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HOW HUNGRY IS THE SELFISH GENE?*

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We examine resource allocation in step-households in the United States and South Africa to test whether child investments vary according to economic and genetic bonds between parent and child. In the United States, households spend less on food when a child is raised by a non-biological mother. The reduction is identical for step, adoptive, and foster households, consistent with the hypothesis that genetic ties are the ones that binds. In South Africa, where food spending can be disaggregated, households spend less on milk, fruit and vegetables, and more on tobacco and alcohol, in the absence of a child's birth mother.

Family living arrangements have changed dramatically in the United States in a generation. Children in the middle of the century were, on the whole, born to married parents, with whom they lived until adulthood. In the United States today, over half of all children will live apart from at least one parent before reaching age 18 (Bumpass and Sweet, 1989), and a majority of these children will live with a step parent or foster parent.

Until recently, most academics were not very concerned about changes in children's family structures. During the 1970s, single parenthood was viewed as a *time of transition* (Ross and Sawhill, 1975) between divorce and remarriage, and step families were considered to be good substitutes for original two-parent families. Since the 1980s, however, several developments have challenged this optimistic view. First, declines in remarriage have lead to extended periods of high poverty for single mothers and their children, undermining the notion that single parenthood is a time of transition.

Second, a growing body of research has shown that children raised by only one of their parents are less successful than children raised by both their parents, when measured across a broad array of outcomes. Although some of these disadvantages are due to characteristics of the parents that predate divorce, there is mounting evidence that parent-absence itself plays at least some causal role in reducing children's life chances. (McLanahan and Sandefur, 1994; Haveman and Wolfe, 1994). A primary mechanism behind the negative association between parent absence and low achievement appears to be poverty and economic insecurity, which accompany family disruption and have long term negative consequences for children (Duncan and Brooks-Gunn, 1996).

Finally, and perhaps most surprisingly, many studies have shown that remarriage is not a panacea. Children who grow up in two-parent families consisting of a biological parent and a step parent have outcomes that more

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closely resemble those of children who grow up with only one parent than those of children raised by both their biological parents. Numerous studies show that children raised in step families are less successful, on average, than children raised by two biological parents (McLanahan and Sandefur, 1994; Amato and Keith, 1991; Hetherington *et al.*, 1998; Cherlin and Furstenberg, 1994). Children in step families are more likely to have academic problems, less likely to finish high school, less likely to attend college, and less likely to complete college than children in intact families. Children raised in step families also exhibit more behavioural problems (externalising and internalising), and they have more trouble finding and keeping a steady job. Girls from step families leave home earlier, become sexually active sooner, and are more likely to become teen mothers than girls from families with two biological parents. Finally, children from step families have poorer mental health and report more problems with relationships in adulthood than children from intact families. The size of these effects ranges from modest to moderate, and they are surprisingly consistent across different racial and ethnic groups and different social classes. Males and females are similarly disadvantaged by step family life, although in some instances girls react more negatively to stepfathers than boys. These differences are not attributable to differences in income across family type, since step and original two-parent families have very similar levels of income.

There may be several reasons why children in two-parent step families fare poorly. First, stepchildren may have been scarred by their biological parents' separation or divorce. Stress and conflict, which undermine the quality of parenting, occur more often in step families than in original two parent families, especially in newly formed families (Hetherington *et al.*, 1998). Residential movement, which cuts community ties and reduces social capital, also occurs more often in step families. Further, parental supervision and discipline are weaker, in part because of higher levels of stress, conflict, and residential movement.

Step families may also choose to invest less in children, which may also lead to poorer school performance, labour market attachment, and life chances. Step parents may not expect to receive transfers of money or time from step children in later life, and may therefore refuse to invest as heavily in non-biological children. (For an excellent summary of this literature, see Bergstrom, 1997.) A complementary explanation is that step parents may not care about sustaining someone else's genetic line, and may for this reason invest less heavily in non-biological children.

If one had information only on whether a child were the 'biological' offspring of a parent, it would not be possible to identify economic motives for investment—based on anticipated future returns of time and money—from biological motives. This paper will separate these effects by identifying different types of non-biological relationships which are thought to carry differing degrees of economic attachment, but identical amounts of genetic attachment. We use data from two parts of the world, the United States and South Africa, to examine whether expenditures on an important input in the production of child outcomes—food—vary according to the economic and genetic bonds between parent and child. We find, comparing food expenditure by family type, holding constant household size, age composition and income, that in those households in which a child is raised by an adoptive, step or foster mother, less is spent on food. In South Africa, where we can disaggregate food consumption more finely, we find that when a child's biological mother is the head or spouse of the head of household, the household spends significantly more on food, in particular on milk and fruit and vegetables, and significantly less on tobacco and alcohol. The genetic tie to the child, and not any anticipated future economic tie, appears to be the tie that binds.

1. Investments in Children

Although we know a good deal about the *outcomes* associated with living in a step family, we know very little about the *inputs* into these outcomes. We do not know, for example, whether step parents are as willing as biological parents to invest in children. Although no one has examined this question directly, there is some indirect evidence. That children in step families are less likely to attend college even after controlling for differences in test scores and family income suggests that stepparents may be less willing to subsidise college expenses (Beller and Chung, 1992; McLanahan and Sandefur, 1994).

Economists often motivate the time and money parents invest in children using intrahousehold allocation models in which parents reach some consensus decision about investments to be made in each child, subject to a budget constraint. (See Becker and Tomes (1976) and Behrman *et al.* (1982). Behrman (1997) provides an extensive review of this literature.) It is often assumed that parents care equally about each child's welfare (a point we will return to below). In this case of 'neutrality' or 'equal concern' for children, differences in investments may be the result of differences in children's endowments—by which is generally meant the predetermined factors that may or may not interact with investments made in the child, but which affect a child's earnings. Parents may invest differentially in children in a way that reinforces differences in their endowments, or they may compensate children with lower endowments (to equalise marginal utility of money, for example), depending on the preferences for equity and efficiency underlying the parents' utility function.

We can use this framework to discuss at least three different reasons why the nature of the relationship between parent and child (biological or nonbiological) may affect a parent's investment decisions. If step children differ systematically from biological children in their *endowments*—possibly due to the scarring left by earlier life events—then investments in step children may not be as productive. Alternatively, if non-biological children systematically receive a lower level of investment, it may be because the assumption of *child neutrality* breaks down when comparing biological and step children. Investments in a step child may be expected to yield a lower return, in terms of future allocations of time and money from the child to the parent, and for this reason a parent may not view a biological and step child with 'equal concern.' Finally, child neutrality may break down if a parent has greater concern for children with whom he or she shares genetic material.

The first two explanations—endowment differentials and differences in expected future returns—have been discussed extensively in the economics literature. The third explanation, protection of genetic material, has received little attention in economics, but has been much studied in other disciplines. Hamilton (1964*a*, *b*) hypothesises that the level of altruism between two people should depend upon the coefficient of their genetic 'relatedness.' Dawkins (1976), presenting work by Trivers (1972), describes parental investment as 'any investment by the parent in an individual offspring that increases the offspring's chance of surviving (and hence reproductive success) at the cost of the parent's ability to invest in other offspring.' (Dawkins, p. 133. See also Trivers 1985.)

There is a great deal of evidence on animals discriminating in favour of their own. For example, Blaffer Hrdy (1977), discussing social structure and family care among langurs, observes that 'though females do not normally allow another female's offspring to nurse, her own older offspring may return and suckle from time to time after the birth of a new sibling. Even if the female's own offspring has died or is not nursing at the time, she may refuse to allow a substitute to suckle.' (Blaffer Hrdy, p. 88)

Drawing on evidence from evolutionary biology, Daly and Wilson (1987) present numerous examples from bird and primate studies to show that this practice of *parental solicitude* is common, and that the ability to identify own offspring coincides with the potential for mixing broods. Where breeding conditions allow for early nest leaving, for example, the capacity to identify one's own eggs or offspring develops early. Where conditions promote late nest leaving or where mixing is not a problem, the ability to discriminate is delayed or does not occur. If eggs (or chicks) are deliberately switched prior to the onset of the discriminatory facility, the parent bird will protect the foreign egg (chick). If eggs (chicks) are switched after the onset of discriminatory power, the parent bird will refuse to care for the foreign egg (chick) (Beecher *et al.*, 1981).

In discussion of human behaviour, Daly and Wilson note that stepparents, driven by 'mating effort', may care for the child of another. However, they provide evidence that child abuse and child homicide are significantly correlated with the presence of a stepparent. This cannot be attributable to poverty, or to family size; incomes and family size are not significantly different between step and natural parent households. The age of the mother is a predictor of abuse, and this does vary between these types of households, but Daly and Wilson suggest that the effect of maternal age is not large enough to explain the differences found. They note that 'no confounding of step-relationships with chronic dispositional or personality variables can explain the excess risk, since abusive stepparents are almost always discriminative, abusing only the stepchildren while sparing their natural offspring within the same household.' (Daly and Wilson, p. 123).

In what follows, we distinguish explanations based on endowment differentials from those based on anticipated reciprocity, and those based on biological motives to invest, by identifying separately biological, step, adopted and foster children. As we will see below, to reconcile the differences in investments made in the non-biological children with a simple endowment explanation, it must be the case that on average all non-biological children of the adult woman in the household have equal endowment deficits. If economic reciprocity were the determining factor, we would expect differences in the treatment of non-biological children, based on anticipated future attachment. If biology were the only phenomenon at work, we should expect to see all non-biological children treated equally, but not as well as biological children.

2. Evidence From the United States

Our data from the United States come from the Panel Study of Income Dynamics (PSID), which contains information on all dyadic relationships within households between 1968 and 1985, allowing us to identify different parent-child relationships, including biological, adoptive, step, and foster relationships. We limit our analysis to this period in order to ensure that we have the most accurate relationship information possible. In order to isolate the impact of family structure, we restrict our attention to two-parent households. Food expenditure information was not collected in the PSID in 1973, which leaves us with seventeen years of food expenditure data over the period 1968 to 1985. A detailed description of our data is presented in Appendix 1.

Table 1 presents information for all children in the file over this period, in column one, and for children in two-parent households for whom the relationship between child and parent is known for every child in the household, in columns two and three. It is the latter set of households that we analyse below. We present information separately for the PSID-SRC two-parent sample in column 2, and for the PSID-SEO sample, which includes an original oversample of households in poverty, in column 3. Our results are robust to the inclusion/exclusion of the SEO sample. The vast majority of children in our two-parent sample live with both biological parents (90%), with the next largest group being those who live with one biological and one step parent (5% in the SRC sample, 7% in the SEO sample).

The SRC sample was nationally representative in 1968, and contained some step, foster and adopted children at that time. More children in the PSID became step, adopted and foster children as adults in the PSID divorced, or were widowed, and remarried.[1] In what follows, we will assume that the household formation decision is made first, and the decision on food expenditure is made subsequent to it. We obtain consistent estimates of the impact of house-

[1] There was attrition over this period in the PSID sample, and persons are more likely to have exited at the time a marriage dissolved, or a job was lost, or a household moved (Fitzgerald *et al.*, 1998). However, Fitzgerald *et al.* find the effects of these variables on attrition to be small (measured by contribution to R^2). There is no reason to believe that selection into the sample will induce correlation between explanatory variables and unobservable variables in the food equations below.

Table 1.

Children's Family Structures, US Data PSID 1968–1985

Percentage of children living with parents of this type:	All children SRC sample	Children in 2-parent households SRC sample	Children in 2-parent households SEO sample
Mother-biological, Father-biological	57.11	90.32	90.66
Mother-adoptive, Father-adoptive	1.60	2.55	0.35
Mother-foster, Father-foster	0.18	0.28	0.53
Mother-biological, Father-adoptive	0.83	1.31	0.67
Mother-adoptive, Father-biological	0.01	0.02	0.02
Mother-biological, Father-step	2.73	4.01	6.04
Mother-step, Father-biological	0.67	0.98	1.03
Mother-biological, Father-foster	0.24	0.36	0.65
Mother-foster, Father-biological	0.04	0.04	0.04
Mother-adoptive, Father-step	0.03	0.04	0.00
Mother-step, Father-adoptive	0.02	0.03	0.00
Mother-adoptive, Father-foster	0.03	0.05	0.00
Mother-foster, Father-adoptive	0.01	0.01	0.00
Mother-foster, Father-step	0.00	0.00	0.01
Mother-biological, Father-unknown	0.05		
Mother-step, Father-unknown	0.01		
Mother only, biological	11.78		
Father only, biological	0.75		
Mother only, adoptive	0.21		
Father only, adoptive	0.02		
Mother only, step	0.01		
Father only, step	0.01		
Mother only, foster	0.14		
Father only, foster	0.04		
Mother only, unknown	0.04		
Father only, unknown	0.00		
At least one parental relationship 'unclear'	23.44		
Number of observations	59,008	36,294	24,587

Sample in column 1 contains information on parent-child relationships for children in the (nationally representative) PSID-SRC households from 1968–85. Column 2 restricted to children in the SRC sample in two-parent households for whom complete relationship information is available for all people living in the same Family Interview Number (FIN) unit in a given year. Column 3 restricted to children in two-parent SEO (poverty oversample) for whom complete relationship information is available. All children in a family are excluded if a parent's FIN is missing for any children in the household. Individual children are excluded if their FIN is missing (which would be due to non-response in a given year), or if the child is not living with any parents.

hold structure on food expenditure, as long as there are no omitted variables that determine both household structure and food expenditure. (For example, we rule out the possibility that step, adoptive, and foster mothers are systematically more likely to be troubled in a way that causes them to purchase less food than biological mothers would purchase.) We control for many determinants of food expenditure that vary with the type of parent (age, education, household income, race), in the hope of limiting the scope for omitted variables to bias our results. Our results are robust to the inclusion (exclusion) of these controls. However, the possibility remains that our results are due to something unobservable that varies systematically with type of mother observed in the household. If there are such variables, it would be intriguing to uncover them. Whether or not this is the case, the result remains that, for some reason, children living apart from their biological mothers live in households where systematically less is spent on food.

There may be many relationships between children and adults living under one roof at any given time. For example, if a woman marries a man who has custody of a biological child from a previous relationship, and the man and woman subsequently have a child together, the younger child will be living with two biological parents, and the older child will be living with a biological father and step-mother. PSID food expenditure data are available only at the household level, and our estimation strategy must be able to account for all of the relationships that exist simultaneously within each household. To accomplish this, in our regression analysis we control for the number of children in the household and, separately, for the number of children with a step mother in the household, the number with an adoptive mother, and the number with a foster mother (the number with a biological mother will be the omitted category). The same holds for fathers: we control separately for the number of children with an step, adoptive, and foster father.

We provide information about households, stratified by household type, in Table 2. This table presents mean characteristics for households in which at least one child has a biological mother (column one), independent of the total number of children in the household; for households in which at least one child has an adoptive mother (column two); at least one child has a step-mother (column three); or at least one child has a foster mother (columns four and five). In the example given above, a household with one child living with his biological mother and one with his step mother, the household's descriptive information would enter the averages in columns one and three of Table 2.

In all of our analysis, foster parents are divided into two types. The PSID allows an adult to identify him- or herself as helping to raise a child in the household. Such an adult is identified by the PSID as a 'foster parent' if the adult is living with, but not married to, the biological, step or adoptive parent of that child. We label this type of child fostering as 'type-1' fostering, and distinguish it from those cases in which *both* parents are foster parents, which we refer to as 'type-2' foster parents.

Household size, composition and characteristics vary with family structure. On average, households with step-mothers are larger, with roughly four-tenths of an extra household member (4.55 versus 4.12), relative to households with biological mothers. The extra household member tends to be a child—on average there are 2.55 children in step-mother households, versus 2.11 in biological mother households—and, in particular, an older child. (There are 0.40 extra children aged 13 to 18 in step-mother households, relative to the case of biological mothers.) Step-mothers are quite a bit younger than biological mothers (31.6 versus 34.9 years old). This is true even though the head of household is on average the same age in these two types of households (37.9

Table 2.

Household Characteristics by Parent Classification

Panel A: US Data PSID-SRC 1968–85

Sibship size and household characteristics in two-parent households in which at least one child has a biological mother (column one); an adoptive mother (column two); a step-mother (column three); a type-1 foster mother (column four); or two foster parents (column five).

	Biological Mother	Adoptive Mother	Step Mother	Type-1 Foster Mother	Type-2 Foster Mother
Number of children	2.11	1.84	2.55	2.27	2.39
Number of children 0–5	0.62	0.38	0.37	0.40	0.32
Number of children 6–12	0.72	0.70	0.98	0.93	0.55
Number of children 13–18	0.56	0.59	0.97	0.80	1.08
Number of children 19+	0.22	0.18	0.22	0.13	0.45
Number of biological children	2.08	0.47	1.16	0.80	1.08
Family size	4.12	3.87	4.55	4.27	4.44
Head's education < 12 years	0.21	0.25	0.30	0.00	0.47
Head's education = 12 years	0.38	0.37	0.35	0.53	0.33
Head's race = white	0.93	0.93	1.00	1.00	0.70
Household real income ($1982)	33,510	34,483	40,222	34,170	31,150
Head's age	37.7	44.8	37.9	37.6	47.8
Wife's age	34.9	41.4	31.6	35.7	44.9
Head's annual hours worked	2,242	2,285	2,320	2,100	1,928
Wife's annual hours worked	732	645	1,117	894	747

'Foster type 1' refers to a household with one biological, adoptive or step-parent, in which the other adult in the household acknowledges raising the child, but is not married to the child's biological/adoptive/step parent.
'Foster type 2' refers to a household with a foster mother and a foster father.

versus 37.7 years old). Step-mothers work more hours than do biological mothers (1,117 hours annually compared to 732), and the total household income in step-mother households is markedly higher ($40,222 in 1982 dollars, relative to $33,510 for biological mother households). In summary, households where at least one child lives with a step-mother have on average higher household incomes, younger mothers who work a greater number of hours, and more teenage children, than do households with biological mothers. Some of these factors would tend to lead to greater food consumption at home (higher income, more teen-aged children), and some to lower food consumption at home (mothers who work more hours).

In our regression analysis, we include controls for a wide range of household characteristics that may determine food expenditures and that may vary between household types. These include information on total household income; the hours worked annually by the head and wife; indicators that the household head has less than a high school degree, that the head has exactly a high school degree, and that the head is white; age of the household head and wife; the value of the household's food stamps; household's size, size squared and size cubed; information on the children in the household, in total and by age category (0–5, 6–12, 13–18); and the information on child-parent relationships discussed above.

2.1. *Estimation*

To inform our regression analysis, we ran locally weighted (Fan) regressions of food expenditure against total household income, separately by households with differing numbers of children. The results are presented in Fig. 1, where we see food expenditure increasing, possibly at a decreasing rate, with total household income. An increase in the number of children shifts the intercept of the food expenditure-income relationship, but does not appear to influence its slope. In what follows, we regress home food expenditure on total household income and its square, and the number of children in the household, and the number of children by age category, together with information on household family relationships.

Table 3 presents our results for the PSID. The dependent variable in columns 1 to 4 is total expenditure on food consumed at home, including food stamps, in real (1982) dollars. All regressions presented in the paper estimate robust standard errors that allow for correlation in the residuals of observations that share the same Family Interview Number (FIN) for 1968. (These will be households that branched from the same original household surveyed in 1968.)

The first eight rows provide information on the importance of household structure. Because we control for the number of children in the household and, separately, for the number of children of each type, the coefficients on household structure have a straightforward interpretation. The coefficients on adoptive, step and foster children of the mother answer the question: holding

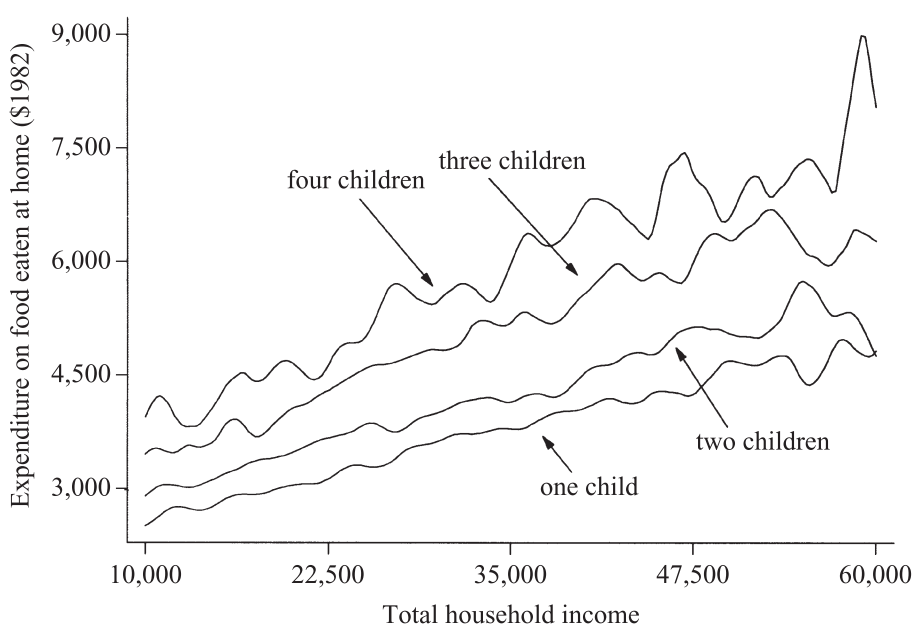

Fig. 1. *Food Expenditure in Two Parent Households PSID-SRC 1968–85*

Table 3.
Food Consumed PSID 1968–85

	Dependent Variable: Real food expenditure, home consumption				Dep Var: Real food expenditure away from home	
	OLS SRC only [$4,305]	OLS SRC only [$4,305]	OLS SRC & SEO [$4,189]	OLS SRC & SEO [$4,189]	OLS SRC only [$701]	OLS SRC & SEO [$625]
Number children with adoptive mother	−184.46 (120.09)	–	−247.97 (115.64)	–	41.98 (64.54)	44.01 (58.76)
Number children with step-mother	−240.83 (121.48)	–	−232.13 (79.92)	–	0.72 (49.26)	−22.96 (29.31)
Number children with type-1 foster mother	−133.55 (241.91)	–	−262.23 (239.04)	–	88.86 (275.21)	122.81 (207.92)
Number children with type-2 foster mother	−343.31 (213.65)	–	−39.12 (166.42)	–	−79.55 (47.08)	−17.98 (43.52)
Number children adoptive, step, or foster mother	–	−225.06 (81.32)	–	−205.34 (62.26)	–	–
Number children with adoptive father	75.31 (92.18)	100.84 (79.59)	146.15 (92.04)	119.98 (72.27)	3.26 (40.73)	−5.85 (34.23)
Number children with step-father	−86.53 (57.62)	−87.09 (57.48)	−35.64 (37.77)	−37.90 (37.67)	−4.65 (23.03)	15.65 (14.59)
Number children with type-1 foster father	−422.49 (104.27)	−411.30 (99.94)	−259.01 (88.31)	−263.97 (85.28)	45.46 (107.73)	27.39 (55.65)
Food stamp value (1982 dollars)	0.280 (0.109)	0.281 (0.109)	0.362 (0.048)	0.361 (0.048)	−0.022 (0.017)	−0.017 (0.010)

Total household income (1982 dollars)	0.043	0.043	0.044	0.044	0.021	0.018
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Total household income^2 (10^{-6})	−0.133	−0.133	−0.135	−0.135	−0.022	−0.011
	(0.021)	(0.021)	(0.020)	(0.020)	(0.024)	(0.023)
Number of children aged 0–5	−165.07	−164.12	−116.61	−115.45	−25.57	−8.71
	(75.35)	(75.01)	(48.92)	(48.84)	(29.83)	(17.81)
Number of children aged 6–12	39.65	40.73	77.88	78.48	26.27	32.62
	(67.69)	(67.53)	(42.85)	(42.86)	(27.51)	(15.48)
Number of children aged 13–18	264.97	265.09	253.61	253.87	32.68	30.69
	(63.22)	(63.22)	(42.21)	(42.23)	(25.41)	(14.90)
R^2	0.8969	0.8969	0.8910	0.8910	0.5637	0.5403
F-test: restriction of equality on coefficients,		0.29		1.00		
different non-biological mothers		(0.8298)		(0.3916)		
		(p-val)		(p-val)		

Notes on Table 3: Variable means in square brackets. Robust standard errors presented in parentheses, estimated allowing for correlation between observations sharing a 1968 Family Interview Number (FIN). Variables included in all regressions are: Year indicators; Head's age; Wife's age; indicator variables for Head's education (less than high school, 12 years of school), and an indicator that head is white; number of children in the household; family size, size squared and size cubed; an indicator that wife does not work, Wife's hours of work, and interaction terms between Wife's hours of work and indicators that the Wife worked a low number of part time hours (no more than 800 hours per year), and an indicator that the Wife worked a high number of part time hours (800–1,400 hours per year). Number of observations in columns 1, 2 and 5 (1968–85, SRC) = 15,809; in columns 3, 4, and 6 (1968–85 SRC and SEO) = 24,660. Last row of the table presents F-tests for restricting the coefficients to be identical for step, adoptive, type-1 and type-2 foster mothers.

The sample is restricted to two-parent households for whom relationships between all parents and children in the same FIN-year are known. The following outliers were removed, which had no qualitatively or quantitatively important effect on results: households reporting food at home greater than $25,000 (1982 dollars) (9 household-years); households reporting total real incomes greater than $250,000 (9 household-years); households in which some children were reported with negative ages (70 children are reported with negative ages, leading to the removal of 199 children). The regressions have been re-run (results not reported here) restricting sample to households with 8 or fewer children and, separately, restricting sample to households with real household income less than $100,000, with no significant change in results. Results do not change when sample is restricted to the period 1972–85.

Results are also robust to instrumenting real household income and real household income squared using Head's annual hours of work, hours of work squared, and an indicator that the head of household is white.

constant the number of children in the household, by how much on average would expenditure on food be expected to change if a biological child of the mother were replaced by an adopted (or step or foster) child? In each case, the results in Table 3 suggest that food expenditure at home would be decreased by roughly \$200—about 5% of the average food budget. Moreover, the results in column 2 say that we cannot reject the hypothesis that the effect of replacing a biological child with a non-biological child is the same, whether the non-biological child is an adoptive, step or foster child of the mother. (An F-test of constraining the coefficients to be the same for different types of non-biological children of the mother is small and insignificant, $F = 0.29$, with a p-value of 0.8298). These results are robust to estimating the food expenditure equation for the SRC and SEO samples jointly (columns 3 and 4).

We find no robust pattern for non-biological children of the (male) household head. Replacing a biological child with an adopted child of the head results in an insignificant increase in spending on food, while replacing a biological child with a step child results in an insignificant decrease in spending on food. For the household head, only replacement with a foster child results in a significant decrease in expenditure on food.

Although step mothers work on average more hours than do biological mothers, our results are robust to inclusion (exclusion) of controls for mother's hours of work. Each of the regressions reported in Table 3 include an indicator that mother does not work (which has a positive and significant effect on home food consumption); mother's hours of work (which has a negative and significant effect on home food consumption); and mother's hours of work interacted with an indicator variable that she works between 0 and 800 hours per year, and mother's hours of work interacted with an indicator that she works between 800 and 1400 hours per year (neither of which has a significant effect on home food consumption).

A check on our results is provided by analysing whether family structure influences expenditure on food away from home. If the family structure variables were simply picking up income effects, then we would expect to see a similar pattern for food expenditure away from home. Alternatively, if non-biological children have a preference for eating out, we may be picking up differences in tastes if we look only at food consumed at home. Results for spending on food away from home are presented in columns 5 and 6 and show a very different pattern from that seen for food at home. The family relationship coefficients are small and insignificant. It does not appear that family structure variables are picking up income effects. Neither does it appear that mothers with non-biological children are spending more money on food away from home.

We have done additional robustness checks on the results that appear in Table 3. In one test, we limited the sample to households with eight or fewer children; in another, to households with incomes less than \$100,000; and in a third test, to the period 1972–85 because, in the earliest years of the PSID, it was not clear whether households were answering food expenditure questions net of their food stamp purchases. We have also compared our results to ones obtained if the sample is limited to households with biological and/or step children only. We have re-run our regressions with a full set of variables indicating the number of children in the household at every age (that is, the number of children aged 1 year, the number aged 2 years, etc.) through to age 18, to remove any issues associated with grouping children by age (Browning, 1992). The results were not different in any meaningful way from those presented here. Finally, we divided the sample along a number of dimensions and re-ran our regressions, to see whether the relationship between mothers and non-biological children were robust. We ran regressions by race (white, non-white); by total household income (less that $25,000 annually ($1982), and more than $25,000); and by education of the household head (less than a high school degree, and a high school degree or more). The results presented here are robust to all of these checks.[2]

We have also created variables for the mean number of years that step children of a woman have been living with her, and created similar variables for adopted children, and foster children by type of fostering, both for mothers and fathers. We added these variables to the regressions run in Table 3, to see whether the length of time living with a non-biological parent affected the connection between parent and child. Controlling for the number of step, adopted and foster children, the time-spent variables were jointly insignificant for mothers and fathers tested together, as were the variables for time spent with mothers, when tested alone.

The results in Table 3 cannot be explained by step and foster children eating more meals away from home with absent biological parents. If that were the explanation, we should expect to find no reduction in food expenditure for adopted children, and we should expect to find a significant effect for the head's step children.

We take two results away from Table 3. The relationship between the woman in the household (who traditionally would be buying the household's groceries) and the children in her household plays a decisive role in the household food budget. Non-biological children of the mother appear to reduce spending on food significantly, regardless of the type of non-biological tie that binds the mother to the child.[3]

In Section 1 we presented three possible explanations for differential treatment of non-biological children. Neither of the first two explanations—endowment differentials and differences in expected future returns—is easily reconciled with our results. If the differences in investments made in the non-biological children is due to an endowment differential, it must be the case

[2] The only change worthy of note was for non-white mothers. The coefficients on non-biological children of non-white mothers were still large and negative, but they were generally not significant at the 5% level.

[3] That a woman's relationship to the children influences expenditure on food while her husband's does not is consistent with a 'separate spheres' equilibrium, in which, in a non-cooperative marriage, division of labour is based on 'a distinct, gender-specific set of household activities'. (Lundberg and Pollak, 1993, p. 994.)

that on average all non-biological children of the adult woman in the household have equal endowment deficits. If parental investments were predicated on some expected future return, then we might see investments mirroring the bond the parents have with each child. In this case, it would seem likely that non-biological children who are expected to be closest to parents (say, adopted children) may be invested in more heavily than children with whom the bond is thought to be less strong (foster children). Step children might be thought to be somewhere in between adopted children and foster children on a spectrum of attachment. Step children may be close to their step parents, but may have multiple sets of parents, reducing the anticipated per-parent return on a given investment of time or money. The investment patterns we observe below do not reflect such gradations.

While we can say with some certainty that a woman's relationship to the children in her household has an effect on food spending in the United States, we cannot pinpoint where the reductions occur. It is possible that less food spending has positive effects on children, if the spending forgone were, say, on sugars and fats. As a test of the robustness of our results, and to see where the reductions occur, we turn to South Africa. In these data, we are able not only to test the relationship between family structure and food expenditure, but also to learn more about how the food budget is spent.

3. Evidence from South Africa

In South Africa, the economic and political 'logic' of the apartheid system led to the geographic separation of Africans from places of employment (primarily White farms and mines). This forced Africans to participate in a migrant labour system that separated parents from children for long periods of time. In South Africa today roughly 20% of African children aged 0 to 18 live apart from their biological mothers, and half live apart from their biological fathers.[4]

To assess the impact of living apart from biological mothers, we analyse data from the 1995 South African Income and Expenditure Survey, a nationally representative household expenditure survey collected as a companion to the annual October Household Survey. This is a large and rich data set; expenditure data were collected from 29,595 households, with complete household income information available for 20,695 of those households. Under the apartheid system, people were classified as belonging to one of four racial groups: African (also called Black), Coloured, Indian (also called Asian) and White. We restrict our attention to African and Coloured households, because Whites and Asians are economically so much more advantaged and socially so different from Africans and Coloureds. Median White household income per capita is roughly five times that for an African household.[5] Roughly one third

[4] Author's calculation using the 1995 October Household Survey, and weights provided therein.

[5] Author's calculation using weighted per capita income estimates from the 1995 Income and Expenditure Survey.

of all African households are three generation or 'skip' generation households, the latter referring to grandparents raising grandchildren with both parents absent. Only 3% of White households are three or skip-generation households.[6] We have complete expenditure, income and education data for 18,433 African and Coloured households, and it is this set of households we analyse below.

These data provide detailed information on household consumption, but they are not as specific in the information they provide on dyads within the household. We know if a child's biological mother is present in the household, and whether she is the spouse or head of household, and we use this information in what follows. In South Africa, one would expect a woman who is head or spouse of head of household to control expenditures on food, and it will prove important to distinguish between a mother who is simply present and one who controls the household budget.

Table 4 provides information on the household characteristics of children living with their biological mothers, when the mothers are either head or spouse of the head of household (column 1); when mothers are present, but not head or spouse (column 2); and when mothers are not present (column 3). Households in which a child's mother is head or spouse tend to have fewer children, and fewer members overall. If a woman is not head or spouse of head, it is most likely that she is living with her husband's family (generally his parents), in which case we would expect to find more adults in the household and, on average, older adults, which has the effect of increasing the age of the

Table 4.
Household Characteristics by Status of Mother
South African Data OHS 1995

Sibship size and household characteristics of children living with biological mother who is head or spouse of head (column one); with biological mother who is not head or spouse of head (column two); and without biological mother (column three). African and Coloured Children Only

	Biological mother is head or spouse	Biological mother present, but not head or spouse	Biological mother not present
Number of children 0–18 in household	3.67	4.30	3.96
Number of children 0–5	1.00	1.55	0.98
Number of children 6–12	1.47	1.64	1.62
Number of children 13–18	1.19	1.11	1.37
Household size	6.23	8.28	6.74
Head's race = African	0.86	0.86	0.89
Maximum educational standard (any household member)	7.01	7.73	7.10
Age of head of household	43.44	59.11	56.10
Household total income	13,980	14,851	12,668
Number of observations	23,108	7,662	8,059

[6] Case and Deaton (1998) Table 2, drawn from the 1993 SALDRU survey.

household head. In our regression analysis, we control for household characteristics that may be correlated with household structure, including household income and income squared, household size and age composition, in addition to a full set of province indicators, age of the household head, age of the head squared, indicators that the head is African and the head is male, and a full set of indicators for maximum years of completed education among household members.

Regression results for South Africa are presented in Table 5, where we present results for expenditure on food at home, in total and by category for milk, cheese and eggs; fruit and nuts; jams and sugars; vegetables; and cereals. We control for the number of children aged 0–5, 6–12 and 13–18, and separately for the number of children aged 0–5, 6–12, and 13–18 with a biological mother present. The coefficient on the number of biological children reflects the amount by which expenditure on the good would be expected to change, holding all else constant, if a non-biological child in this age group were replaced by a biological child. Overall spending on food would increase on average by roughly seven rand (about 2%), if a biological child aged 0–5 were to replace a non-biological child in the same age group. We can discern what this expenditure goes toward, by looking at expenditure groups separately. Two extra rand are spent on milk, cheese and eggs, increasing the budget on dairy products by roughly 6%. One extra rand is spent on fruit and nuts (an 8% increase). One and a quarter extra rand is spent on jams and sugars, and one and a half on vegetables.

Table 5 also shows that when young children live with their biological mothers, the household spends significantly less on tobacco (about 5% less), less on alcohol (about 15% less), and more on infant and children's clothing and footwear. For children aged 6 to 12, the presence of the child's biological mother is also positively and significantly correlated with expenditure on education.

Table 6 distinguishes biological mothers who are the head or spouse of head of household from those who are not, in order to test whether the correlation between mothers' presence and expenditure patterns is due to mothers' decisions to spend more on the children, or some other factor. When women live with their husbands' parents, they tend to have less voice in spending decisions. If the increased spending we observe in Table 5 is attributable to mothers' decisions, the increased spending on biological children should be more pronounced when the mother is head or spouse. The results in Table 6 are consistent with this argument: it is not a mother's presence, but her control over resources, that leads to greater spending on food for her biological children. The results observed in Table 5 are more pronounced for almost every spending category for biological mothers who are heads or spouses of heads. In contrast, in those households in which a child's biological mother is present, but is not head or spouse, resource allocation is not significantly different from what it is in households where the child's biological mother is not present at all. We take this finding as further evidence that the spending on biological children is an active response of the child's mother.

Results in Tables 5 and 6 also suggest that it is the youngest children in the household for whom a biological mother's resource control appears to have the most important effect. By the time children are teenagers, biological and non-biological children do not have significantly different effects on resource allocation. We return to the PSID in Table 7, and find the same pattern there. In a specification similar to that used for South Africa in Table 5, we find that the presence of a child's biological mother increases food spending for children aged 0–5 and 6–12. By age 13, whether the child is the biological or non-biological child of the woman in the household appears not to affect resource allocation.

4. Conclusions

The presence of a child's biological mother appears to increase expenditure on an important input into the production of healthy children—food. In South Africa, the presence of a child's biological mother increases expenditure, in particular, on healthy foods. The benefits are limited to households in which mothers have control over food expenditure, and they are limited to children in the youngest age groups. In this way, biological mothers protect their offspring during the children's most vulnerable years.

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Appendix 1

A.1. *Identifying parent-child relationships in the PSID*

In order to identify children who lived with biological parents, adoptive parents, step parents, or foster parents during the years between 1968 and 1985, we adopted the following steps:

Step 1.

We downloaded the 1968–1985 Relationship file (file name: 85relhis.dat, created on 7/10/96) from the PSID web site (http://www.isr.umich.edu/src/psid/). The Relationship file contains information about the relationships, on a pair-wise basis, of all individuals who were ever part of, or derived from, the same original 1968 household. In total, the Relationship file contains 426,608 pairs of the relationship over the 18 years, from 1968 to 1985.

Step 2.

The 1968–1985 Relationship file contains two sources of information about the relationships between parent and child. One is the 1985 Marital and Childbirth History file (HIS); the other is the 1968–1985 Relationship-to-Head file (RTH). We identified all individuals who were ever a biological, adoptive, step, or foster child during the years from 1968 to 1985 using the information from the HIS file. If the information is

Table 5.
Expenditure Patterns in the OHS 1995

OLS Regressions with robust standard errors given in parentheses

[*Means of dependent variables provided in square brackets*]

	Food (at home) [361.29]	Milk/ Cheese/ Eggs [30.99]	Fruit and Nuts [12.84]	Jams and Sugar [30.37]	Vegetable [38.90]	Cereals [105.53]	Alcohol at home [12.51]	Tobacco [18.09]	Shoes infants [3.10]	Shoes Children [107.56]	Infants Clothing [17.53]	Clothing children [310.34]	Education (Total) [154.99]
Number children aged 0–5 with a biological mother	6.55	1.95	0.938	1.24	1.43	−1.37	−2.04	−0.931	1.45	6.07	3.43	18.61	−14.72
	(3.44)	(0.650)	(0.363)	(0.363)	(0.594)	(1.30)	(0.828)	(0.530)	(0.629)	(4.13)	(2.07)	(11.26)	(11.84)
Number children aged 6–12 with a biological mother	5.23	0.212	0.257	0.535	0.783	0.809	−0.657	−0.370	−0.363	9.29	0.328	29.03	20.38
	(2.95)	(0.507)	(0.294)	(0.296)	(0.427)	(1.14)	(0.612)	(0.467)	(0.449)	(3.49)	(1.16)	(10.31)	(9.99)
Number children aged 13–18 with a biological mother	−5.91	−0.321	−0.031	−0.120	−0.440	−2.51	−0.437	−0.683	0.491	6.38	−0.464	0.016	9.82
	(3.72)	(0.571)	(0.317)	(0.356)	(0.534)	(1.43)	(0.588)	(0.644)	(0.578)	(4.37)	(1.17)	(12.48)	(10.63)
Number children aged 0–5 in the household	3.67	2.96	1.02	−0.891	−0.576	1.92	−0.241	−3.01	3.02	1.24	24.35	3.73	−8.23
	(3.33)	(0.536)	(0.295)	(0.354)	(0.594)	(1.27)	(0.721)	(0.561)	(0.396)	(3.62)	(1.61)	(10.42)	(11.34)

Number children aged 6–12 in the household	2.52	0.596	0.508	−0.127	−0.417	1.61	−0.849	−3.58	−0.379	22.18	−1.69	55.70	−2.55
	(2.96)	(0.462)	(0.298)	(0.310)	(0.498)	(1.08)	(0.556)	(0.471)	(0.323)	(3.34)	(1.03)	(9.49)	(9.73)
Number children aged 13–18 in the household	9.61	1.03	0.348	0.404	−0.036	4.23	−1.38	−2.53	0.148	34.00	−0.756	111.01	34.98
	(3.58)	(0.514)	(0.282)	(0.343)	(0.574)	(1.37)	(0.615)	(0.527)	(0.362)	(4.21)	(1.14)	(12.05)	(10.10)
Household size	11.95	−0.206	−0.503	1.66	1.89	6.59	0.109	2.55	−0.305	1.36	−1.06	10.89	12.63
	(1.64)	(0.249)	(0.143)	(0.181)	(0.281)	(0.573)	(0.309)	(0.295)	(0.191)	(1.63)	(0.523)	(4.15)	(5.48)
Total household income (10^3)	19.8	2.11	1.01	1.22	1.81	4.60	1.08	0.937	0.361	7.26	1.49	18.02	0.851
	(0.882)	(0.125)	(0.087)	(0.090)	(0.181)	(0.289)	(0.248)	(0.166)	(0.071)	(8.79)	(0.259)	(2.74)	(3.37)
Total household income^2 (10^6)	−0.157	−0.017	−0.004	−0.013	−0.013	−0.052	−0.008	−0.008	−0.007	−0.023	−0.018	0.010	0.261
	(0.027)	(0.003)	(0.003)	(0.003)	(0.006)	(0.008)	(0.008)	(0.005)	(0.002)	(0.027)	(0.007)	(0.086)	(0.110)

Notes: Robust standard errors appear in parentheses, where allowance has been made for correlation between observations from the same sampling cluster. Also included in the regressions are a full set of province indicators, age of household head, age of head squared, indicators that head is African and head is male, and a full set of indicators for maximum years of completed education among household members. 19,182 African households were surveyed in OHS95, of which 18,609 reported information in the expenditure survey. There were 3,833 Coloured households surveyed in OHS95, of which 3,757 reported information in the expenditure survey. Of these 22,366 households, 22 were missing information on education of household members, and 3,908 were missing information on total household income. Observations were removed if household expenditure exceeded household income by more than R62,000 (6 cases). Total sample size = 18,433. Results in this table are robust to instrumenting total household income and income squared using total household expenditure and expenditure squared, to limit the effect on results of measurement error in household income.

Table 6.

Comparing Biological Mothers who are Heads and Spouses With Biological Mothers who are Not

OLS Regressions with robust standard errors given in parentheses

[*Means of dependent variables provided in square brackets*]

	Food (at home) [361.29]	Milk/ Cheese/ Eggs [30.99]	Fruit and Nuts [12.84]	Jams and Sugar [30.37]	Vegetables [38.90]	Tobacco [18.09]	Infants Shoes [3.01]	Children Shoes [107.56]	Infants Clothing [17.53]	Children Clothing [310.34]	Educ (Total) [154.99]
Number children aged 0–5 with a biological mother head or spouse	8.44 (4.82)	2.23 (0.892)	1.32 (0.463)	1.52 (0.472)	1.39 (0.724)	−1.44 (0.704)	2.32 (0.697)	10.60 (5.19)	12.55 (2.44)	24.62 (14.38)	−32.54 (14.60)
Number of children 6–12 with a biological mother head or spouse	1.40 (3.37)	−0.373 (0.593)	0.041 (0.323)	0.459 (0.338)	0.639 (0.504)	−0.023 (0.488)	−0.447 (0.449)	8.77 (4.10)	−1.05 (1.28)	31.73 (11.99)	7.78 (11.31)
Number of children 13–18 with a biological mother head or spouse	−7.50 (3.94)	−0.201 (0.589)	−0.148 (0.328)	−0.367 (0.396)	−0.955 (0.593)	−0.950 (0.697)	0.482 (0.601)	5.38 (4.88)	−1.31 (1.26)	−3.09 (14.74)	12.34 (11.85)
F-test of joint significance of vars: number of children with bio mother head or spouse (p-value)	2.32 (0.0734)	2.15 (0.0921)	3.25 (0.0210)	5.64 (0.0007)	2.66 (0.0465)	3.01 (0.0292)	4.08 (0.0067)	5.30 (0.0012)	9.22 (0.0000)	4.91 (0.0021)	2.02 (0.1085)

Children aged 0–5 with a bio mother in the hhold, not head or spouse	3.12 (5.03)	0.452 (0.871)	0.563 (0.455)	0.406 (0.473)	−0.024 (0.810)	−0.750 (0.800)	1.24 (0.592)	6.53 (5.71)	13.14 (2.86)	8.34 (16.00)	−24.13 (17.19)
Children 6–12 with a bio mother in the hhold, not head or spouse	−8.48 (4.54)	−1.34 (0.729)	−0.450 (0.426)	−0.121 (0.470)	−0.276 (0.702)	0.786 (0.701)	−0.112 (0.322)	−0.671 (5.98)	−2.25 (1.74)	7.16 (16.07)	−31.08 (13.49)
Children 13–18 with a bio mother in the hhold, not head or spouse	−7.29 (7.34)	0.296 (1.11)	−0.452 (0.584)	−0.926 (0.636)	−2.06 (1.03)	−1.01 (1.00)	0.132 (0.657)	−3.07 (7.93)	−1.72 (2.48)	−9.57 (22.05)	0.607 (21.19)
F-test of joint significance of vars: children with bio mother in hhold, not head or spouse (p-value)	2.08 (0.1004)	1.16 (0.3235)	1.11 (0.3434)	0.90 (0.4392)	1.68 (0.1703)	0.73 (0.5355)	2.10 (0.0988)	0.48 (0.6949)	7.05 (0.0001)	0.26 (0.8526)	4.54 (0.0035)

Notes: Robust standard errors appear in parentheses, where allowance has been made for correlation between observations from the same sampling cluster. Also included in the regressions are household size, total household income and income squared, number of children 0–5, number of children 6–12, and number of children 13–18, a full set of province indicators, age of household head, age of head squared, indicators that head is African and head is male, and a full set of indicators for maximum years of completed education among household members. 19,182 African households were surveyed in OHS95, of which 18,609 reported information in the expenditure survey. There were 3,833 Coloured households surveyed in OHS95, of which 3,757 reported information in the expenditure survey. Of these 22,366 households, 22 were missing information on education of household members, and 3,908 were missing information on total household income. Observations were removed if household expenditure exceeded household income by more than R62,000 (6 cases). Total sample size = 18,433. Results in this table are robust to instrumenting total household income and income squared using total household expenditure and expenditure squared.

Table 7.

Food Consumption in the PSID Using the Specification for the October Household Survey

	1968–85 OLS SRC	1968–85 OLS SRC and SEO
Number of biological children of the mother aged 0–5	293.91	259.22
	(149.27)	(124.63)
Number of biological children of the mother aged 6–12	162.35	132.12
	(93.94)	(74.61)
Number of biological children of the mother aged 13–18	52.98	117.25
	(123.77)	(94.63)
Number of children in household aged 0–5	−263.51	−251.32
	(130.78)	(108.04)
Number of children in household aged 6–12	−145.38	−52.11
	(99.76)	(76.54)
Number of children in household aged 13–18	100.65	91.39
	(125.51)	(96.16)
Number of observations	15,809	24,660

Notes on Table 7: Robust standard errors presented in parentheses, estimated allowing for correlation between observations sharing a 1968 Family Interview Number (FIN). Also included in both regressions: head of household's age, wife's age, family size, family size squared, family size cubed, number of biological children of the head aged 0–5, 6–12, 13–18, real household income, real household income squared, head's annual hours of work, indicator that wife does not work, works part-time (less than 800 hours annually), works part-time (800–1,400 hours annually), wife's annual hours of work, indicator that head is White, head has less than a high school degree, head has exactly a high school degree, year indicators. Indicator of SEO status included in column 2. F-test on the number of biological children aged 0–5, 6–12, 13–18, of the head is 2.03 (p-value = 0.1081) in column 1, and 0.89 (p-value = 0.4449) in column 2. The sample in column 1 is restricted to two-parent households in the PSID SRC sample for whom relationships between all parents and children in the same FIN-year are known. Column 2 includes the PSID-SEO sample.

missing on the HIS file but not on the RTH file, we used the RTH file information. If the information on the HIS file contradicts that on the RTH file, we used the information from the HIS file. We also coded information for children whose relationship to a parent is unclear or unknown. Of the 426,608 pairs of relationships on the Relationship file, we identified 17,828 pairs of parent-daughter relationships (13,119 from HIS and 4,709 from RTH) and 18,771 pairs of parent-son relationships (13,657 from HIS and 5,114 from RTH). In aggregate, we identified 19,057 children (9,276 daughters and 9,781 sons).

Step 3.

From those children identified in Step 2, we located their biological, adoptive, step, and foster parents on the Relationship file. One child had two foster mothers during 1976 and 1978, one child had two foster mothers in 1982, one child had two biological fathers in 1985, and one child had two step fathers in 1983. For these children we assigned parent status based on the 68–85 Individual Level Information File. Moreover, 58 parents were identified as both 'biological parent' and 'parent with unclear or unknown status'. These parents were treated as biological parents for all of the years.

Step 4.

We merged children identified in Step 2 with parents (whose relationships to children were adjusted in Step 3) using the 1968–1985 Individual-Level file. By doing so, we were able to obtain the child's and parent's Family Interview Numbers (FIN), which we used to determine whether children and parents lived in the same household. A child and his or her parent(s) were defined as living together in the same household in the particular year if the child and his or her parent(s) shared the same FIN in that year.

Step 5.

By comparing children's FINs and parents' FINs during the years 1968 and 1985, we found 38 children shared the same FIN with a biological parent and a second same-sex parent (step, adopted or foster) in the same year. We treated these children as living with the biological parent. We then created 48 types of living arrangement for each child in each year by the type and gender of the parents.

A.2. *Food expenditure questions in the PSID*

In each year except 1973, the PSID asked questions about food consumption. The questions are worded:

'How much do you (your family) spend on the food that you use at home in an average week?'

and

'About how much do you (your family) spend in an average week eating out, not counting meals at work or at school?'

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