive and include both inter-household and intra-household transfers based on micro-level economic data. We analyze the lifecycle of parents from birth cohorts of 1925 to 1945.

Taiwan is chosen for our study because enormous economic and demographic changes occurred there in past few decades. In addition, the data documenting those changes are extensive and of high quality. The speed of demographic change is extraordinary. Total fertility rate declined sharply from 7.40 in 1951 to 1.23 in 2003. Real gross domestic product grew by annual rate of 9.7 percent during the 1970s and 8.5 percent during the 1980s. With high economic growth, public welfare for the elderly, however, was not well-established. Familial transfers supported on average one-third of elderly consumption in 1998 while only one-fifth is supported by public transfers (Mason et al 2005, Lai 2005). Hence, it is important to investigate the significance of familial transfers in supporting old-age.

Our results show that parents of high cohort fertility (5-3.5 children) receive positive net familial transfers from children. The direction of net transfers is upward. Parents of low cohort fertility (3.5 children and less) experience reversed direction. They receive familial transfers from children less than what they have given to children. This result is consistent with Caldwell's wealth flow theory (1976).

The timing of fertility reduction, however, is not exactly corresponded to the changing direction of net transfers. We compare the investment in children with physical investments. Physical investments yield higher returns than children. If the financial opportunity costs of rearing children (profits forgone from investing in physical investment) are taken into account, the timing of fertility reduction is corresponded with the downward net transfers.

2. Related Literature

The relationship between fertility and costs of children are discussed by various literature. Notestein (1945) suggests that costs of children are major determinant of fertility. Following Notestein, Leibenstein (1957) proposes that parents derived utility from children in two ways: child labor and old age security. Becker (1960) develops the quality and quantity trade off in the theory of demand for children. Caldwell (1976) asserts that the economic value of children and the direction of familial intergenerational wealth flows, determine one of the incentives for childbearing.

Caldwell's wealth flow theory links the intergenerational transfers across the life course to fertility decision. If the value of the parental wealth transfers to children exceeds the value of all children's transfers to parents, the economically rational decision for parents is to desire fewer children. On the other hand, if the parents receive more wealth flows than they provide to children, parents desire as many children as possible. In this case, parents' wealth increases as a function of the number of children.

Wealth flow theory also links the individual value system of intergenerational transfers to fertility transition. Before modernization, children provide net economic benefits to parents, and therefore fertility is high. Children provide economic benefits by working in the farm; contributing monetary transfers to family; taking care of aged parents; and increasing the family's political power and thus the economics resources of the family. After modernization, individuals adopt new individualistic values through mass education that result in downward wealth flows (children provide to parents less than they received from parents). The transition from traditional to modern family value produces the fertility transition from high to low. The value system pertaining to supporting parents in old age is one of the determinants of familial (intra-household and inter-household) transfers.

Wealth flow theory is discussed on the economic benefits of children associated with fertility. There are many benefits children can provide: satisfy parent's altruistic desires, give attention and care to parents, provide household help, contribute financial support, increase the family's political power, etc. Tests on wealth flow theory are in two major forms. First is the economic contribution of child labor. Second is the economic benefits received from children during parents' old age.

In testing the relationship of fertility and economics benefits of child labor, empirical studies search for whether children consume more than they produce and contribute to parents in high fertility societies. Results are mixed. Several empirical evidence show positive relationship. DeLancey (1990) and Makinwa-Adebusoye (1994)'s find parents perceived net upward transfers in high fertility regions using sub-Saharan African national level survey data. Chang (1990)'s analysis on national level data of China concludes that the reduction of economic contribution of children caused the fertility decline. Other micro-level analyses do not find net upward transfers from child production in high fertility in India (Das Gupta 1994 (in Punjab), Vlassoff 1982).

Several studies measure the absolute wealth flows by comparing the consumption and production of children through the life course in primitive societies. In these studies, elderly remain active and are producer surplus in the peasant societies. Children do not produce more than they consume during childhood. Net wealth flows are from parents to children and therefore, wealth flow theory is not supported (Mueller 1976 (in Third World), Kaplan 1994 (in Paraguay and Peru), Lee 2000 (in Third World), Lee and Kramer 2002 (in Maya)).

Wealth flow theory also emphasizes the old age security of parents. A society where parents receive high economic support from children has high fertility. When society adopts individualistic value and adult children do not provide economic benefits during old age, fertility declines. Several empirical studies test on economic benefits received from children during parents' old age. Lee, Y.J (2000)'s micro level analysis in South Korea, and Bhaumik and Nugent (2000)'s micro level analysis in Peru provide evidence of gross upward transfers from older children outside parental home to parents. Other empirical studies find high fertility to be positively associated with expectation of old age support (Hugo 1997, Cain 1981, Delancey 1990, Nugent and Gillaspy 1983). Vlassoff and Vlassoff (1980) concludes no evidence that old age security motivates high fertility in India. However, none of the studies explicitly test on the relationship of old age benefits to fertility.

In testing the wealth flow theory, absolute flow of economic benefits received and given to children should be analyzed. The evidence in support or against of wealth flow theory is based on the expectation of support during old age and the indicators of changes in economic contributions of children. Qualitative data provide subjective expectations of the future. Indicators provide weak test on economic flows. Direct economic data should be used to measure economic returns.

Transfers between parents and children occur throughout the lifecycle. Previous empirical evidence measures child contribution during childhood or during parent's old age. The measurement of economic returns should therefore include the lifecycle of the parent or the child. Data on inter-household transfers are available. Data on transfers through co-residency or intra-household transfers, however, are not available. Estimates of transfer flows should include both inter-household and intra-household transfers.

Strong test of this wealth flow theory can be implemented in different ways. One way is to find children provide net economic benefits to parents in high fertility societies and net economic costs to parents in low fertility societies. Empirical studies that measure absolute transfer flows in this test find that children are net economic cost in high fertility and peasant societies (Lee 2000, Stecklov 1999, Lee and Kramer 2002). Lee (2000) concludes that parents receive net economic transfers from the next generations in low fertility and industrialized societies when public transfers are included. Another way is to find high fertility actually increases the net economic benefits, and the net flows of transfers decline in fertility transition. There is no solid empirical work on this test yet.

We test on both ways. We investigate the net economic benefits to parents in high cohort fertility and low cohort fertility. We also analyze whether the net transfer flows change during the fertility transition. In testing this wealth flow theory, we use a comprehensive measure of familial transfers that include both inter-household and intra-household transfers. New method is introduced to describe the detailed costs and benefits of children to the perspective of an individual parent. These costs and benefits are estimated over a parent's lifetime. A long period of historical data and projections are used instead of single-year cross-sectional data that are sensitive to time variations.

Table 1: Recent Empirical Assessments on Economic Returns

Source	Data	Method	Results
Lai (2005)	Taiwan FIES 1978-2003, Taiwan FIES report 1964-1976, Education Statistics 1950-2003	Inter-household and intra-household transfers over parent's birth cohort	IRR with survival discounting: +4.6% (cohort 1925) to -0.4% (cohort 1945) for upward transfers (2004-2030) projected at income growth g=5%** +4.4% (cohort 1925) to -2.4% (cohort 1945) for upward transfers projection at g=3%
G. Stecklov (1999)	1986 data of World Bank's Living Standard Measurements Study: Survey of Cote d'Ivoire	Inter-household and intra-household transfers	IRR without survival discounting: -2.5% to -17.3% IRR with survival discounting: -6.4% to -31.5%
R. Lee and K. Kramer (2002)	Time allocation data for a group of Maya agriculturists in Yucatan, Mexico	consumption and production	IRR (with survival discounting) of a child from birth through age of leaving home is highly negative
R. Lee (2000)	Adjusted from Mueller's (1976) data on Third World	consumption and production	IRR -3.7% to -6.7%

** Upward transfer projection does not affect rates of return of early birth cohorts (1925-1929). Estimates of these cohorts are mainly based on historical transfer data.

The estimates of our benefit and cost ratios and internal rate of returns are higher than previous empirical studies. Previous empirical studies find negative internal rate of returns. Children are found to be a strong net drain economically. These different results are due to different empirical foundations and different case settings. For example, Stecklov's (1999) empirical analysis is rich with inter-household and intra-household transfers on Cote d'Ivoire. Our results are different from Stecklov's estimates partly because of the different cases. In Stecklov's analysis of Cote d'Ivoire, the elderly tend to be household heads, and all rental income is attributed to the heads. Elderly therefore continue to have high incomes, and income is larger than consumption until age 74. Estimates of familial transfers given to the elderly are relatively very small and children therefore are found to be net burdens.

3. Data

In this section, we describe the data resources used. Then, we explain the method for deriving individual consumption and labor income by age. These consumption and labor income estimates will be used in estimating familial transfers in Section 4.

We rely on a variety of data resources. The main data used for this analysis is the Survey of Family and Income and Expenditure (FIES) of Taiwan (1978-2003). Other data resources used include data on the number of students by age for different school levels from Ministry of Education[1], and data on population and fertility from the Population Register of Taiwan and the Statistical Yearbook of the Republic of China.

The FIES survey was known as the Survey of Personal Income distribution until 1993. The FIES is a large, nationally representative household survey. It is conducted by the Directorate-General of Budget, Accounting and Statistics (DBGAS), Executive Yuan, Republic of China. This survey is carried out as part of the computation of the national income statistics. The survey was first conducted in 1964. It was conducted every other year until 1972, when the frequency was increased to every year. About 13,000-16,000 households are surveyed and approximately 52,000-68,000 civilians are interviewed each year. Methods of collection include interviews and diaries. The survey is cross-sectional and therefore we cannot track individual households longitudinally.

Data at both the household and individual levels are collected. For years before 1976 summary reports were published[2]. Data are available starting 1976. There are five main components of the survey: household facilities and housing conditions; household members; income and expenditure; consumption expenditure; and capital gains losses and transfer of payment.

In the FIES, data on income and expenditure are detailed. Income includes employee compensation, entrepreneurial, property, and transfer income for all household members. Transfer income includes inter-household transfers, private transfers to abroad, social security benefits, social assistance grants, unfunded payment for employees such as hazard compensation and severance pay, other unrequited transfer of income. On the other hand, data on current transfer expenditures include private inter-

[1] Data on number of students were compiled and provided by Dr. An-Chi Tung from Academia Sinica.

[2] FIES reports total private consumption starting 1964. The total private consumption before 1964 is estimated based on the private consumption growth rate computed from the National Income report. FIES reports the percentage of consumption spent on recreation, education, and culture starting 1964. For years before 1964, we assume the same percentage of year 1964, which is 1.2 percent.

household transfers, direct taxes, social security contributions, private pension contributions, current transfer of payment to private non-profit institutions, and others.

We first describe the empirical method of the household consumption allocation. Household consumption is the value of the consumption goods and services acquired and consumed by the household[3]. Since data on consumption are generally reported at the household level, we need to allocate this household consumption among the family members. Allocating household consumption among household members is not an easy task because of the existence of public goods and consumption externalities within the household. An extensive literature is concerned with allocating household consumption individual members. Detailed of the literature and comparison are discussed in Deaton (1986, 1997) and Lee et al. (2004).

We allocate household consumption of FIES 1978-2003 to household members based on the method of the National Transfer Account (NTA) Project (Lee and Mason, 2004). In the NTA method, age targeted consumption such as education and health are allocated to household members using some simple regressions. Then, the remaining consumption is allocated using a fixed allocation rule (equivalence scale) after an extensive review of the literature and other estimation methods. The detailed methods of each allocation are discussed and presented in Lai (2005).

Education consumption from year 1951 through 1977 are estimated using a fixed cross-sectional per student age-shape, and then shift the levels of these age profiles upwards using actual level of expenditures and actual number of students. Individual consumption from 1951 through 1977 are estimated using a fixed cross-sectional per capita consumption age profile, and shift the level of consumption by actual expenditure reported and population age distribution. Detailed models are presented in Appendix A and B.

While individual consumption is derived subject to empirical method, individual labor income is derived directly from survey data. Labor income is defined as all compensation that is a return from work effort[4]. It includes the compensation of employees[5] and a portion of self-employment or entrepreneurship[6]. We assume that two-thirds of entrepreneurial income is a return to labor and one-third is a return to capital.

Data on earnings and entrepreneurial income in the FIES Taiwan are provided on an individual basis, and therefore labor income is calculated directly from the survey. In the survey, data on compensation of employees is reported before taxes and social security contributions for a calendar year. Compensation of employees includes payroll, retirement pay, awards, fringe and death benefits, and health and pension insurance contributed by employers. Data on entrepreneurial income include net profits earned by households from participation in unincorporated enterprises. We exclude retirement pay from compensation of employees.

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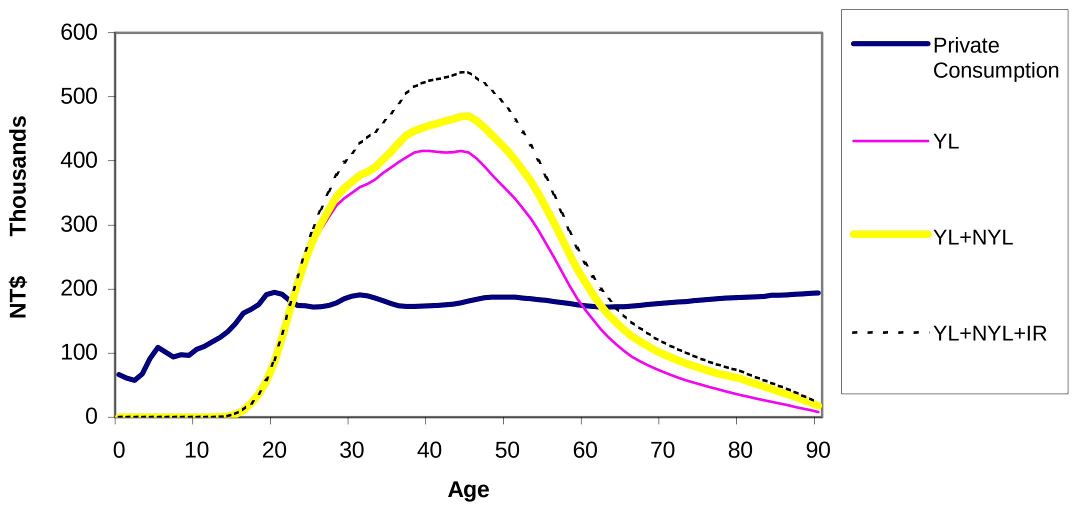
[3] However, consumption excludes the purchases of durables or a home, but includes the imputed services of consumer durables and owned housing.

[4] Labor income does not include the value of time associated with childrearing or other at-home activities that do not produce market goods or services.

[5] Compensation of employees includes earnings, employer-provided benefits (e.g. bonus and housing), and social contributions paid by employers (e.g. pension).

[6] Entrepreneurial income includes returns to capital and labor.

Figure 1: Per Capita Consumption and Labor Income, Taiwan, 1998



YL= Labor Income or production, NYL= Non Labor Income, IR= Imputed Rent Own

Sources: FIES Taiwan, 1998

Figure 1 presents the per capita consumption and production (labor income) age profiles for year 1998. Definition and allocation of consumption and labor income were described earlier. Non-labor income (NYL) includes property income and one-third of entrepreneurial income. Imputed rent own housing (IR) is the imputed rent net of depreciation, land tax, house tax and insurance premium. Both non-labor income and imputed rent are allocated to household heads[7].

The elderly in Taiwan experience lifecycle deficits in their early 60s when their labor income is lower than their consumption level. The lifecycle deficits can be supported by private transfers, public transfers, non-labor income and dis-saving. Despite adding non-labor income (and imputed rent income on own-occupied housing), the elderly experience consumption levels that exceed their income levels in their mid 60s. Transfers play an important role in supporting elderly.

4. Analysis of Economic Returns

In this section, we analyze the economic cost and benefit of children. First, we describe the average economic costs paid by a parent and the economic benefits received by a parent (section 4.1 and 4.2). Subsequently, we analyze these costs and benefits over the lifecycle of a parent by tracking their birth cohorts (section 4.3).

[7] Household head in the FIES of Taiwan is defined as persons in the household who earns the largest personal share of pay in the family income. FIES of Taiwan reports all types of income including non-labor income and imputed rent income at both household and individual basis. The income data are high quality and nationally representative. We compare the per capita age profile of non-labor income allocated to individuals with the age profile of non-labor income allocated to heads only. Both age profiles yield a similar pattern.

4.1 The Economic Cost of Children

The cost of children is the total familial transfers given by parents to children. Total familial transfers include both inter-household and intra-household transfers. Inter-household transfer income and expenditure are derived directly from the household survey. In Taiwan context, most inter-household transfers are given from working adults to elderly age groups. Inter-household transfers given to children are not substantial.

Intra-household transfers are transfers that occur through co-residency. However, data on such transfers are not widely available. We measure intra-household transfers given by parents to children using a model of Mason et al. (2005).

In the model of Mason et al. (2005), household income is pooled—the common pot model. Household members maximize household utility by contributing their disposable income surplus towards the consumption of members for whom disposable income is less than consumption. Disposable income is defined as labor income plus net public cash transfers (cash inflows less taxes) plus net inter-household transfers. Disposable income surplus is the difference between consumption and disposable income. There is no Pareto superior allocation of goods among members. The allocation plan may be socially imposed or at the discretion of the household head.

Motivations behind the transfers are not assumed in this model. This model is general and indistinguishable from altruism or exchange models. Becker's Rotten Kid Theorem (Becker 1993) restrictively provides a single explanation of a more generalized set of behaviors to produce an identical system of reallocations as the common pot model. Detailed description of model and results of familial transfers are presented in Lai (2005).

A household member who consume more than his disposable income has current deficits. He will receive intra-household transfers from members who consume less than their disposable income. A child therefore receives intra-household transfers if he has current deficit. The current surplus and current deficit of a child are therefore calculated as:

$$X(k,j) = Y^l(k,j) + TGCash(k,j) + TPB(k,j) - CC(k,j) \tag{0.1}$$

where k is a child of the head

$$surplus(k,j) = X(k,j) \ if \ \ X(k,j) > 0$$
$$deficit(k,j) = -X(k,j) \ if \ \ X(k,j) \le 0$$

where $Y^l(k,j)$ is the labor income of child *k*, $TGCash(k,j)$ is the public cash transfer inflow to person *i*, $TPB(k,j)$ is the inter-household transfer to person *k*, and $CC(k,j)$ is the current consumption[8] of person *k*.

In this model, household head owns all household assets and, thus, all income generated by those assets flows to the head. The consumption of durables by any non-

8 Current consumption is total consumption minus the services of housing and consumer durables.

head household member is "financed" by an intra-household transfer from the head to the member equal to the value of durable consumption.

Therefore, the intra-household transfer inflows to child *k*, $TPW(k, j)$, is equal to the current deficit plus the value of asset consumption $CD(k, j)$:

$$TPW(k, j) = deficit(k, j) + CD(k, j) \qquad (0.2)$$

Intra-household transfers to support current consumption (non-durable consumption) are "financed" by imposing a household specific flat-rate tax on each member's surplus income. Within the household each member is taxed at the same rate. Thus, children deficits, $deficit(kj)$, are supported by household member at the rate equal to:

$$tax(kj) = \min[1, deficit(kj) / surplus(j)] \qquad (0.3)$$

where $deficit(kj)$ is the total deficit of children in household *j*, and $surplus(j)$ is the total surplus for every member in household *j*.

For non-heads the intra-household transfer outflow is equal to the tax rate times the surplus. For heads the outflow is equal to the tax rate times the surplus, plus total durable consumption by non-head household members $CD_{-h(j)}$, plus the difference between the household's deficit and surplus if positive.

$$TPWO(i,kj) = -tax(kj) \times surplus(i, j) \text{ for i=non head}$$
$$TPWO(i,kj) = -tax(kj) \times surplus(i, j) + CD_{-h(j)} \text{ for i=head and surplus(j)>deficit(j)}$$
$$TPWO(i,kj) = -tax(kj) \times surplus(i, j) + CD_{-h(j)} + (deficit(j)-surplus(j)) \text{ for i=head and surplus(j)<deficit(j)} \qquad (0.4)$$

where $TPWO(i,kj)$ is the total intra-household transfers given by member *i* in household *j* to support[9] children who experience deficits. Age profile of $TPWO(i,kj)$ is presented in Figure 2.

Figure 2 presents the per capita net familial transfers given by an adult to children across age and time. Transfer age profiles are normalized to total of one within a year to facilitate the comparison across time. Each transfer age profile indicates the distribution of child costs[10] contributed across age groups within a year.

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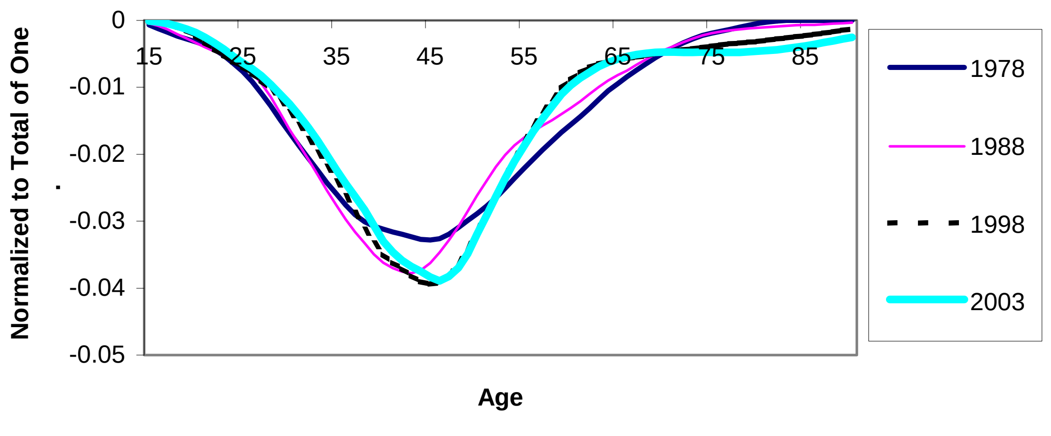
9 In some households, total disposable income is less than total consumption, and they support some part of their consumption using property income or, if necessary, by dis-saving. This portion of the deficit is financed by additional intra-household transfers from the household head to household members.

10 Costs of children are for those who face current deficits in equation (0.2) (where a child's disposable income is less than his total current private consumption). For example, if a child aged 25 experiences current deficits, the cost of children includes the familial transfers given to this child. If a child aged 19 experiences a current surplus, he earns disposable income more than he consumes in equation (0.2). Cost estimates hence exclude this child.

Figure 2: Per Capita Familial Transfers Given to Children (Outflows), Taiwan



The cost of children is primarily borne by working adults aged 30-59. The peak ages of contribution are around the mid 40s, and the peak age increases over time. In the 1980s, the peak ages of contribution were around 45. After the 1990s, peak ages were delayed to the late 40s. The delay may due to the deferred age of marriage and childbearing. Also, the delay may be caused by the increasing age of child dependency. The portion of children entering college increased in the 1990s.

Per capita familial transfers given to children are estimated using micro data of FIES for 1978-2003. Estimates of 1951-1976 are estimated using a fixed cross-sectional per capita familial transfer age-shape, and then shift the levels of these age profiles upwards using actual level of expenditures reported and actual population age distribution.

4.2 Economic Benefits of Children

Benefits of children are the net upward transfers received by parents during old age. Net upward transfers are transfers received by parents minus transfers given by parents. Transfers include both inter-household transfers and intra-household transfers.

Estimates of inter-household transfers received by parents are derived directly from the FIES survey[11]. Inter-household transfers are prominent in Taiwan. On average, gross inter-household transfers is 18 percent of household income for households where net transfer income is positive. These transfers appear to flow from high to low-income households and to the elderly[12].

[11] A large proportion of the transfer inflows are reported to collective households. For example, in 1998, 65% of the inflows were reported to the collective household, 20% to the head, 2% to the spouse of the head, and remaining to other members. Transfers inflows to the collective household are not reported to any specific members in the inflows to the collective household are not reported to any specific members in the household. We allocate these collective transfer inflows using a simple regression, where the collective transfer inflows of the household are regressed by age groups.

[12] A supporting statistic is that the total pre-private transfer income and labor income of net givers are double the amount of net recipients. In addition, net givers have 10 times more non-labor income, such as

Intra-household transfers received by parents are measured using the model described above. Instead of measuring the deficits of children, now we measure the deficits of parents and grandparents. Thus, the intra-household transfer inflows to parent p, $TPW(p, j)$, is equal to the current deficit plus the value of asset consumption $CD(p, j)$:

$$TPW(p, j) = deficit(p, j) + CD(p, j) \qquad (0.5)$$

where *p* is the parent or grandparent to the household head. Intra-household transfer outflows given by parent, *TPWO (p,j),* is similar to the concept of equation (0.4). Parents give transfers to any household members who have current deficits. Therefore, net intra-household transfers received by parents are intra-household transfer inflows $TPW(p, j)$ minus intra-household transfer outflows *TPWO (p,j)*.

Intra-household transfers in equation (0.5) are measured for households with adult children living with parents or grandparents, and the adult children are the heads. Intra-household transfers measured exclude households with elderly living independently from adult children in order to leave out transfers among spouses. However the per capita transfers shown in the following Figure 3 are the mean transfers of the entire survey sample.

Figure 3: Per Capita Net Upward Transfers, Taiwan

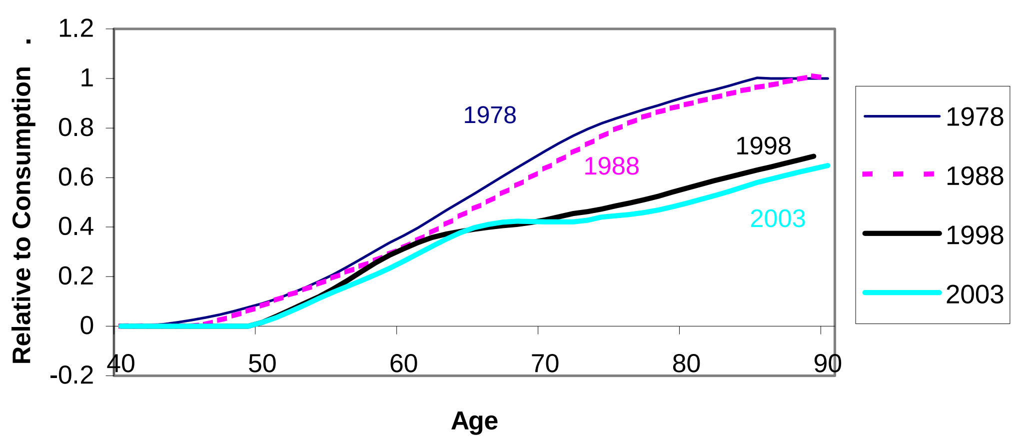


Figure 3 presents the per capita net upward transfers received by a parent across age groups. Total net upward transfers include net inter-household transfers and net intra-household transfers. Net transfers received by a parent are measured relative to the consumption of the parent.

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property income, than net recipients. This result indicates that net givers are richer. Also, net recipients have three times more average old-age allowances and low-income social allowances than the net givers. This result shows net recipients are comprised of the elderly and low-income households because old-age allowances are social benefits for low-income seniors who do not receive any retirement pay.

Parents started receiving positive net transfers in their 50s. However, the transfers were a small percentage of parents' consumption. In their late 60s, net upward transfers supported half of parents' consumption. For the remaining consumption, parents may rely on other sources such as labor income, asset income and dis-saving.

The importance of familial transfers increased by the age of parents before the 1990s. A parent in his 70s had 80 percent of his consumption supported by upward transfers. A parent aged 80 and older almost fully relied on upward transfers to support their consumption. After the 1990s, parents rely less on upward transfers. One of the reasons is the introduction of public transfer programs targeting the elderly during this decade. The decreasing intra-household transfers are accompanied by increasing inter-household transfers. This implies a changing co-residency pattern between elderly and adult children.

Net upward transfers for year 2004-2030 are projected using a simple consumption-transfer model. Consumption, earnings and transfers are assumed to follow an invariant age profile over the lifecycle, but to shift up with growth. Similar projection model is used by Deaton and Paxson (2000). Details of the projection model and results are presented in Appendix C.

4.3 Lifecycle Transfers

Here we analyze the lifecycle transfers given to and received from children over a parent's lifetime. Two measurements are examined: benefits and cost ratio, and the internal rate of return.

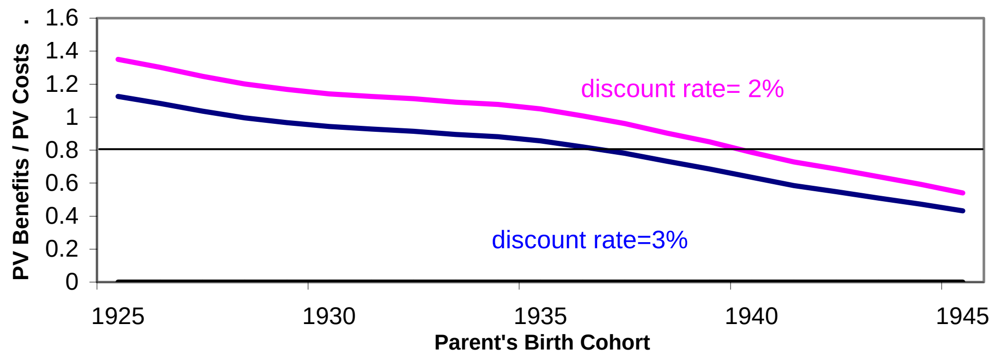
4.3.1 Benefit and Cost Ratio

The benefit and cost ratio is the ratio of the net present value of benefits to the net present value of costs. The ratio is the current value of all future transfer flows discounted at a rate *r*. The rate *r* may reflect the opportunity cost of investment or the interest rate. We use the net familial transfers given to children over a parent's lifetime as the cost. The benefit is the net familial transfers received by the parent over his lifetime. The cost and benefit are matched by the parent's birth cohort.

$$\text{benefit and cost ratio} = \frac{\sum_{a}^{T} e^{-ra}(\tau_{a,c}^{f})S_{25}^{a,c}}{\sum_{a}^{T} e^{-ra}(C_{a,c}^{-})S_{25}^{a,c}} \qquad a=0,1,2,\ldots,T \qquad (0.6)$$

where $\tau_{a,c}^{f}$ and $C_{a,c}^{-}$ are the vectors of length *T* with single-year age intervals. Each vector is indexed by *c*, the birth cohort of a parent. The vector $\tau_{a,c}^{f}$ represents the average net familial transfers received by a parent at age *a* for birth cohort *c*. The vector $C_{a,c}^{-}$ represents the average child costs given by a parent at age *a* of birth cohort *c*. Both the vectors $\tau_{a,c}^{f}$ and $C_{a,c}^{-}$ are multiplied by the survival probability at childbearing decision-making age, which is assumed to be 25. $S_{25}^{a,c}$ is the survival rate of age *a* from age 25 for cohort *c*. Since the parent will not be in a position to make a fertility decision unless he or she is alive, our calculations are conditioned on survival to the fertility decision age of 25. *T* is the final age, *r* is the discount rate, and we use historical upward transfers (1978-2003) and transfer projection (2004-2030). Model and results of projections are shown in Appendix C.

Figure 4: Benefit and Cost Ratio, Taiwan



Upward tranfsers (2004-2030) are orojected at 5% income growth rate (Appendix C).
Projection does not affect benefit and cost ratio of parents of birth cohorts (1925-1930) because these estimates are mainly based on historical transfer data.

Figure 4 presents benefits and costs that are discounted by a survival rate of age *a* from the childbearing decision age 25 for each cohort. At a 2 percent discount interest rate, parents born before 1936 are able to get more than what they have invested in children. A parent born in 1925 receives 35 percent more than what his has invested in children at a 2 percent discount interest rate. A parent born in 1930 receives a 14 percent return from his investment in children. However, a parent born in 1940 can only partially recover (78 percent) the investment in children.

4.3.2 Internal Rate of Return

Another measure by which to evaluate the economic contribution of children to their parents is the internal rate of return. This rate is the discount rate that makes the net present value of investment flows zero. This return rate is often used to assess and compare different types of investment options. Similarly, children are described as investment by parents who might be motivated to provide old age security. It is useful to compare the rate of return of children with other investments.

The internal rate of return from investment in children is the discount rate at which the net present values of the transfers given to children and transfers received would equal zero. Internal rate of return for a parent's birth cohort c, R_c, is computed by:

$$\sum_{a}^{T} \frac{B_{a,c}}{(1+R_c)^a} = 0 \qquad (0.7)$$

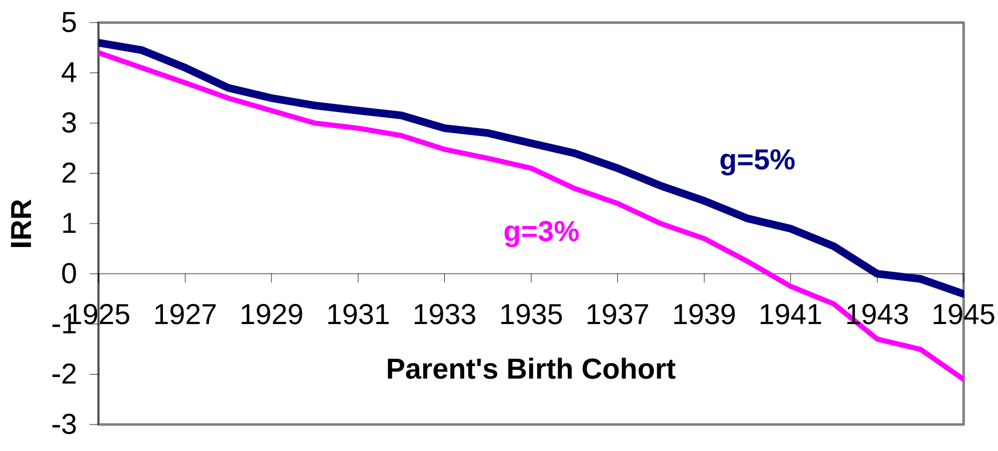
where $B_{a,c} = \sum_a \tau^f_{a,c} \times s^{a,c}_{25} - \sum_a C^-_{a,c} \times s^{a,c}_{25}$

where $B_{a,c}$ is the vector of average net benefits received and average costs paid by a parent at age *a* for birth cohort *c*, *T* is the final age, R_c is the internal rate of return for cohort *c*, $C^-_{a,c}$ is the vector of average child costs given by a parent at age *a* of birth cohort *c*, $\tau^f_{a,c}$ is the vector of average net familial transfers received by a parent at age *a* for birth cohort *c*, and $S^{a,c}_{25}$ is the survival rate of age *a* from age 25 for cohort *c*. We use historical upward transfers (1978-2003) and transfer projections (2004-2030) in Appendix C.

We are measuring the return to investments made in children by a parent born in the cohort *c* compared to the net familial transfers received by the parent over his lifetime. When computing the internal rate of return, problems often arise with series of flows that are non-monotonic. When the series of flows are non-monotonic, multiple roots may exist for the solution of equation (0.7). The negative root closest to zero has been used in all cases (Herbst, 1990).

Figure 5 presents the internal rate of return of the investment in children by the parent's birth cohort. Two results are presented. One rate is computed based on historical transfers (1978-2003) and upward transfers (2003-2030) at 5 percent growth rate. Another rate is calculated based on historical transfers (1978-2003) and upward transfers (2003-2030) at 3 percent growth rate. Transfers are adjusted with survival discounting.

Figure 5: Internal Rate of Return, Taiwan



g= income growth rate for upward transfer projection (Appendix C)
Projection does not affect much rates of return of parents birth cohorts (1925-1929) because estimates of these cohorts are mainly based on historical data

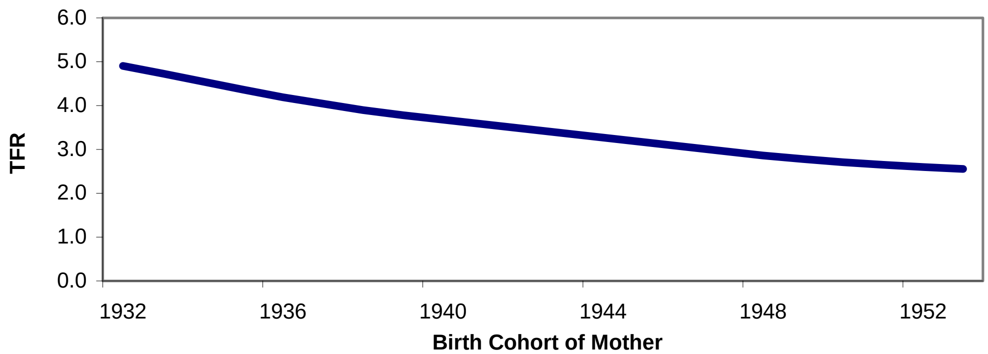
A positive internal rate of return implies that parents are receiving more than they have invested in children. Net transfer flow is upward. A negative internal rate of return shows that parents are receiving less than they invested in children. Net transfer flow is downward.

At 3 percent growth rate, the rates of return are lower than rates computed using 5 percent growth rate. Upward transfers projection does not affect much the results for earlier birth cohorts (1925-1929) because estimates of these cohorts are based on historical data (1978-2003). Parents born in 1925, on average, have a rate of return of 4.4 percent from investing in children. Parents born before 1940 are receiving more than they have invested in children. The net transfer flow is upward. Parents born after 1940, on average, are receiving less than the investment made in children. The net transfer flow is downward.

At 5 percent growth rate, the rates of return are positive for parents born between 1925 through 1942. Parents are receiving more than they have invested in children. The net transfer flow is upward. Parents born after 1943, on average, are receiving less than the investment made in children. The net transfer flow is downward. The rate of return is decreasing across the birth cohorts. Parents born in 1925, on average, have a rate of return of 4.6 percent from investing in children. Two decades later, parents born in 1945 receive a negative return rate of –0.4 percent.

Results of internal rate of return conclude that the direction of net wealth flow is upward for parents born before the 1940s. The direction of net wealth flow is downward, however, for parents born after the 1940s.

Figure 6 (a): Total Fertility Rate by Birth Cohort, Taiwan



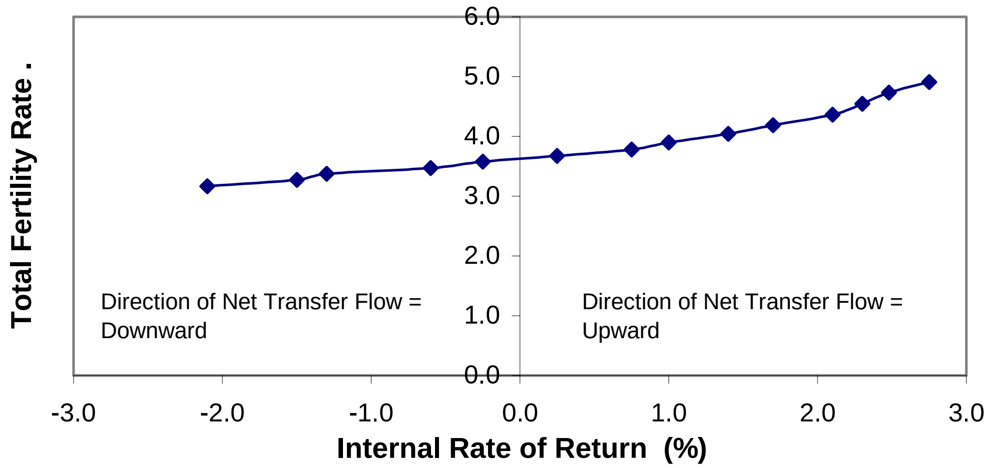
Source: Statistical Yearbook of Republic of China, 1975-2004

Now, we investigate the total fertility rate by birth cohort of mother in Taiwan presented in Figure 6 (a). Cohort fertility is the actual childbearing of cohorts of women. It measures the average number of births 50-year-old women had during their past reproduction years. Taiwan has declining birth cohort fertility between 1932 and 1952. Mothers born in the early 1930s have an average of 5 to 4 children. Mothers born in the 1940s, however, have an average of 4 to 3 children.

Figure 6(b) presents the total fertility rate and internal rate of return in Taiwan for parents born between 1932 and 1945. The high fertility cohorts (5-3.5 children) receive positive internal rate of return. The direction of net transfer flow is upward. Later cohorts who have fertility less than 3.5 experience reversed direction. Internal rate of return is negative and thus the direction of net transfer flow is downward.

Does the changes in the direction of net transfers correspond to the timing of the fertility reduction? Fertility declined rapidly for parents born between cohort 1932 and 1940. During these cohorts, the net economic returns of childrearing are positive and the net direction of transfers is upward. That is to say, fertility declined rapidly even though children are net economic benefits. The timing of fertility reduction is not exactly corresponded to the changing of direction of net transfers presented in Figure 6(b). We further investigate the opportunity cost of investing in children in the following.

Figure 6 (b) Total Fertility Rate and Internal Rate of Return, Parent's Birth Cohort 1932-1945, Taiwan



Notes: Upward transfers for 2004-2030 are projected at 3% income growth

We compare the investment in children with investment in time deposits. Figure 10 shows the average interest rate of time deposits by parent's birth cohort. The interest rates are estimated using historical average rates during a parent's childrearing age (age 30 to age 60)[13]. The average interest rates range from 7.5 to 6.5 percent. Comparing the rate of return from investment in children (ranging from 4.6 to –0.4 percent), the return to time deposits is higher. Parents will earn more by saving money in the bank than investing in children. Other investments, such as bonds and properties, yield far higher returns than time deposits.

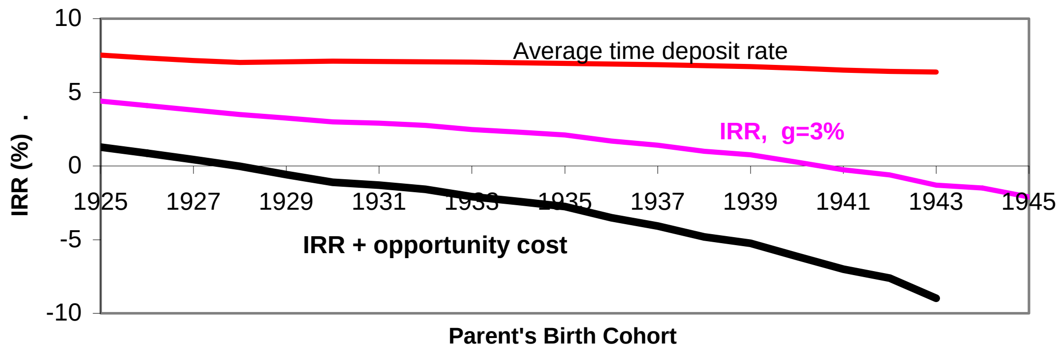
Both rates of return from time deposit and from children are declining. Rates of return from children drop faster than the time deposit. Physical investments are more promising than investment in children.

If parents take into account the financial opportunity costs rearing children (profits forgone from investing in time deposit), economic returns of children are still positive for parents born in the late 1920s. The returns are negative, however, for parents born after the 1920s. These returns are presented in Figure 7.

[13] Interest rates during parent's old age (60+) are not available because the rates will be future rates and need to be projected. Source of interest rates is the Statistical Yearbook of the Republic of China 1975-2004.

Children are net economic costs to parents born in the 1930s and thereafter, if parents take into account the financial opportunity costs rearing children. Recall that fertility also declines rapidly during these cohorts. Parents may reduce the number of children because children are net economic costs. The timing of fertility reduction is corresponded with the downward net transfers when including the opportunity costs of childrearing.

Figure 7: Investment in Children Vs Physical Investment Taiwan



g= income growth rate of upward transfer projection (2003-2030) Appendix C
Source: Statistical Yearbook of the Republic of China, 1975-2004
Family Income and Expenditure Survey, Taiwan, 1964-2003

Despite the lower return rate to children than time deposit investments, children may still remain as economic assets to parents. Pension system and old-age welfare are not well established in Taiwan. In 1994, only two-thirds of the population aged 25 and older are covered by pension insurance. One-third of the population aged 25 and older is not covered. Most of them are housewives, self-employed workers, farmers, and small business workers. The pension coverage has the maximum amount of 45 times the last working month's salary, which is equivalent to 3.75 years of retirement pay. Elderly do not received pension benefits until their last day. National health care system was not implemented until 1995. Health insurance covers a large part of the medical expenditures, care and attention from children may be desired by parents during their old age. Children are still important to old age security.

The golden rule and steady-state[14] model of Lee (2001) and Willis (1982) discuss how the changes in the population growth rate affect the present value of lifecycle consumption. If transfer wealth from parent to children is positive and the net direction of transfer is downward, an increase of population growth will reduce the per capita wealth and welfare. On the other hand, if transfer wealth from parent to children is negative and the net direction of transfer is upward, an increase of population growth will increase the per capita wealth and welfare. Our results show that net familial transfers flow from parent to children within the family. The steady-state model implies that the

[14] Golden rule condition is achieved when population growth rate is equal to the interest rate. Golden rule steady-state growth rate is achieved when interest rate equals the population growth rate plus technology growth rate

wealth and welfare of parents within the family will reduce when parents have more children. Parents will therefore tend to reduce the number of children instead of increasing them.

The current total fertility rate in Taiwan is below the replacement level at 1.23 in year 2003. Low fertility is an important cause of rapid population aging. The Council Economic Planning and Development of Taiwan projected that 20 percent of the population will be elderly by 2027. When the population is aging, the overall labor force participation and saving rates have been declining in Taiwan[15]. Population aging may therefore cause difficulties for government to fund national health insurance, pension system, and other social benefits. Population aging may also cause labor shortage and declining demand for goods and services, and consequently slowdown the economic growth. Our results show that children are net economic costs to parents. Other physical investments yield higher returns than investment in children. One of the policy implications is to implement pronatalist policies and programs, such as, child allowances, tax deductions for rearing children, paid childcare leave, and childcare services and subsidies.

6. Conclusion

During the rapid economic growth and demographic transition of the last few decades, familial transfers continued to be pivotal sources of support for children and elderly. Transfers to children increased over time because young adults receive more education and hence delayed the dependency age and entrance into labor market. The pattern of transfers to the elderly has changed. Inter-household transfers increased substantially while intra-household transfers decreased. The changed pattern was partly due to the increase in public transfers, and more elderly living independently from adult children. The role of total familial transfers in supporting elderly consumption diminished.

Results conclude that children are net economic benefits in high fertility cohorts, and children are net economic costs in low fertility cohorts. The internal rate of return of children decreases over a parent's birth cohort. Parents born before the 1940s have high cohort fertility (5-3.5 children). They are able to recover their investments made in children. They receive at least as much as or more than what they have invested in children. The net direction of net transfer flow is upward. However, the direction is downward for parents who have low cohort fertility (3.5 children and less). Results show a positive relationship between cohort fertility and net transfer flow from children to parents. This relationship is consistent with Caldwell (1976)'s hypothesis that the declining economic value of children reduces fertility.

The timing of the fertility reduction does not correspond to the change of the direction of net transfers. We further investigate returns of physical investments, which are found to yield far higher returns than investment in children. When we include the opportunity costs of childrearing (profit forgone from physical investment), the net economic returns of childrearing decline substantially. The timing of fertility reduction is corresponded to downward net transfers (from parents to children).

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[15] The overall labor force participation rate fell from the peak of 60.4 in 1986 to 58.0 percent in 1998. Household saving rate fell from 29.3 percent in 1986 to 17.0 percent in 1998.

Although children are net economic costs to parents, results show that parents still receive substantial payback from children. Children remain as important assets for old-age security where old-age welfare system is not well established. Our economic returns of childrearing are higher than previous research. Our estimates appear to be among the most comprehensive estimates of life-cycle transfers between children and parents (over the parent's lifetime). These results shed light on an area of research which has been long debated and has shaky empirical foundations. Our approach presents the results for individuals in a more comprehensive way. We examine the lifecycle transfers over a parent's lifetime using a long period of historical data (52 years) and projections (30 years).

For current decades, results show that children are net economic costs to parents. The economic cost of children is one of the important determinants of fertility. Low fertility is an important cause of rapid population aging. One policy implication is to implement pronatalist programs. Countries facing the same issue, such as Japan and Singapore, have started some pronatalist policies and programs: child allowances, tax deductions for rearing children, paid childcare leave, and childcare service and subsidies (Retheford and Ogawa 2005).

There are several limitations in this study. First, the economic return estimate is the average return to a child, and not the marginal return of a child. Our analysis shed light on the average return from children for a parent, instead of the marginal return of an additional child. Second, our transfer estimates are focused on financial transfers. Indirect transfers such as time transfers and the opportunity cost of mothers taking care of children and elderly parents are not included. Data on time transfers are difficult to obtain and are not widely available. Third, our transfer estimates are limited by the data to include only inter-household transfers and intra-household transfers. Planned bequests or other asset transfers are not taken into account. Planned bequests for children should be treated as cost of a child. If bequests are accidental by product of lifecycle saving and uncertainty of age at death, then this analysis does not require additional information on bequests.

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Appendix A: Deriving Private Education Transfer Inflows 1951-1975

Household consumption on education is allocated to household members using micro-level data of FIES. However, FIES data are not available before 1976. Therefore, estimations before 1976 rely on several sources: statistics of Ministry of Education (MOE), FIES reports, and FIES estimations after 1976. To derive historical estimates before 1976, we utilize a few variables: private education expenditure per student, number of students and population across age groups. Since these estimates are historical, we are certain of the level of expenditures. The FIES reports total household expenditure spent on entertainment, recreation and education for the years before 1976. Therefore, we assume a fixed cross-sectional per student age-shape, and then shift the levels of these age profiles upwards using actual level of expenditures (reported in the FIES) and actual number of students (reported in the MOE). Note that the age profiles of expenditure per student are fixed and similar before 1976. However, the shapes of the per capita age profiles are different because they depend on the actual number of students across time. The fixed per capita age profile used is the average age profiles of real expenditure per student estimated from 1978 to 1984. The detailed statistics and sources of the actual education expenditure used are illustrated in the Appendix.

The total private education by age *a* in year *t* is given by:

$$\hat{\tau}^{e+}_{a,t} = T^{e}_{t} \times \frac{\hat{\tau}^{e+}_{a,t}(x,t) \times s_{a,t}}{\sum_{a} \hat{\tau}^{e+}_{a,t}(x,t) \times s_{a,t}} \qquad (0.8)$$

$$\text{private education per capita} = \frac{\hat{\tau}^{e+}_{a,t}}{n_{a,t}} \qquad (0.9)$$

where T^{e}_{t} is the total private education transfers (expenditure) in year t; $\hat{\tau}^{e+}_{a,t}(x,t)$ is the approximate private education transfer per student across age groups *x* in year *t*; $s_{a,t}$ is the actual number of student at age *a* in year *t*; and $n_{a,t}$ is the actual population by age reported by the Population Register of Taiwan.

Actual level of education expenditure, T^{e}_{t}, is reported by the FIES starting 1964. To estimate actual level expenditure before 1964, we compute the private consumption growth rate from the National Income Report. The details and statistics are reported in Appendix. The approximate age profile of private education transfer per student, $\hat{\tau}^{e+}_{a,t}(x,t)$, is the average age profiles of real expenditure per student estimated from 1978 to 1984. We derived this age profiles using FIES data from 1978-1984. The number of student, $s_{a,t}$, is obtained from the MOE, and An-Chi Tung from Academia Sinica, Taiwan.

Appendix B: Allocating Consumption 1951-1977

Household consumption is allocated to household members using micro-level data of FIES. However, we also need to estimate consumption of children for historical years when household survey data are not available. Therefore, we rely on reports of *FIES* on the total private consumption, National Income, and *FIES* data (1976-2003). Total private consumption is reported in the reports of *FIES* (1964-1977). Total consumption before 1964 is estimated by computing the consumption growth rate in the National Income report. To allocate total private consumption across age groups, we use estimated per capita consumption age profiles (excluding education), and shift the level of consumption by actual expenditure reported and population age distribution. Education inflows by age are estimated separately using actual number of students and actual level of education expenditures that are shown in equation (0.8).

The consumption of age *a* in year *t* is given by:

$$\hat{c}_{a,t} = (C_t - T_t^e) \times \frac{\tilde{c}_a(x,1978-1984) \times n_{a,t}}{\sum_a \tilde{c}_a(x,198-1984) \times n_{a,t}} + \hat{\tau}_{a,t}^{e+} \qquad (0.10)$$

$$\text{Per capita consumption} = \frac{\hat{c}_{a,t}}{n_{a,t}} \qquad (0.11)$$

where C_t is the actual reported total private consumption of Taiwan in year *t* ; $T^e{}_t$ is the total private education expenditure in year t, $\tilde{c}(x,t)$ is the per capita consumption across age groups *x* in year *t* and therefore $\tilde{c}_a(x,1978-1984)$ is the approximate consumption for age *a* in year *t*; $n_{a,t}$ is the population of age *a* at year *t*; and $\hat{\tau}_{a,t}^{e+}$ is the total private education inflows by age *a* in year *t* derived in equation (0.11).

Per capita consumption, $\tilde{c}_a(x,1978-1984)$, is the approximate age profile of consumption except education, which is estimated from years with FIES data 1976-1989. As described in equation (8), $\tau_{a,t}^{e+}$ is the derived using FIES data, number of students, and population age distribution. Details of allocation are described earlier in the education section. The remaining consumption, $oc_a(x,t)$, is the approximate age profile of other consumption, which is estimated from years with FIES data 1976-1989.

Appendix C: Projection of Upward Transfers

Deriving Projection of Upward Transfers Inflows (2004-2033)

Upward transfers are net familial transfers received by parents. Net familial transfers include net inter-household transfers received and intra-household transfers received. Historical estimates on upward transfers from 1978 throughout 2003 are estimated using the *FIES* data. The method of estimating these transfers is described earlier in the familial transfers section. This section describes the projection model and method we used to estimate upward transfers 2004 to 2033.

Consider a consumption-transfer model. In each period, consumption by age is constrained by income, private and public transfers, and saving. Income consists of both labor income and non-labor income. Thus, an individual age *a* in year *t* has the budget identity,

$$c(a,t) + s(a,t) = y(a,t) + \tau^{f}(a,t) + \tau^{g}(a,t) \tag{0.12}$$

where *c* is the individual consumption, *s* is the saving, *y* is income before transfer, τ^f is the familial transfer, and τ^g is public transfer.

Consumption at age *a* depends on income, transfers and dis-saving. An individual faces two dependencies when he consumes more than he produces: young and old. Transfers occur to reallocate resources from one age group to another to support this consumption in the dependency stages. Therefore, we assume consumption at age *a* is proportional to age. Also, consumption and income grow over time. We assume consumption at age *a* is proportional to the time trend. As a result, consumption is assumed to follow an invariant age profile over lifecycle, but to shift up with growth over time.

$$\begin{aligned} c_{at} &= f(a)W_t \\ W_t &= y_t + \tau_t^f + \tau_t^g - s_t \end{aligned} \tag{0.13}$$

where *f(a)* if the age profile of consumption and W_t is a measure of total income and transfers for year *t*.

Consumption is assumed to follow an invariant age profile over lifecycle, but to shift up with growth. Following Modigliani's and Deaton's work, labor income has an age profile that is invariant to changes in growth rate of the economy. That means age profiles of earnings are not changed by economic growth, so that economic growth or time trend affects the year, not the age patterns for any given year. If we consider the same set of assumptions for saving and transfers, net total familial transfer (upward transfers) is therefore

$$\tau_{at}^f = c_{at} + s_{at} - y_{at} - \tau_{at}^g \qquad \text{for } a>=50 \tag{0.14}$$

$$= h(a)X_t$$

$$X_t = c_t + s_t - y_t - \tau^g_t$$

where τ^f_{at} is the net familial transfer of age *a* in year *t*, *c* is the individual consumption, *s* is the saving, *y* is income before transfer, τ^g is public transfer, *h(a)* is the age profiles of transfers, and Xt is the year trend of ($c_t + s_t - y_t - \tau^g_t$).

Upward transfers τ^f_{at} are assumed to follow an invariant age profile over lifecycle, but to shift up with growth. We assume public policy (public cash transfers) remains the same as in year 2000 to 2003 in the projection. That is, the existing social cash assistance program is assumed to continue and shift up with income growth *g*[16]. Co-residency pattern is consistent with year 2000 to 2003 for the next 30 years[17]. The total upward transfers by age are given by:

$$\tau^f_{at} = \sum_a \tau^f_{a,2003} \times g \times \left(\frac{\tau^f_{a,2000-2003} \times n_{a,t}}{\sum_a \tau^f_{a,2000-2003} \times n_{a,t}} \right) \qquad (0.15)$$

where τ^f_{at} is the net familial transfers of age group *a* in year *t*, $\sum_a \tau^f_{a,2003}$ is the sum of net familial transfers across age groups in year 2003, *g* is the income growth rate, $\tau^f_{a,2000-2003}$ is the approximate age profile of net familial transfers between year 2000 and 2003, and $n_{a,t}$ is the population[18] of age group *a* in year *t*.

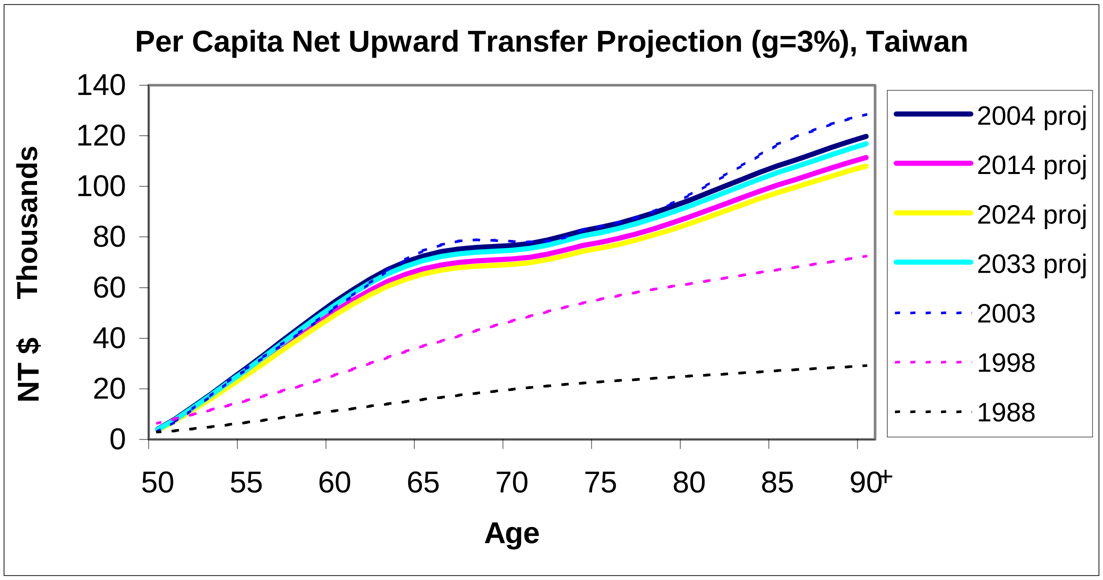
Using equation (0.15), we project upward transfers using different growth rates, g. Figures below present these projections with 3 percent and 5 percent growth rate respectively. A 3 percent growth rate gives relatively constant upward transfer projections over the next 30 years. A 5 percent growth rate gives a rising upward transfers over the next 30 years.

Using historical upward transfers between 1994 and 2003, we test the trend and growth during this period. Upward transfers had a growth rate of 5.64 percent.

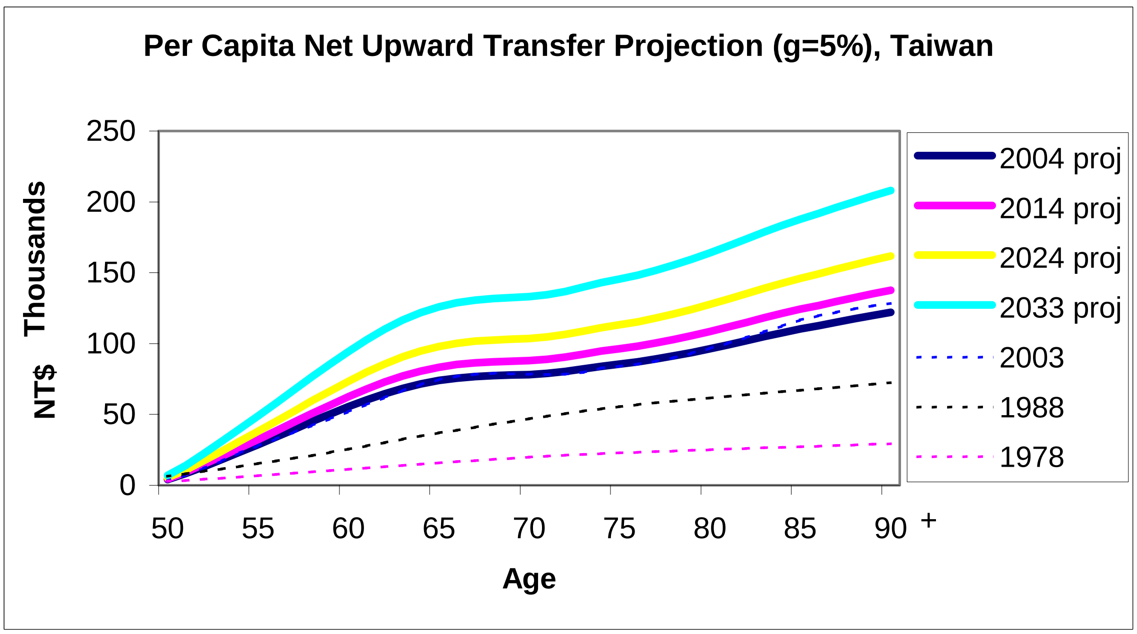
[16] If public transfers are substitutes (crowd out) of private transfers, and social cash assistance increases substantially in the next 30 years, our familial transfer projection may be overestimated. However, if social cash assistance program ceases or reduces the cash given, our transfer projection will be underestimated.

[17] If the percentage of elderly co-reside with adult children declines over the next 30 years, and elderly live independently, per capita intra-household transfers given to elderly may decrease. The decline in intra-household transfers may be or may not be substituted by inter-household transfers. Our projection may be upward or downward biased if the co-residency pattern changes.

[18] We use population projections provided by the Central of Economic Planning Department, Taiwan.



Per Capita Net Upward Transfer Projection (g=3%), Taiwan
NT $ Thousands
140
120
100
80
60
40
20
0
50
55
60
65
70
75
80
85
90+
Age
2004 proj
2014 proj
2024 proj
2033 proj
2003
1998
1988



Per Capita Net Upward Transfer Projection (g=5%), Taiwan
NT$ Thousands
250
200
150
100
50
0
50
55
60
65
70
75
80
85
90 +
Age
2004 proj
2014 proj
2024 proj
2033 proj
2003
1988
1978