

**TESTING FOR BOY-GIRL DISCRIMINATION WITH HOUSEHOLD  
EXPENDITURE DATA: RESULTS FOR PAPUA NEW GUINEA**

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Running Title "Boy-girl discrimination in Papua New Guinea households"

**ABSTRACT:** Discrimination in the allocation of goods between boys and girls is tested for, using expenditure data from households in Papua New Guinea. Deaton's (1989) method of identifying demographic effects on adult goods expenditure is used to indicate gender bias. Valid adult goods are found to be adult clothing, alcohol, gambling, meals eaten away from home, and tobacco. Adding a young boy to a household reduces expenditure on adult goods by as much as would a one-third reduction in total outlay per member, but young girls have no effect on adult goods expenditure. The difference in these point estimates is estimated imprecisely, and falls just outside conventional levels of statistical significance.

## Testing for boy-girl discrimination with household expenditure data:

### results for Papua New Guinea

#### I. INTRODUCTION

Deaton (1989) provided a method for using household expenditure data to test for discrimination in the allocation of goods between boys and girls. Testing for unequal allocations of expenditure within the household helps determine whether *household* level data understates the true number of *persons* falling below the poverty line (Haddad and Kanbur, 1990). There is also considerable interest in the issue of sex bias in developing countries (Sen, 1984).

The intuition behind Deaton's method is that there are certain goods that are not consumed by children, e.g., adult clothing. The addition of a child to the household reduces the income available to be spent on these "adult goods" because the child has to be fed and clothed but adds no income to the household. Evidence for gender bias is found by (statistically) answering the question: Is the reduction in spending on adult goods as big when there is a girl as when there is a boy?

The objective of this paper is to use Deaton's method to test for boy-girl discrimination in Papua New Guinea (PNG). There is evidence that women and girls in PNG are disadvantaged in schooling (Gannicott and Avalos, 1994) and health (Groos and Garner, 1988). For example, in a sample of urban children only 12.3 percent of boys but 18.7 percent of girls were underweight, as compared with international standards (Gibson, 1996). However, these standards, which are based on U.S. children, may not apply equally to boys and girls in PNG. Hence, another method of testing whether PNG

households direct an equal amount of resources to girls as they do to boys may be helpful.

## II. METHODS AND DATA

The first step is to identify the set of adult goods. Deaton, Ruiz-Castillo and Thomas (1989) use the linear model

$$p_i q_i = b_{0i} + b_{1i} x_G + \sum c_{ij} n_j + \mathbf{d}_i \bullet \mathbf{z} + v_i \quad 1$$

where  $p_i q_i$  is expenditure on candidate adult good  $i$ ,  $x_G$  is total expenditure on adult goods,  $n_j$  is the number of people in each of eight age and gender classes,  $\mathbf{z}$  is a vector of control variables, and  $v_i$  is a random error. Children affect only the total expenditure allocated to adult goods, not the allocation within the adult goods group once total group expenditure is given. Therefore, if good  $i$  is a genuine adult good, the age and gender of children should play no part in equation (1), which can be tested by an  $F$ -test on the estimated  $c_{ij}$  coefficients. Estimation is by instrumental variables because  $x_G$ , which is the sum of the  $p_i q_i$ , may not be exogenous. Total expenditure  $x$  acts as the instrument for  $x_G$ .

Once the list of adult goods has been finalised, "outlay equivalent ratios" are estimated. For any normal commodity  $i$  and demographic category  $r$ , the outlay equivalent ratio  $P_{ir}$  is

$$P_{ir} = \frac{\partial(p_i q_i) / \partial n_r}{\partial(p_i q_i) / \partial x} \bullet \frac{n}{x} \quad 2$$

which gives the effect of an additional person of type  $r$  on the demand for good  $i$ , measured as the percentage change in outlay (expenditure) per person that would have been necessary to produce the same effect on demand. These ratios can be calculated from any estimated Engel curve. Following Deaton (1989), the Engel curve used here is specified as

$$w_i = \frac{p_i q_i}{x} = \mathbf{a}_i + \mathbf{b}_i \ln \left( \frac{x}{n} \right) + \mathbf{h}_i \ln n + \sum_{j=1}^{J-1} \mathbf{g}_j \left( \frac{n_j}{n} \right) + \mathbf{d} \cdot \mathbf{z} + \mathbf{u}. \quad 3$$

Equation (3) can be estimated by ordinary least squares (OLS). The OLS estimates of the parameters are used to calculate

$$p_{ir} = \frac{(\mathbf{h}_i - \mathbf{b}_i) + \mathbf{g}_r - \sum_{j=1}^J \mathbf{g}_j (n_j / n)}{\mathbf{b}_i + w_i} \quad 4$$

for  $r = 1, \dots, J$ , where  $?_{ij}$  is defined to be zero. Sample means are used for  $w_i$  and the  $n_j/n$  ratios. The calculated  $P$ -ratios are then used to test the hypothesis,

$$H_0 : p_{ir} = p_{ik} \quad 5$$

for all  $i$  adult goods, where  $r$  refers to boys and  $k$  refers to girls.

Data for the test come from the 1985-87 Urban Household Survey, carried out by the National Statistical Office. This survey, which took place in nine towns and surrounding villages, is the largest household expenditure survey ever carried out in PNG. However, it is a weakness of the data that it includes mainly urban households because gender biases may be different in rural households.

The data required to estimate equations (1) and (3) are available for 1095 households. There are six commodities in the survey that are plausible candidates as adult goods: adult clothing, alcohol, betelnut (a mild narcotic), gambling, meals eaten away from home, and tobacco. All except for betelnut and gambling have been included as adult goods by Deaton (1989). Eight demographic groups were created: the number of males and females in each of four age groups, 0-6 years, 7-14 years, 15-50 years, and over 50. The

control variables included dummies for location and for the ethnicity of the household head.

### III. RESULTS

Table 1 contains the results of testing the candidate adult goods. The hypothesis that the age and gender of children plays no part in explaining the allocation of expenditure within the adult goods group is accepted for all candidate goods except betelnut. The presence of children in the household evidently influences the demand for betelnut in a way that cannot be captured just by income effects. This may reflect the fact that there are no legal prohibitions on the supply of betelnut to children, unlike laws specifying a minimum age of 18 for purchasing alcohol and tobacco. In light of the result in Table 1, betelnut is removed from the list of adult goods.

In contrast to the results for children, adult composition effects are statistically significant influences on expenditures on individual adult goods, even when total adult goods expenditure is held constant. This suggests differing patterns of demand for the various adult goods amongst the different age and gender groups of adults.

Table 2 contains the estimated outlay equivalent ratios. These are interpreted as follows: the  $P$ -ratio of -0.24 for the effect of young boys on adult clothing means that the addition of a boy of age 0-6 years to the household has the same effect on adult clothing expenditure as would a 24 percent reduction in total outlay per household member.

The first four rows of Table 2 give the  $P$ -ratios for children. These should be negative

although in a few cases they are statistically insignificant but with positive point estimates. For most of the cases where the  $P$ -ratio is positive, children are unlikely to consume these goods themselves, given that little girls are seldom seen to drink, smoke and gamble. Possibly the addition of a young girl to the household causes substitution towards adult goods (Deaton and Muellbauer, 1986). Of the others with positive ratios, it is feasible that boys aged 7-14 smoke and gamble, although the large ratio of 1.43 for gambling is mainly caused by one household where gambling expenses accounted for 83 percent of the total budget. Removing that household reduces the ratio to 0.68. (The results for gambling are the least reliable because equation (3) explains only one percent of the variation in the budget share for gambling, whereas it explains between six and ten percent of the budget share for the other adult goods.)

If boys are favoured over girls, the  $P$ -ratios for adult goods should be bigger negative numbers for boys than for girls. For the youngest age group (0-6) this pattern occurs for four of the five individual adult goods, as well as for the aggregate adult goods group. For the older age group (7-14) this pattern holds for two of the five individual adult goods, as well as for the aggregate group.

Turning to the point estimates, for the aggregate adult goods group the addition of a young boy to the household reduces expenditure by as much as would a 36 percent reduction in total outlay per member. But the addition of a young girl to the household has almost no impact on adult goods expenditure. Similarly, the  $P$ -ratio for older boys (age 7-14) is -0.26, while for girls of the same age it is only -0.14. These point estimates suggest that the households in the sample devote about 30 percent less to their under-

seven-year-old children if the children are girls rather than boys, and about 10 percent less to their older children if the children are girls rather than boys.

The results of testing whether these point estimates are statistically significant are contained in Table 3. The null hypothesis of equal treatment for boys and girls is not rejected at conventional levels of statistical significance. However, it comes close to being rejected when looking at the effect that boys and girls of either age group have on alcohol expenditures ( $p=0.11$  and  $p=0.16$ ) and for the effect that young children have on spending on the aggregate adult goods group ( $p=0.12$ ).

Although estimated mainly to look for boy-girl discrimination, the  $P$ -ratios in Table 2 can also say something about the effects that adults of different age and gender have on the demand for adult goods. All of the ratios are positive for prime age (15-50) males and this group has especially strong effects on the demand for alcohol and tobacco. In total, adding an extra prime age male to a household increases expenditure on adult goods as much as does an 83 percent increase in total outlay per member. The effect of other adults is much smaller: adding an old man to the household is equivalent to a 17 percent increase in outlay, while adding women is equivalent to small decreases in outlay.

It cannot be inferred from the negative  $P$ -ratios for women that there is a bias against them in the allocation of goods. It might just be that women have different preferences than men and choose to not consume these adult goods but, overall, receive their fair share of total household resources. It is because of this inability to rule out differing preferences that boy-girl discrimination was studied indirectly by looking at expenditures

on goods that are not consumed by boys and girls.

#### IV. CONCLUSIONS

In this sample of urban PNG households there is evidence of a preference in favour of boys, especially for the youngest age group. However, the effect falls just outside the usual levels of statistical significance so it cannot be claimed with confidence that bias in favour of boys exists in all urban households in PNG. This is similar to Deaton's (1989) finding for rural Thailand, but contrasts with his results for Côte d'Ivoire, and with Haddad and Reardon's (1993) results for Burkina Faso, where no bias in favour of boys was found.

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Table 1: Identifying Adult Goods Using  $F$ -tests for Exclusion of Demographics

Adult good	Children excluded		Adults excluded	
	Test	p-value	Test	p-value
Adult clothing	1.18	0.32	2.43	0.05
Alcohol	0.90	0.46	6.25	0.00
Betelnut	2.21	0.07	11.54	0.00
Gambling	1.42	0.23	2.19	0.07
Meals out	0.14	0.97	4.29	0.00
Tobacco	1.38	0.24	9.34	0.00

*Note:*  $F$ -test is only asymptotically valid with instrumental variables estimates.

Table 2: Outlay Equivalent Ratios for Adult Goods

Gender and age	Adult clothing	Alcohol	Gambling	Meals out	Tobacco	All adult goods
p-ratios						
<i>Children</i>						
Male 0-6	-0.24	-0.37	-1.13	-0.47	-0.11	-0.36
Male 7-14	-0.52	-0.54	1.43	-0.05	0.32	-0.26
Female 0-6	-0.47	0.11	0.03	0.02	0.14	-0.01
Female 7-14	-0.19	0.01	-0.44	-0.39	-0.18	-0.14
<i>Adults</i>						
Male 15-50	0.72	0.74	0.19	0.38	2.09	0.83
Male > 50	0.18	-0.21	-0.58	0.40	1.48	0.17
Female 15-50	0.86	-0.75	1.03	0.10	0.64	-0.06
Female > 50	0.38	-0.19	-1.13	-1.06	0.26	-0.22
Standard errors						
Male 0-6	0.32	0.22	0.88	0.25	0.37	0.14
Male 7-14	0.29	0.20	1.09	0.32	0.37	0.14
Female 0-6	0.35	0.24	0.88	0.32	0.44	0.16
Female 7-14	0.32	0.27	1.06	0.28	0.37	0.17
Male 15-50	0.24	0.18	0.56	0.20	0.34	0.12
Male > 50	0.29	0.24	0.56	0.98	0.51	0.23
Female 15-50	0.30	0.21	1.15	0.26	0.35	0.15

Female > 50	0.55	0.31	0.63	0.85	0.60	0.23
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Table 3: Tests for Equality of P-ratios by Gender

	Young children	Adolescents	Prime Adults	Old Adults
Adult good				
		p-values		
Adult clothing	0.66	0.50	0.69	0.68
Alcohol	0.16	0.11	0.00	0.96
Gambling	0.22	0.32	0.19	0.32
Meals out	0.26	0.45	0.37	0.39
Tobacco	0.69	0.40	0.00	0.15
All adult goods	0.12	0.60	0.00	0.29