Intergenerational correlations for the Pimbwe of Tanzania

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Same results a Nov 07 2007 memo; improved discussion and some corrections

1. Background

The Pimbwe are a horticultural and mostly subsistence-based population living in the Rukwa valley of western Tanzania (Rukwa Region, Mpimwbe Division), who also hunt, fish and collect honey on a seasonal basis. Mpimwbe (population ~ 100,000 souls) was until 2006 exceedingly poorly connected to the national grid (poor roads, no mobile phone access, no electricity, water available primarily from seasonal rivers that sink >10 feet below ground in the mid to late dry season, weakly supported primary schools in each village, one secondary school, and the provision of extremely basic and poorly supplied dispensaries in approximately two thirds of the villages (Paciotti et al. 2005). In 2006, largely on account of the efforts of a powerful Member of Parliament (now Prime Minister) and the recent infusion of aid money into a newly liberalized Tanzanian economy, there have been many changes – an improved road that may allow proper wet season access to the Division, a programme to dig new deep wells (and renovate existing ones), a mobile phone tower (which still doesn't work), and a second secondary school (soon to open to Form 1 students). Primary schooling has been available in almost all villages since the early 1970s as a result of President Julius Nyerere's villagization programme, although schools are not well maintained and funded.

The Pimwbe have little accumulated wealth. While a small percentage (always less than 10% and in most years <5%) of the population own smallstock (goats) these are generally used as cash savings, and sold in times of need; this is the same for poultry, that are more commonly raised. Land in Tanzania is crown property but effectively held by village councils. Families have rights to land through cultivation. Sons and daughter may cultivate part of their father's or mother's plots after their marriage, but often they request new or unused land from the village government, or move to a different village in Mpimbwe (or elsewhere) where one or both of them may have relatives. Other types of wealth include bicycles, homemade shot guns, axes, hoes, watches, radio-tape machines, drums for beer-making, buckets, mats, baskets, 12v. batteries, and occasionally furniture; a few individuals own carpentry equipment or other specialized tools (bicycle pumps, spanners, etc). A couple of families stand out as wealthy, either because of connections to powerful politicians in a nearby town (or further afield), employment (government salaries include 7 teachers, and the village secretary), remittances (very rare) or private initiative (running a bar, shop or kiosk).

With these limited sources of material capital, how do people accrue income to pay for cooking oil, salt, sources of protein, soap, kerosene, tools, clothing, medicine (people and animals), school uniform, beer, taxes and other necessities? While the main source of cash is the sale of maize (and other cash crops such as sunflower, rice, peanuts that are sporadically encouraged and purchased by traders from big towns) average earnings from cash crops are very low (and show high interannual variation, with many years of zero returns); furthermore income from maize sales is often at the expense of subsistence supplies, and hence a risky strategy. A considerable number of men make additional income from a craft or trade such as fishing, hunting, honey production, carpentry, house building, brickburning, general repairs (buckets, tools, shoes), tailoring, timber-cutting, dispensing traditional medicine, providing wichdoctor services, trading old clothes, manual labor, etc; many of these activities are temporary and/or seasonal. For women the primary source of additional income is brewing (and distillation), using either purchased or subsistence supplies of maize to brew beer that is sold either privately or in one of the village's rowdy bars. An increasing proportion of destitute individuals sell their labor to an immigrant population of agropastoralists (the Sukuma) who have been arriving in Rukwa since the early 1970s and live on the periphery of the Pimbwe villages; day laborers are paid not with cash but a bowl of maize flower or cassava, and are therefore unable to break out of the cycle of increasing poverty and dependence.

With regards to demographic transition a survey in 1996 indicated that about 10% of a sampled 107 women (<45 years) had experimented with family planning methods, but only a couple reported current use; furthermore, most subjects indicated that their ideal family size was "up to God", expressing no desire to limit births. Whether this is still the case is uncertain, but clearly this population has not yet entered into full demographic transition. Fertility is strongly desired by men and women, although its tradeoffs with education are acutely appreciated, with pregnancy among primary school students viewed as a big problem.

From this brief sketch we can see that "wealth" is best thought about in Mpimbwe as strength, energy, fertility, health and control of (children's) labor. To an outsider these do indeed seem to be valuable commodities for the people of Mpimbwe, given the high incidence of disease and malnutrition (Hadley 2005), chronic food insecurity at the household level (Hadley, Borgerhoff Mulder, and Fitzherbert 2006), considerable maternal anxiety (Hadley and Patil 2006) and little interpersonal trust (Paciotti and Hadley 2003). People view self reliance as a virtue, considering even close to be a hindrance in some circumstances (Hadley 2004). As such wealth can best be captured as somatic human capital, stored in brains and bodies.

Accordingly these preliminary analyses of intergenerational correlations in "wealth" focus on four types of human capital: education, fertility and number of surviving offspring, and adult weights and heights. {Further analyses if time will examine components of material wealth (land under cultivation, agricultural productivity, estimated income from additional economic specialization, and ownership of sundry items (bicycles, watch, radio, house type)}.

2. Sample

Analyses are focused on the villagers of Mirumba, the most northerly of the villages of Mpimbwe, lying at the base of the Ufipa escarpment and 8 kilometres south of Katavi National Park.

Data come from 6 surveys of every Pimbwe household in Mirumba, conducted 1995/1996, 1998, 2000, 2002, 2004 and 2006. At each survey the reproductive and educational history of every individual in the household was determined (either for the first time or appropriately updated). Given considerable fluidity of individuals both between households and between villages over time there are considerable challenges in identifying representative samples for analysis; for example, focusing only on individuals consistently sampled across years will provide the highest quality data but will bias estimates to the more stable families. Accordingly the sample used here includes all individuals over 15 years old ever sampled (i.e., appearing in a household survey) for whom appropriate data for their mother and father are available; 15 is chosen since this is the earliest age of first birth. Since no surveys were conducted in villages other than Mirumba, this necessarily biases towards F1/F2 pairs where both the parent and the child had at one survey, but not necessarily the same survey, been residing in Mirumba. New immigrants to the village who come without their parents, and parents whose children were not residing in the village during any of the survey periods are not included. Quite how such biases might affect estimates of intergenerational correlation is unclear.

Because of the nature of the sample ages are determined at the date of the last survey in which data was taken on any individual (AGELS). Note that a few individuals may appear both as the parent of a set of focal individuals, and as a focal individual (linked to their own parents).

3. Analysis and Presentation

All analyses were conducted in STATA (v.7) using the reg command. The model used was as follows:

$$\beta w = \log W + F2age + F2age^2 + F1age + F1\ age^2 + meanF2age*\log W$$

where w is the measure of offspring human capital, and W is the measure of parental human capital. Age and age squared terms for F1 and F2 are entered to control for age effects, and the interaction term is used so that the main effect of logW can be interpreted as if measured at a representative age, the representative age being set at the mean age of the F2 generation. Modifications were made for reproductive wealth, as outlined in the Methods Memo (November 2006). Finally analyses were clustered by mother's or father's code, depending on which parent's wealth was the focus of analysis, to produce robust standard errors.

With few institutions to guide intergenerational transmission in this population all possible pairings were examined M-S, M-D, F-S and F-D. For the measures of fertility and offspring survival analyses were conducted for both the full sample, and for those where both parents and offspring had completed reproduction (males at 55 years, and females at 45 years). For measures of education the complete sample of paired individuals was used.

For the sake of brevity, regression analyses are presented only for the logged data; analyses for unlogged data showed substantially the same patterns. Significant parameters are bolded. For brevity too, scatterplots are presented only for the unlogged data, and are included in the spreadsheet with a small jitter function is set to increase visibility of overlapping data points. The β estimates are summarized in a summary table in the spreadsheet, and in Table 5 below.

4. Education

Education is measured as final standard reached, reflecting roughly the number of years spent in education, typically seven years of primary and 4 years of secondary (although the actual break between primary and secondary has changed over time). There is considerable clustering at 0 and 7 years, probably reflecting reporting error. Many people report no schooling (0), even though they may have tried it for a few months (or even years); many others report finishing primary school (7), even though they may have dropped out in the last year or even before.

Plotted data for the relationships between parents' education and offspring education are shown in the spreadsheet for all four pairings. For women betas are positive but low; the only significant effect is women's education (β = .11, p=0.023, Table 1a). For men there is absolutely no intergenerational relationship.

Positive effects of age on education with a negative squared term may seem surprising but most likely reflects a secular trend – the recent decline in educational services in this country, and the particularly poor current conditions in Rukwa region (Ministry 2003).

5. Fertility

Fertility is measured as the number of livebirths reported. It is calculated for two samples: all individuals, and individuals who have passed their 45th (women) or 55th (men) birthday – the latter samples designed to capture those individuals for whom fertility is most likely complete. The raw data are plotted in the spreadsheet figures, and the regression results are presented in Table 2a (M-D, F-D) and Table 2b (F-D, F-S).

The betas for fertility are unstable across samples, highly variable, and associated with high standard errors, and the sample sizes for postreproductive sample are small. Apart from the anticipated age effect, we find only one statistically significant result – women's fertility was affected *negatively* by their father's fertility (β =-0.51, p=0.04, Table 2a), an effect that retained direction (β =-0.30) but not significance in the smaller sample of women who had reached their 45th birthday (Table 2b). For men, there were no consistent effects of parental fertility on their own fertility, neither in the full sample (Table 2c) nor in the smaller sample of men who had reached their 55th birthday (Table 2d).

6. Surviving offspring

Surviving offspring is measured as the number of offspring who reached 5 years of age, since child mortality drop precipitously after this age. As with fertility surviving offspring is calculated for two samples – all individuals and those who have most likely completed their reproduction. The relationship between parental surviving offspring and daughter's and son's surviving offspring is shown in the spreadsheet, and the results of the regressions are presented in Table 3. Generally the betas are negative, but not significant.

For the full sample of women, apart again from anticipated age effects, there were no significant effects of mother's or father's surviving offspring on women's production of surviving offspring (Table 3a), a pattern that holds in the smaller post-reproductive sample (Table 3b). For the full sample of men again no clear patterns were observed in the full sample (Table 3c), but in the post reproductive sample high negative betas were found for the MS pairing (β =-1.08, P<0.01) and FS pairing (β =-0.88, ns) (Table 3d).

7. Adult weights and heights.

An adequate sample was available only for M-D pairings, since so few adult males were weighed and measured (given another focus on maternal child health). For mothers and daughters, however, clear positive associations were found for both weight and height (MD weight β =0.5, p=0.017, MD height β =0.75, p=0.028).

8. Summary

To summarize the pattern of findings is shown below, highlighting statistically significant results: women benefit educationally from having educated mothers, and in terms of growth by having tall and heavy mothers. They suffer in terms of fertility if their fathers had high fertility, although these effects do not persist when we count only children who survive beyond age 5, probably because lower fertility results in less mortality in infants and toddlers; furthermore no effects were found in the post reproductive sample. Corrected betas are given in the intergenSummary.xls spreadsheet.

Table 5. Summary

	Women		**Men**	
	Mother (MD)	**Father (FD)**	**Mother (MS)**	**Father (FS)**
Education	.11	.14	0	-.02
Fertility	.06	-.51	-.05	.17
Fertility (PR)	-.25	-.30	-.16	1.43
Soff5	-.35	-.28	.07	-.16
Soff5 (PR)	.24	-.27	-1.08	-.88
Adult weight	.5	NOT TESTED	NOT TESTED	NOT TESTED
Adult height	.75	NOT TESTED	NOT TESTED	NOT TESTED

For men there is no intergenerational correlation in education. This may reflect the fact that most of the educated men in the village come from outside (e.g. school teachers and government officials), men for whom we have no parental measures, hence they do not appear in the pairings data set; accordingly we have little variance to play with. It may also reflect the fact that most parents encourage schooling in their sons, irrespective of their own education men (indeed schooling has been strongly emphasized since Ujamaa, 1975). For men there are also no significant intergenerational correlations for fertility, although the direction is positive with fathers and negative with mothers. For completed reproduction only the negative pattern persists, but is statistically significant only for the MS pairing in the completed reproductive sample. This may suggest a negative effect of sibling competition on men's reproductive careers that shows itself only over the whole reproductive lifespan and not in the early years of reproduction; alternatively it may suggest a secular change – sibling competition was more important in past than now..

In sum, there is clear intergenerational transmission of somatic capital (educational and anthropometric status) in this population, at least between mothers and daughters. Interestingly this does not consistently translate into fitness variables (fertility, RS); perhaps reproduction is just too stochastic in the highly unpredictable (weather, prices, disease) and impoverished Pimbwe environment; indeed the rather consistent . negative β values for reproduction would appear to indicate intergenerational *competition* for the scarce resources that support reproduction. This provides an interesting contrast to results for groups with productive capital (such as land and livestock) where there is evidence of RS intergenerational transmission as well (e.g. Kipsigis). There is little evidence of clear differences between sons and daughters with respect to parental effects An effort will be made to obtain anthropometric measures for men, since it would be very interesting to see if FS, FD, and MS are as strong as MD.

8. Future work

Intergenerational correlations of material wealth are still to be appropriately coded, and are not expected to show much intergenerational correlation.

9. Literature cited

Hadley, C. 2004. The costs and benefits of kin: Kin networks and children's health among the Pimbwe of Tanzania. *Human Nature* 15:377-395.

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Hadley, C. A. 2005. Ethnic expansions and between-group differences in children's health: A case study from the Rukwa Valley, Tanzania. *American Journal of Physical Anthropology* 128:682-692.

Paciotti, B., and C. Hadley. 2003. The Ultimatum game among sympatric ethnic groups in southwestern Tanzania: Ethnic variation and institutional scope. *Current Anthropology*.

Paciotti, B., C. Hadley, C. Holmes, and M. Borgerhoff Mulder. 2005. Grass-roots Justice in Tanzania. *American Scientist* 93:58-64.

Table 1a EDUCATION – WOMEN

M-D

```
. reg lfin lmatfin agels3 agesq matagels3 matagels3sq dmaxlmatfin, cluster (mcodes)

Linear regression                                      Number of obs =     272
                                                       F(  6,   128) =   23.49
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.2572
                                                       Root MSE      =  2.0522

                              (Std. Err. adjusted for 129 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
        lfin |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lmatfin |    .108406   .0470854     2.30   0.023     .0152395    .2015725
      agels3 |   .2554918   .0675039     3.78   0.000     .1219238    .3890598
       agesq |  -.0043193   .0009184    -4.70   0.000    -.0061365   -.0025022
   matagels3 |   .2408123   .1214326     1.98   0.049     .0005371    .4810876
 matagels3sq |  -.0018751   .0009988    -1.88   0.063    -.0038514    .0001012
 dmaxlmatfin |   .0060839   .0073717     0.83   0.411    -.0085023      .02067
       _cons |   -5.24431   3.710574    -1.41   0.160    -12.58631    2.097695
------------------------------------------------------------------------------

. reg lfin lpatfin agels3 agesq patagels3 patagels3sq dmaxlpatfin, cluster (fcodes)

Linear regression                                      Number of obs =     213
                                                       F(  6,    89) =   10.85
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.1937
                                                       Root MSE      =  1.9582

                               (Std. Err. adjusted for 90 clusters in fcodes)
------------------------------------------------------------------------------
             |               Robust
        lfin |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lpatfin |   .1355875    .102169     1.33   0.188    -.0674202    .3385951
      agels3 |   .3397022    .130861     2.60   0.011     .0796843    .5997202
       agesq |  -.0053027   .0017369    -3.05   0.003    -.0087539   -.0018516
   patagels3 |   .0930155   .1176726     0.79   0.431    -.1407974    .3268285
 patagels3sq |  -.0008465   .0010478    -0.81   0.421    -.0029285    .0012355
 dmaxlpatfin |  -.0027044   .0079026    -0.34   0.733    -.0184067    .0129978
       _cons |  -2.239042   3.117921    -0.72   0.475    -8.434284    3.956201
```

Table 1b EDUCATION - MEN

MOTHER-SON

```
. reg lfin lmatfin agels3 agesq matagels3 matagels3sq smaxlmatfin, cluster (mcodes)

Linear regression                                      Number of obs =     267
                                                       F(  6,   134) =    1.41
                                                       Prob > F      =  0.2137
                                                       R-squared     =  0.0598
                                                       Root MSE      =  1.9382

                               (Std. Err. adjusted for 135 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
        lfin |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lmatfin |   .0003803   .0498022     0.01   0.994    -.0981198    .0988805
      agels3 |   .1349582   .0756298     1.78   0.077    -.0146244    .2845408
       agesq |  -.0016723   .0010167    -1.64   0.102    -.0036831    .0003384
   matagels3 |   .0736099   .1349932     0.55   0.586     -.193383    .3406029
 matagels3sq |  -.0009575   .0012596    -0.76   0.449    -.0034488    .0015339
 smaxlmatfin |   .0020743    .006784     0.31   0.760    -.0113432    .0154918
       _cons |    2.48522   3.813957     0.65   0.516    -5.058122    10.02856
------------------------------------------------------------------------------
```

FATHER-SON

```
. reg lfin lpatfin agels3 agesq smaxlpatfin patagels3 patagels3sq, cluster (fcodes)

Linear regression                                      Number of obs =     220
                                                       F(  6,    98) =    1.72
                                                       Prob > F      =  0.1252
                                                       R-squared     =  0.0942
                                                       Root MSE      =  1.9358

                                (Std. Err. adjusted for 99 clusters in fcodes)
------------------------------------------------------------------------------
             |               Robust
        lfin |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     lpatfin |  -.0174561   .0500508    -0.35   0.728    -.1167803    .0818681
      agels3 |   .1210498   .0780743     1.55   0.124    -.0338861    .2759858
       agesq |  -.0023072   .0010348    -2.23   0.028    -.0043607   -.0002537
 smaxlpatfin |   .0089203   .0049634     1.80   0.075    -.0009294      .01877
   patagels3 |  -.0729795   .0931539    -0.78   0.435    -.2578403    .1118813
 patagels3sq |   .0004848   .0007503     0.65   0.520    -.0010041    .0019738
       _cons |   7.269829   2.550524     2.85   0.005     2.208396    12.33126
------------------------------------------------------------------------------
```

TABLE 2A FERTILITY (ALL SAMPLE WOMEN)

M-D

```
. reg lfert lmatfert agels3 agesq matagels3 matagels3sq ddasflr ddasflrxlmatfert, cluster
(mcodes)

Linear regression                                      Number of obs =     289
                                                       F(  7,   137) =   37.78
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.4970
                                                       Root MSE      =  1.5957

                               (Std. Err. adjusted for 138 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
       lfert |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lmatfert |   .0550084   .2284993     0.24   0.810    -.3968333    .5068501
      agels3 |   1.215244    .199852     6.08   0.000     .8200501    1.610437
       agesq |   -.010587   .0017465    -6.06   0.000    -.0140405   -.0071335
   matagels3 |   .0930925   .0917876     1.01   0.312    -.0884112    .2745961
 matagels3sq |  -.0009018   .0007718    -1.17   0.245     -.002428    .0006244
     ddasflr |   .3014579   .1130431     2.67   0.009      .077923    .5249927
ddasflrxlm~t |   .0553204   .0300633     1.84   0.068    -.0041277    .1147685
       _cons |  -23.02408   3.951304    -5.83   0.000    -30.83752   -15.21065
------------------------------------------------------------------------------
```

F-D

```
. reg lfert lpatfert agels3 agesq patagels3 patagels3sq ddasflr ddasflrxlpatfert, cluster
(fcodes)

Linear regression                                      Number of obs =     246
                                                       F(  7,   106) =   29.38
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.4422
                                                       Root MSE      =  1.6293

                               (Std. Err. adjusted for 107 clusters in fcodes)
------------------------------------------------------------------------------
             |               Robust
       lfert |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lpatfert |    -.51411   .2471683    -2.08   0.040    -1.004145   -.0240749
      agels3 |   1.119535   .1987756     5.63   0.000     .7254427    1.513627
       agesq |  -.0099355   .0016768    -5.93   0.000    -.0132598   -.0066111
   patagels3 |  -.0311953   .0526072    -0.59   0.554    -.1354942    .0731036
 patagels3sq |   .0002528   .0004091     0.62   0.538    -.0005584    .0010639
     ddasflr |   .3949144   .1145996     3.45   0.001     .1677095    .6221193
ddasflrxlp~t |  -.0085239   .0328755    -0.26   0.796    -.0737028    .0566549
       _cons |  -16.38701   4.457278    -3.68   0.000    -25.22399    -7.55002
```

TABLE 2B. FERTILITY (POSTREPRODUCTIVE) WOMEN

M-D

```
. reg lfert lmatfert if agels2 !=. & matagels2 !=., cluster (mcodes)

Linear regression                                      Number of obs =      43
                                                       F(  1,    33) =    0.29
                                                       Prob > F      =  0.5964
                                                       R-squared     =  0.0044
                                                       Root MSE      =  1.4951

                                (Std. Err. adjusted for 34 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
       lfert |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lmatfert |  -.2534615   .4740164    -0.53   0.596    -1.217855     .710932
       _cons |    6.62035    .931589     7.11   0.000     4.725018    8.515682
------------------------------------------------------------------------------
```

F-D

```
. reg lfert lpatfert if agels2 !=. & patagels2 !=., cluster (fcodes)

Linear regression                                      Number of obs =      33
                                                       F(  1,    25) =    0.89
                                                       Prob > F      =  0.3548
                                                       R-squared     =  0.0069
                                                       Root MSE      =  1.2626

                                (Std. Err. adjusted for 26 clusters in fcodes)
------------------------------------------------------------------------------
             |               Robust
       lfert |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lpatfert |  -.2982949   .3164058    -0.94   0.355    -.9499448     .353355
       _cons |   6.873019   .6251554    10.99   0.000     5.585487     8.16055
------------------------------------------------------------------------------
```

TABLE 2C FERTILITY (ALL SAMPLE) MEN

MS

```
. reg lfert lmatfert agels3 agesq matagels3 matagels3sq dsasflr dsasflrxlmatfert, cluster
(mcodes)

Linear regression                                      Number of obs =     289
                                                       F(  7,   143) =   87.09
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.5344
                                                       Root MSE      =   2.035

                               (Std. Err. adjusted for 144 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
       lfert |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lmatfert |  -.0461102   .3061342    -0.15   0.880    -.6512433    .5590229
      agels3 |   .9708655   .2134334     4.55   0.000     .5489735    1.392758
       agesq |  -.0074001   .0013036    -5.68   0.000     -.009977   -.0048233
   matagels3 |   .0964565   .0884856     1.09   0.278    -.0784522    .2713652
 matagels3sq |    -.00093   .0008713    -1.07   0.288    -.0026523    .0007923
     dsasflr |   .2106811   .1745523     1.21   0.229    -.1343549    .5557172
dsasflrxlm~t |   .0240925    .021905     1.10   0.273    -.0192069     .067392
       _cons |   -20.7763    5.24931    -3.96   0.000    -31.15257   -10.40003
------------------------------------------------------------------------------
```

FS

```
. reg lfert lpatfert agels3 agesq patagels3 patagels3sq dsasflr dsasflrxlpatfert, cluster
(fcodes)

Linear regression                                      Number of obs =     264
                                                       F(  7,   114) =   55.29
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.5396
                                                       Root MSE      =  2.0397

                               (Std. Err. adjusted for 115 clusters in fcodes)
------------------------------------------------------------------------------
             |               Robust
       lfert |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lpatfert |   .1708516   .3550351     0.48   0.631    -.5324702    .8741734
      agels3 |    .997597   .1814986     5.50   0.000     .6380496    1.357144
       agesq |  -.0076816   .0011408    -6.73   0.000    -.0099415   -.0054217
   patagels3 |  -.0258244   .0919768    -0.28   0.779    -.2080297    .1563808
 patagels3sq |   .0003068   .0007831     0.39   0.696    -.0012446    .0018581
     dsasflr |   .2763706   .1381862     2.00   0.048     .0026249    .5501164
dsasflrxlp~t |   .0060071   .0231024     0.26   0.795    -.0397585    .0517728
       _cons |  -19.10605    4.68877    -4.07   0.000    -28.39447   -9.817637
------------------------------------------------------------------------------
```

TABLE 2D FERTILITY (POSTREPRODUCTIVE) MEN

M-S

```
. reg lfert lmatfert if agels2 !=. & matagels2 !=., cluster (mcodes)

Linear regression                                      Number of obs =      34
                                                       F(  1,    22) =    0.02
                                                       Prob > F      =  0.8813
                                                       R-squared     =  0.0009
                                                       Root MSE      =  2.3962

                                (Std. Err. adjusted for 23 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
       lfert |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lmatfert |  -.1611712    1.06712    -0.15   0.881    -2.374242      2.0519
       _cons |     5.6239   2.493455     2.26   0.034      .452791    10.79501
------------------------------------------------------------------------------
```

F-S

```
. reg lfert lpatfert if agels2 !=. & patagels2 !=., cluster (fcodes)

Linear regression                                      Number of obs =      30
                                                       F(  1,    17) =    0.50
                                                       Prob > F      =  0.4878
                                                       R-squared     =  0.0350
                                                       Root MSE      =  2.4894

                                (Std. Err. adjusted for 18 clusters in fcodes)
------------------------------------------------------------------------------
             |               Robust
       lfert |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lpatfert |   1.431067   2.017869     0.71   0.488    -2.826264    5.688397
       _cons |   1.854934   4.824731     0.38   0.705    -8.324359    12.03423
------------------------------------------------------------------------------
```

TABLE 3A. SURVIVING OFFSPRING (FULL SAMPLE) WOMEN

M-D

```
. reg lsoff5 lmatsoff5 agels3 agesq matagels3 matagels3sq ddasflr ddasflrxlmatsoff5,
cluster (mcodes)

Linear regression                                      Number of obs =     289
                                                       F(  7,   137) =  127.17
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.6455
                                                       Root MSE      =  1.6742

                              (Std. Err. adjusted for 138 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
      lsoff5 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lmatsoff5 |  -.3548513   .2668774    -1.33   0.186     -.882583    .1728805
      agels3 |    .934957   .1822141     5.13   0.000     .5746411    1.295273
       agesq |  -.0081131   .0016322    -4.97   0.000    -.0113407   -.0048855
   matagels3 |    .195959   .0984309     1.99   0.048     .0013187    .3905993
 matagels3sq |  -.0018298   .0008597    -2.13   0.035    -.0035299   -.0001297
     ddasflr |   .2700906   .0972318     2.78   0.006     .0778214    .4623598
ddasflrxlm~5 |  -.0428295   .0271233    -1.58   0.117    -.0964641     .010805
       _cons |   -20.7517   3.874672    -5.36   0.000     -28.4136   -13.08981
------------------------------------------------------------------------------
```

M-S

```
. reg lsoff5 lpatsoff5 agels3 agesq patagels3 patagels3sq ddasflr ddasflrxlpatsoff5,
cluster (fcodes)

Linear regression                                      Number of obs =     246
                                                       F(  7,   106) =  110.11
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.6464
                                                       Root MSE      =   1.689

                              (Std. Err. adjusted for 107 clusters in fcodes)
------------------------------------------------------------------------------
             |               Robust
      lsoff5 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lpatsoff5 |  -.2826109   .3024576    -0.93   0.352    -.8822626    .3170408
      agels3 |   .9916642   .2231835     4.44   0.000     .5491811    1.434147
       agesq |  -.0090966   .0019362    -4.70   0.000    -.0129354   -.0052579
   patagels3 |   .0008034   .0797512     0.01   0.992     -.157311    .1589178
 patagels3sq |  -.0000776   .0006737    -0.12   0.908    -.0014133     .001258
     ddasflr |   .2170684   .1226295     1.77   0.080    -.0260565    .4601934
ddasflrxlp~5 |  -.0156386   .0292859    -0.53   0.594    -.0737008    .0424236
       _cons |  -16.41596   4.307284    -3.81   0.000    -24.95557   -7.876353
```

TABLE 3B. SURVIVING OFFSPRING (POST REPRO SAMPLE) WOMEN

M-D

```
. reg lsoff5 lmatsoff5 if agels2 !=. & matagels2 !=., cluster (mcodes)

Linear regression                                      Number of obs =      43
                                                       F(  1,    33) =    0.34
                                                       Prob > F      =  0.5659
                                                       R-squared     =  0.0040
                                                       Root MSE      =  1.8645

                                (Std. Err. adjusted for 34 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
      lsoff5 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lmatsoff5 |   .2360717    .407093     0.58   0.566    -.5921653    1.064309
       _cons |    5.12215   .6255927     8.19   0.000     3.849372    6.394928
------------------------------------------------------------------------------
```

F-D

```
. reg lsoff5 lpatsoff5 if agels2 !=. & patagels2 !=., cluster (fcodes)

Linear regression                                      Number of obs =      33
                                                       F(  1,    25) =    0.20
                                                       Prob > F      =  0.6621
                                                       R-squared     =  0.0039
                                                       Root MSE      =  1.5787

                                (Std. Err. adjusted for 26 clusters in fcodes)
------------------------------------------------------------------------------
             |               Robust
      lsoff5 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lpatsoff5 |  -.2748422   .6214348    -0.44   0.662    -1.554711    1.005027
       _cons |   6.098949    1.08786     5.61   0.000      3.85846    8.339438
. reg lsoff5 lmatsoff5 if agels2 !=., cluster (mcodes)
```

TABLE 3C. SURVIVING OFFSPRING (FULL SAMPLE) MEN

M-S

```
. reg lsoff5 lmatsoff5 agels3 agesq matagels3 matagels3sq dsasflr dsasflrxlmatsoff5,
cluster (mcodes)

Linear regression                                      Number of obs =     289
                                                       F(  7,   143) =   66.52
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.5542
                                                       Root MSE      =    1.88

                               (Std. Err. adjusted for 144 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
      lsoff5 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lmatsoff5 |   .0726266    .328681     0.22   0.825    -.5770745    .7223277
      agels3 |   .2050033   .1987227     1.03   0.304    -.1878103     .597817
       agesq |  -.0021616   .0013184    -1.64   0.103    -.0047677    .0004446
   matagels3 |   .0121354   .0884115     0.14   0.891     -.162627    .1868977
 matagels3sq |  -.0000789    .000866    -0.09   0.928    -.0017907    .0016329
     dsasflr |  -.1580261   .1479016    -1.07   0.287     -.450382    .1343299
dsasflrxlm~5 |   .0093484   .0256644     0.36   0.716    -.0413823    .0600791
       _cons |  -2.427202   4.568562    -0.53   0.596    -11.45784    6.603438
------------------------------------------------------------------------------
```

F-S

```
. reg lsoff5 lpatsoff5 agels3 agesq patagels3 patagels3sq dsasflr dsasflrxlpatsoff5,
cluster (fcodes)

Linear regression                                      Number of obs =     264
                                                       F(  7,   114) =   41.22
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.5499
                                                       Root MSE      =  1.8769

                               (Std. Err. adjusted for 115 clusters in fcodes)
------------------------------------------------------------------------------
             |               Robust
      lsoff5 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lpatsoff5 |  -.1559129   .3919431    -0.40   0.692    -.9323493    .6205234
      agels3 |   .1389619   .1841142     0.75   0.452     -.225767    .5036907
       agesq |  -.0016745   .0012531    -1.34   0.184    -.0041569    .0008079
   patagels3 |  -.0076518   .0828014    -0.09   0.927    -.1716807    .1563772
 patagels3sq |   .0001673   .0007651     0.22   0.827    -.0013484    .0016831
     dsasflr |  -.1069668   .1306192    -0.82   0.415    -.3657224    .1517888
dsasflrxlp~5 |  -.0313447   .0322181    -0.97   0.333    -.0951686    .0324791
       _cons |  -.3127421   4.518533    -0.07   0.945    -9.263921    8.638437
------------------------------------------------------------------------------
```

TABLE 3D. SURVIVING OFFSPRING (POSTREPRO) MEN

M-S

```
. reg lsoff5 lmatsoff5 if agels2 !=. & matagels2 !=., cluster (mcodes)

Linear regression                                      Number of obs =      34
                                                       F(  1,    22) =    5.77
                                                       Prob > F      =  0.0252
                                                       R-squared     =  0.0698
                                                       Root MSE      =  2.2129

                                (Std. Err. adjusted for 23 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
      lsoff5 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lmatsoff5 |  -1.075439   .4479033    -2.40   0.025    -2.004334   -.1465446
       _cons |   6.563044   .6376488    10.29   0.000     5.240641    7.885446
------------------------------------------------------------------------------
```

F-S

```
. reg lsoff5 lpatsoff5 if agels2 !=. & patagels2 !=., cluster (fcodes)

Linear regression                                      Number of obs =      30
                                                       F(  1,    17) =    0.83
                                                       Prob > F      =  0.3746
                                                       R-squared     =  0.0245
                                                       Root MSE      =  2.3845

                                (Std. Err. adjusted for 18 clusters in fcodes)
------------------------------------------------------------------------------
             |               Robust
      lsoff5 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lpatsoff5 |  -.8773077   .9620999    -0.91   0.375    -2.907161    1.152546
       _cons |   6.292447   1.395552     4.51   0.000     3.348089    9.236805
```

Table 4 ANTHROPOMETRICS

M-D

```
. reg lweight lmatweight f_agey f_ageysq mc_agey mc_ageysq dmf_ageyxlmatweight, cluster
(mcodes)

Linear regression                                      Number of obs =      87
                                                       F(  6,    50) =    6.66
Prob > F      =  0.0000
                                                       R-squared     =  0.3017
                                                       Root MSE      =  .21822

                                (Std. Err. adjusted for 51 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
     lweight |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  lmatweight |   .5022046   .2030738     2.47   0.017     .0943189    .9100902
      f_agey |   .0940775   .1543415     0.61   0.545    -.2159265    .4040815
    f_ageysq |  -.0018705   .0007457    -2.51   0.015    -.0033682   -.0003727
     mc_agey |   .0079459    .032147     0.25   0.806    -.0566231     .072515
   mc_ageysq |  -.0000502    .000331    -0.15   0.880     -.000715    .0006146
dmf_a~weight |   .0040647   .0395454     0.10   0.919    -.0753645    .0834939
       _cons |   .6276628   3.676009     0.17   0.865    -6.755819    8.011144
------------------------------------------------------------------------------
```

M-D

```
. reg lheight lmatheight f_agey f_ageysq mc_agey mc_ageysq dmf_ageyxlmatheight, cluster
(mcodes)

Linear regression                                      Number of obs =      79
                                                       F(  6,    48) =    3.61
                                                       Prob > F      =  0.0049
                                                       R-squared     =  0.2343
                                                       Root MSE      =  .06487

                                (Std. Err. adjusted for 49 clusters in mcodes)
------------------------------------------------------------------------------
             |               Robust
     lheight |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  lmatheight |   .7480029   .3292619     2.27   0.028     .0859775    1.410028
      f_agey |  -.3227315   .4379424    -0.74   0.465    -1.203274    .5578106
    f_ageysq |  -.0004538   .0002679    -1.69   0.097    -.0009926    .0000849
     mc_agey |   .0013598   .0092662     0.15   0.884    -.0172711    .0199908
   mc_ageysq |  -6.19e-06   .0000934    -0.07   0.947     -.000194    .0001817
dmf_a~height |   .0690395   .0883998     0.78   0.439    -.1087002    .2467792
       _cons |   10.09313   10.39077     0.97   0.336    -10.79892    30.98519
------------------------------------------------------------------------------
```

Table 5 Beta Table

Site	Wealth type	Pair	N pairs	β	SE	*p*-value	Measurement error	Corrected β	% zero parent	% zeros child	lost fr sample
Pimbwe	education	m-d	272	0.11	0.047	**0.023**	0.8	0.14	66	15	0
Pimbwe	eduation	f-d	213	0.14	0.102	0.19	0.8	0.18	26	12	0
Pimbwe	education	m-s	267	0	0.05	0.994	0.8	0.00	3	10	0
Pimbwe	education	f-s	220	-0.02	0.05	0.728	0.8	-0.03	29	10	0
Pimbwe	fertility(full)	m-d	289	0.056	0.228	0.81	0.98	0.06	0	16	0
Pimbwe	fertility(full)	f-d	246	-0.51	0.247	**0.04**	0.98	0.52	0	15	0
Pimbwe	fertility(full)	m-s	289	-0.05	0.306	0.88	0.98	-0.05	0	44	0
Pimbwe	fertility(full)	f-s	264	0.17	0.355	0.631	0.98	0.17	0	47	0
Pimbwe	fertility (postrepro)	m-d	43	-0.25	0.474	0.596	0.98	-0.26	0	5	0
Pimbwe	fertility (postrepro)	f-d	33	-30	0.316	0.355	0.98	-30.61	0	3	0
Pimbwe	fertility (postrepro)	m-s	34	-0.16	1.067	0.881	0.98	-0.16	0	17	0
Pimbwe	fertility (postrepro)	f-s	30	1.43	2.02	0.488	0.98	1.46	0	19	0
Pimbwe	RS (full sample)	m-d	289	-0.35	0.267	0.186	0.98	-0.36	0	41	0
Pimbwe	RS (full sample)	f-d	246	-0.28	0.302	0.352	0.98	-0.29	0	42	0
Pimbwe	RS (full sample)	m-s	289	0.07	0.329	0.825	0.98	0.07	0	62	0
Pimbwe	RS (full sample)	f-s	264	-0.16	0.392	0.292	0.98	-0.16	0	65	0
Pimbwe	RS (postrepro)	m-d	43	0.24	0.407	0.566	0.98	0.24	0	11	0
Pimbwe	RS (postrepro)	f-d	33	-0.27	0.621	0.662	0.98	-0.28	0	11	0
Pimbwe	RS (postrepro)	m-s	34	-1.08	0.448	**0.025**	0.98	-1.10	0	15	0
Pimbwe	RS (postrepro)	f-s	30	-0.88	0.962	0.375	0.98	-0.90	0	17	0
Pimbwe	adult weight	m-d	87	0.5	0.203	**0.017**	0.95	0.53	0	0	60
Pimbwe	adult height	m-d	79	0.75	0.329	**0.028**	0.95	0.79	0	0	60