# Intergenerational correlations for the Pimbwe of Tanzania

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## 1. Background

The Pimbwe are a horticultural and mostly subsistence-based population living in the Rukwa valley of western Tanzania (Rukwa Region, Mpimwbe Division). Mpimwbe 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 Minister of State) 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 (now 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, 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 8 teachers, and the village secretary), remittances (very rare) or private initiative (running a successful bar, a shop or kiosk).

With these limited sources of material capital, how do people accrue income to pay for oil, salt, sources of protein, soap, 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 carpentry, fishing, hunting, honey production, house building, general repairs (buckets, tools, shoes), tailoring, timber-cutting, dispensing traditional medicine, providing wichdoctor services, trading old clothes, etc; many of these activities are temporary and/or seasonal. For women the primary source of additional income is brewing, using either purchased maize or often their own subsistence supplies 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 labour to an immigrant population of agropastoralists (the Sukuma) who have been arriving in Rukwa since the early 1970s; 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 three types of human capital: education, fertility and number of surviving offspring. Further analyses will examine anthropometrics, and 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 on the lower slopes 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. 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; note however that the pairs need never have both been currently residing in the village. 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 too that a few individuals may appear both as the parents of a set of focal individuals, and as focals themselves (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 offspring measure of human capital, W is the parent measure of 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. Analyses were clustered by mother's code to produce robust standard errors.

Because of the exploratory nature of these investigations analyses were run for females and males separately, and for the effects of a) mother's human capital, b) father's human capital and c) parental human capital. Parental capital was calculated as an average of mother's and father's values, replacing missing data with the value of the other parent. For the measures of fertility and offspring survival analyses were conducted for both currently reproductive F2 individuals and for those who have most likely completed their reproduction (as detailed below). 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 only for parental wealth averaged. A small jitter function is set to increase visibility of overlapping data points. The β estimates are summarized in a final table (Table 4).

## 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. The relationships between parental education and daughters' and sons' education is shown in Figures 1a and 1b, and the results for the regressions with mother's education, father's education and parents' education are presented in Tables 1a and 1b.[1] For women, education is associated with her mother's education (Table 1a).[2] For men, both paternal education, and the averaged parental education measure, are both positively associated with education (Table 1b).

## 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 45$^{th}$ (women) or 55$^{th}$ (men) birthday – the latter samples designed to capture those individuals for whom fertility is most likely complete. The relationship between parental fertility and daughters' and sons' fertility is shown in Figure 2, and the results for the regression with mother's fertility, father's fertility and parental fertility are presented in Tables 2.

For the full sample, apart from the anticipated age effects, women's fertility was affected *negatively* by their father's fertility (Table 2a), an effect that retained direction but not significance in the smaller sample of women who had reached their 45$^{th}$ birthday (Table 2b). There were no significant maternal effects on fertility. For men, apart from expected age effects in the full sample, there were no significant correlations with the fertility of either their mother or their father, neither in the full nor in the completed sample.[3]

## 6. Surviving offspring

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[1] The suggestion from the figures that more women go to secondary school than do men (ie., lie above the 7 on the Y axis) reflects sample distortion. Although there are more secondary educated men in the sample, rather few of them have parents in Mirumba, hence they drop out of the paired sample.

[2] In fact this result only holds when the interaction term is in the model; furthermore note that the association between age and education is positive in the regression model, yet an examination of the data in a scatterplot shows a clearly negative relationship (which makes more sense – younger women are more educated than older women). This needs further investigation.

[3] Very high but non sig est and se for LPATSIBE (small sample) needs investigation

Surviving offspring is measured as the number of offspring currently alive.[4] Like fertility it 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 Figure 3, and the results of the regressions with mother's surviving offspring, father's surviving offspring and parental surviving offspring are presented in Table 3.

For the full sample, apart again from anticipated age effects, there were no 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 sample (Table 3b). Exactly the same pattern holds for men – no statistically significant effects in either the full (Tables 3c) and the completed samples (Table 3d).

## 7. Summary

The results are summarized in Table 4. The only robust β estimates are the sex-specific effects on education. The remarkable absence of intergenerational effects on fertility and offspring survival held, even when for the smaller samples (that had completed their reproduction) the interaction term, the age and age squared terms, and the clustering term were progressively dropped from the analysis, suggesting that lack of statistical power is not an important consideration in evaluating these results.

It is worth stressing that these analyses are preliminary, the data have not yet been fully cleaned, and that children less than five years old at last survey have not yet been censored from the counts of surviving offspring. These provisos aside, it appears that there is very little intergenerational transmission of reproductive performance. Intergenerational correlations of anthropometric status are still to be investigated, and are likely to show some associations. Measures of material wealth are still to be appropriately coded, and are less likely to show correlations.

## 8. 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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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.

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[4] This still needs to be corrected to number of offspring surviving to 5 years. Correction will have little effect on estimates based on the women > 45 years, but could substantially alter the estimate for the full sample.

**Table 1a Women's education**

*i. Estimation of the effect of mother's education (n=237, number of clusters 126)*

| LFIN | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| **LMATFIN** | **.1848839** | **.0803916** | **2.30** | **0.023** | **.0257789** | **.3439889** |
| **AGELS3** | **.2255459** | **.0395904** | **5.70** | **0.000** | **.1471915** | **.3039003** |
| **AGESQ** | **-.0032072** | **.0005561** | **-5.77** | **0.000** | **-.0043078** | **-.0021066** |
| C3xLMATFIN | .012722 | .0075645 | 1.68 | 0.095 | -.0022491 | .0276931 |
| _cons | -2.057486 | .7171743 | -2.87 | 0.005 | -3.476863 | -.6381088 |

*ii Estimation of the effect of father's education (n=179, 92 clusters)*

| LFIN | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| LPATFIN | .1245273 | .1348203 | 0.92 | 0.358 | -.1432766 | .3923312 |
| **AGELS3** | **.2638254** | **.0806477** | **3.27** | **0.002** | **.1036286** | **.4240222** |
| **AGESQ** | **-.0041449** | **.0011389** | **-3.64** | **0.000** | **-.0064071** | **-.0018826** |
| C3xLPATFIN | -.0081013 | .0084287 | -0.96 | 0.339 | -.0248438 | .0086413 |
| _cons | -2.592293 | 1.305302 | -1.99 | 0.050 | -5.185115 | .0005294 |

*iii Estimation of the effect of parent's education (n=248, 133 clusters)*

| LFIN | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| LPARFIN | .1705401 | .1249171 | 1.37 | 0.175 | -.0765582 | .4176384 |
| **AGELS3** | **.2023688** | **.0464507** | **4.36** | **0.000** | **.1104846** | **.2942529** |
| **AGESQ** | **-.0030893** | **.0007277** | **-4.25** | **0.000** | **-.0045287** | **-.0016499** |
| C3xLPARFIN | .0061875 | .0088743 | 0.70 | 0.487 | -.0113667 | .0237418 |
| _cons | -1.604561 | .7528905 | -2.13 | 0.035 | -3.093853 | -.1152695 |

**Table 1a Men's education**

*i. Estimation of the effect of mother's education (n=150, clusters 92)*

| LFIN | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| LMATFIN | .0460601 | .0935339 | 0.49 | 0.624 | -.1397335 | .2318537 |
| AGELS3 | .0929313 | .0637368 | 1.46 | 0.148 | -.0336739 | .2195365 |
| AGESQ | -.0013891 | .0008886 | -1.56 | 0.121 | -.0031542 | .000376 |
| C3xLMATFIN | -.0012316 | .0081251 | -0.15 | 0.880 | -.0173711 | .0149078 |
| _cons | .1518397 | 1.156142 | 0.13 | 0.896 | -2.144694 | 2.448374 |

*ii. Estimation of the effect of father's education (n=114, clusters 69)*

| LFIN | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| **LPATFIN** | **.1739319** | **.0769364** | **2.26** | **0.027** | **.0204078** | **.327456** |
| AGELS3 | .0286539 | .0749485 | 0.38 | 0.703 | -.1209036 | .1782113 |
| AGESQ | -.0006377 | .0008494 | -0.75 | 0.455 | -.0023326 | .0010572 |
| C3xLPATFIN | .0063819 | .0061174 | 1.04 | 0.301 | -.0058253 | .018589 |
| _cons | 1.368036 | 1.545637 | 0.89 | 0.379 | -1.716236 | 4.452307 |

*iii. Estimation of the effect of parents' education (n=162, clusters 100)*

| LFIN | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| **LPARFIN** | **.1454251** | **.0721247** | **2.02** | **0.046** | **.0023141** | **.2885362** |
| AGELS3 | .0694393 | .05662 | 1.23 | 0.223 | -.0429071 | .1817856 |
| AGESQ | -.0009666 | .0006428 | -1.50 | 0.136 | -.0022421 | .0003088 |
| C3xLPARFIN | .002293 | .0047343 | 0.48 | 0.629 | -.0071009 | .011687 |
| _cons | .4607692 | 1.145502 | 0.40 | 0.688 | -1.812154 | 2.733693 |

**Table 2a Women's fertility (all)**

*i. Estimation of the effect of mother's fertility (n=252, number of clusters 134)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LMATSIBE | -.0172714 | .0807252 | -0.21 | 0.831 | -.1769427 | .1424 |
| **AGELS3** | **.1432912** | **.0136823** | **10.47** | **0.000** | **.1162281** | **.1703543** |
| **AGESQ** | **-.0013001** | **.0001877** | **-6.93** | **0.000** | **-.0016714** | **-.0009289** |
| C3xLMATSIBE | .0006755 | .0010085 | 0.67 | 0.504 | -.0013192 | .0026702 |
| _cons | -1.832261 | .3293863 | -5.56 | 0.000 | -2.483775 | -1.180748 |

*ii. Estimation of the effect of father's fertility (n=211, number of clusters 109)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| **LPATSIBE** | **-.1811986** | **.0720412** | **-2.52** | **0.013** | **-.3239968** | **-.0384003** |
| **AGELS3** | **.1598742** | **.017312** | **9.23** | **0.000** | **.1255587** | **.1941896** |
| **AGESQ** | **-.0012914** | **.0002029** | **-6.36** | **0.000** | **-.0016935** | **-.0008892** |
| C3xLPATSIBE | -.0008585 | .0008195 | -1.05 | 0.297 | -.002483 | .000766 |
| _cons | -2.072648 | .3633204 | -5.70 | 0.000 | -2.792812 | -1.352484 |

*iii. Estimation of the effect of parent's fertility (n=252, number of clusters 134)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPARSIBE | -.0253986 | .0895242 | -0.28 | 0.777 | -.2024739 | .1516768 |
| **AGELS3** | **.1312878** | **.0182713** | **7.19** | **0.000** | **.0951479** | **.1674278** |
| **AGESQ** | **-.0012897** | **.0001796** | **-7.18** | **0.000** | **-.0016451** | **-.0009344** |
| C3xLPARSIBE | .0080406 | .0078242 | 1.03 | 0.306 | -.0074353 | .0235165 |
| _cons | -1.3859 | .5274337 | -2.63 | 0.010 | -2.429144 | -.3426567 |

**Table 2b Women's fertility (>44 years)**

*i. Estimation of the effect of mother's fertility (n=45, number of clusters 37)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LMATSIBE | .1278975 | .2351864 | 0.54 | 0.590 | -.3490827 | .6048777 |
| **AGELS2** | **.1096873** | **.0268393** | **4.09** | **0.000** | **.0552546** | **.16412** |
| **AGESQ** | **-.0009543** | **.0002986** | **-3.20** | **0.003** | **-.0015599** | **-.0003486** |
| C2xLMATSIBE | .0012182 | .0025159 | 0.48 | 0.631 | -.0038844 | .0063207 |
| _cons | -1.339302 | 1.054302 | -1.27 | 0.212 | -3.477525 | .7989209 |

*ii Estimation of the effect of father's fertility (n=35, number of clusters 28)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPATSIBE | -.3646527 | .287223 | -1.27 | 0.215 | -.9539856 | .2246801 |
| **AGELS2** | **.133019** | **.0396402** | **3.36** | **0.002** | **.051684** | **.2143539** |
| **AGESQ** | **-.0010298** | **.0003132** | **-3.29** | **0.003** | **-.0016725** | **-.0003871** |
| C2xLPATSIBE | -.0001789 | .0023457 | -0.08 | 0.940 | -.004992 | .0046341 |
| _cons | -1.178023 | 1.363206 | -0.86 | 0.395 | -3.975091 | 1.619045 |

*iii. Estimation of the effect of parent's fertility (n=45, number of clusters 37)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPARSIBE | .0431984 | .239559 | 0.18 | 0.858 | -.4426497 | .5290464 |
| **AGELS2** | **.0965357** | **.0406897** | **2.37** | **0.023** | **.0140131** | **.1790583** |
| **AGESQ** | **-.0009767** | **.0002686** | **-3.64** | **0.001** | **-.0015215** | **-.000432** |
| C2xLPARSIBE | .0122064 | .0186594 | 0.65 | 0.517 | -.0256366 | .0500494 |
| _cons | -.3882884 | 1.90753 | -0.20 | 0.840 | -4.256939 | 3.480362 |

**Table 2c. Men's fertility (all)**

*i. Estimation of the effect of mother's fertility (n=168, number of clusters 100)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LMATSIBE | -.0630704 | .1162527 | -0.54 | 0.589 | -.293741 | .1676002 |
| **AGELS3** | **.1562831** | **.0308386** | **5.07** | **0.000** | **.0950926** | **.2174735** |
| **AGESQ** | **-.0011251** | **.0003394** | **-3.31** | **0.001** | **-.0017986** | **-.0004515** |
| **C3xLMATSIBE** | **-.0020217** | **.0010152** | **-1.99** | **0.049** | **-.0040361** | **-7.40e-06** |
| _cons | -2.812047 | .660409 | -4.26 | 0.000 | -4.122441 | -1.501652 |

*ii. Estimation of the effect of father's fertility (n=144, number of clusters 84)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPATSIBE | .0995619 | .2714539 | 0.37 | 0.715 | -.4403489 | .6394727 |
| **AGELS3** | **.1547844** | **.0340439** | **4.55** | **0.000** | **.0870725** | **.2224963** |
| **AGESQ** | **-.0013044** | **.0004281** | **-3.05** | **0.003** | **-.0021559** | **-.0004528** |
| C3xLPATSIBE | -.0001879 | .002403 | -0.08 | 0.938 | -.0049675 | .0045916 |
| _cons | -2.764504 | .787099 | -3.51 | 0.001 | -4.330013 | -1.198996 |

*iii. Estimation of the effect of parents' fertility (n=168, number of clusters 100)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPARSIBE | -.069128 | .1326568 | -0.52 | 0.603 | -.332348 | .1940919 |
| **AGELS3** | **.1756808** | **.0370436** | **4.74** | **0.000** | **.1021782** | **.2491833** |
| **AGESQ** | **-.0011425** | **.0003381** | **-3.38** | **0.001** | **-.0018133** | **-.0004717** |
| C3xLPARSIBE | -.0164503 | .0082725 | -1.99 | 0.050 | -.0328648 | -.0000357 |
| _cons | -3.598866 | .9603473 | -3.75 | 0.000 | -5.504404 | -1.693329 |

**Table 2d. Men's fertility (> 55 years)**

*i. Estimation of the effect of mother's fertility (n=29, number of clusters 22)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LMATSIBE | -.1127857 | .3028842 | -0.37 | 0.713 | -.7426678 | .5170964 |
| AGELS2 | .118035 | .1222591 | 0.97 | 0.345 | -.1362168 | .3722867 |
| AGESQ | -.0007216 | .0008936 | -0.81 | 0.428 | -.00258 | .0011368 |
| C2xLMATSIBE | -.001309 | .0056123 | -0.23 | 0.818 | -.0129803 | .0103624 |
| _cons | -2.205606 | 4.851913 | -0.45 | 0.654 | -12.29571 | 7.8845 |

*i. Estimation of the effect of father's fertility (n=24, number of clusters 17)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPATSIBE | .6818487 | 1.043661 | 0.65 | 0.523 | -1.530614 | 2.894311 |
| AGELS2 | .0931836 | .1049329 | 0.89 | 0.388 | -.1292643 | .3156314 |
| AGESQ | -.0009807 | .0010022 | -0.98 | 0.342 | -.0031052 | .0011438 |
| C2xLPATSIBE | .0030804 | .0064704 | 0.48 | 0.640 | -.0106363 | .0167971 |
| _cons | -1.819235 | 4.223724 | -0.43 | 0.672 | -10.77313 | 7.134659 |

*iii. Estimation of the effect of parents' fertility (n=29, number of clusters 22)*

| LFERT | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPARSIBE | -.050909 | .326296 | -0.16 | 0.878 | -.7294787 | .6276607 |
| AGELS2 | .139269 | .1646363 | 0.85 | 0.407 | -.2031109 | .4816489 |
| AGESQ | -.0007046 | .0009378 | -0.75 | 0.461 | -.0026549 | .0012456 |
| C2xLPARSIBE | -.0153116 | .0424806 | -0.36 | 0.722 | -.1036548 | .0730316 |
| _cons | -3.606963 | 7.227677 | -0.50 | 0.623 | -18.63774 | 11.42381 |

**Table 3a Women's surviving offspring (all)**

*i. Estimation of the effect of mother's surviving offspring (n=252, clusters 134)*

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LMATSIBU | .1368825 | .1180286 | 1.16 | 0.248 | -.0965736 | .3703385 |
| **AGELS3** | **.1255261** | **.0255339** | **4.92** | **0.000** | **.075021** | **.1760312** |
| **AGESQ** | **-.0011015** | **.000246** | **-4.48** | **0.000** | **-.001588** | **-.000615** |
| C3xLMATSIBU | .0007814 | .0017577 | 0.44 | 0.657 | -.0026952 | .004258 |
| _cons | -2.083308 | .6317548 | -3.30 | 0.001 | -3.332894 | -.8337215 |

**ii. Estimation of the effect of father's surviving offspring (n=211, clusters 109)**

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPATSIBU | -.0175227 | .1700032 | -0.10 | 0.918 | -.3544986 | .3194531 |
| **AGELS3** | **.1287054** | **.0291711** | **4.41** | **0.000** | **.0708832** | **.1865276** |
| **AGESQ** | **-.0011248** | **.000288** | **-3.91** | **0.000** | **-.0016957** | **-.0005539** |
| C3xLPATSIBU | .0005363 | .001899 | 0.28 | 0.778 | -.0032279 | .0043005 |
| _cons | -1.914429 | .6114164 | -3.13 | 0.002 | -3.126362 | -.7024956 |

**iii. Estimation of the effect of parent's surviving offspring (n=252, clusters 134)**

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPARSIBU | .1137998 | .1414999 | 0.80 | 0.423 | -.1660816 | .3936812 |
| **AGELS3** | **.1095425** | **.0279608** | **3.92** | **0.000** | **.054237** | **.164848** |
| **AGESQ** | **-.0010418** | **.0002489** | **-4.19** | **0.000** | **-.001534** | **-.0005496** |
| C3xLPARSIBU | .0093267 | .0079337 | 1.18 | 0.242 | -.0063659 | .0250193 |
| _cons | -1.542611 | .6695778 | -2.30 | 0.023 | -2.867009 | -.2182117 |

**Table 3b Women's surviving offspring (>45 years)**

*i. Estimation of the effect of mother's surviving offspring (n=45, clusters 37)*

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LMATSIBU | .1634493 | .1404374 | 1.16 | 0.252 | -.1213709 | .4482696 |
| **AGELS2** | **.1377371** | **.0584289** | **2.36** | **0.024** | **.0192379** | **.2562364** |
| **AGESQ** | **-.0011484** | **.0005407** | **-2.12** | **0.041** | **-.0022451** | **-.0000517** |
| C2xLMATSIBU | .0008204 | .0035914 | 0.23 | 0.821 | -.0064633 | .0081042 |
| _cons | -2.661708 | 1.636641 | -1.63 | 0.113 | -5.98097 | .6575547 |

*ii. Estimation of the effect of father's surviving offspring (n=35, clusters 28)*

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPATSIBU | .0332389 | .4560014 | 0.07 | 0.942 | -.9023987 | .9688765 |
| **AGELS2** | **.1848262** | **.08828** | **2.09** | **0.046** | **.0036906** | **.3659617** |
| AGESQ | -.001384 | .0007887 | -1.75 | 0.091 | -.0030023 | .0002343 |
| C2xLPATSIBU | -.0032083 | .0043778 | -0.73 | 0.470 | -.0121908 | .0057742 |
| _cons | -4.295701 | 2.463032 | -1.74 | 0.093 | -9.349425 | .7580225 |

*iii. Estimation of the effect of parent's surviving offspring (n=45, clusters 37)*

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPARSIBU | .1861357 | .2119023 | 0.88 | 0.386 | -.243622 | .6158935 |
| AGELS2 | .1254876 | .0582335 | 2.15 | 0.038 | .0073845 | .2435907 |
| AGESQ | -.0011096 | .0005526 | -2.01 | 0.052 | -.0022303 | .0000111 |
| C2xLPARSIBU | .0086546 | .0161518 | 0.54 | 0.595 | -.0241027 | .0414119 |
| _cons | -2.163066 | 1.704916 | -1.27 | 0.213 | -5.620796 | 1.294664 |

**Table 3c Men's surviving offspring (all)**

*i. Estimation of the effect of mother's surviving offspring (n=168, clusters 100)*

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| LMATSIBU | -.0273188 | .1412613 | -0.19 | 0.847 | -.3076118 | .2529743 |
| **AGELS3** | **.1364544** | **.0364537** | **3.74** | **0.000** | **.0641225** | **.2087864** |
| **AGESQ** | **-.0010692** | **.0003798** | **-2.82** | **0.006** | **-.0018228** | **-.0003156** |
| C3xLMATSIBU | -.0011507 | .0018451 | -0.62 | 0.534 | -.0048117 | .0025103 |
| _cons | -2.410073 | .7729572 | -3.12 | 0.002 | -3.943788 | -.8763585 |

*ii. Estimation of the effect of father's surviving offspring (n=144, clusters 84)*

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| LPATSIBU | .2468528 | .272651 | 0.91 | 0.368 | -.2954391 | .7891446 |
| **AGELS3** | **.129829** | **.0471253** | **2.75** | **0.007** | **.0360986** | **.2235594** |
| **AGESQ** | **-.0011735** | **.0004372** | **-2.68** | **0.009** | **-.0020431** | **-.0003038** |
| C3xLPATSIBU | .0015243 | .0029327 | 0.52 | 0.605 | -.0043086 | .0073573 |
| _cons | -2.367653 | .919807 | -2.57 | 0.012 | -4.197112 | -.5381941 |

*iii. Estimation of the effect of parents' surviving offspring (n=168, clusters 100)*

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| LPARSIBU | .0265076 | .2236357 | 0.12 | 0.906 | -.417234 | .4702493 |
| **AGELS3** | **.1336611** | **.0452305** | **2.96** | **0.004** | **.0439141** | **.2234082** |
| **AGESQ** | **-.001029** | **.0003903** | **-2.64** | **0.010** | **-.0018035** | **-.0002544** |
| C3xLPARSIBU | -.0036458 | .0127588 | -0.29 | 0.776 | -.0289621 | .0216705 |
| _cons | -2.45331 | 1.03259 | -2.38 | 0.019 | -4.502192 | -.4044274 |

**Table 3d Men's surviving offspring (>55 years)**

*i. Estimation of the effect of mother's surviving offspring (n=29, clusters 22)*

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LMATSIBU | -.2110506 | .1593064 | -1.32 | 0.199 | -.5423464 | .1202452 |
| AGELS2 | .0847761 | .0723413 | 1.17 | 0.254 | -.0656659 | .235218 |
| AGESQ | -.0006336 | .0007338 | -0.86 | 0.398 | -.0021596 | .0008924 |
| C2xLMATSIBU | .001405 | .0026984 | 0.52 | 0.608 | -.0042065 | .0070166 |
| _cons | -.779606 | 1.713113 | -0.46 | 0.654 | -4.342219 | 2.783007 |

*ii. Estimation of the effect of father's surviving offspring (n=24, clusters 17)*

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPATSIBU | -.2650413 | .4748582 | -0.56 | 0.584 | -1.271696 | .7416131 |
| AGELS2 | .131901 | .0927077 | 1.42 | 0.174 | -.0646305 | .3284325 |
| AGESQ | -.0010811 | .0009369 | -1.15 | 0.265 | -.0030673 | .000905 |
| C2xLPATSIBU | .000077 | .0046294 | 0.02 | 0.987 | -.0097369 | .0098909 |
| _cons | -1.820252 | 2.070935 | -0.88 | 0.392 | -6.210437 | 2.569934 |

*iii. Estimation of the effect of parents' surviving offspring (n=29, clusters 22)*

| LSOFF | Coef. | Robust Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| LPARSIBU | -.4106609 | .362958 | -1.13 | 0.271 | -1.165473 | .3441517 |
| AGELS2 | .0991567 | .0683315 | 1.45 | 0.162 | -.0429463 | .2412598 |
| AGESQ | -.0006398 | .0007292 | -0.88 | 0.390 | -.0021562 | .0008765 |
| C2xLPARSIBU | -.0045493 | .0141957 | -0.32 | 0.752 | -.0340708 | .0249723 |
| _cons | -1.275421 | 1.453522 | -0.88 | 0.390 | -4.298186 | 1.747343 |

**Table 4 Pimbwe Summary**

| | **Beta parameter (significance level, standard error and sample size)** | | | | | |
|---|---|---|---|---|---|---|
| | **Women** | | | **Men** | | |
| Model Parameters | Mum-daughter | Dad - daughter | Parent - daughter | Mum - son | Dad - son | Parent - son |
| Education | **.18 *** (.08, 126) | .12 (.13, 179) | .17 (.12, 248) | .05 (.09, 150) | **.17 *** (.08, 114) | .15 * (.08, 162) |
| Fertility (all ages) | -.02 (.08. 252) | **-.18 *** (.07, 211) | -.03 (.09, 252) | -.06 (.11, 168) | .10 (.27. 144) | -.07 (.13, 168) |
| Fertility (complete) | .13 (.24, 45) | -.36 (.29, 35) | .04 (.24, 45) | -.11 (.30, 29) | .68 (1.04, 24) | -.05 (.33, 29) |
| Surviving offspring (all ages) | .14 (.12, 252) | -.02 (.17, 211) | .11 (.14, 252) | -.03 (.14, 168) | .25 (.27, 144) | .03 (.22, 168) |
| Surviving offspring (complete) | .16 (.14, 45) | .03 (.46, 35) | .19 (.21, 45) | -.21 (.16, 29) | -.28 (.48, 24) | -.41 (.36, 29) |

**Figure 1a. Women's education**

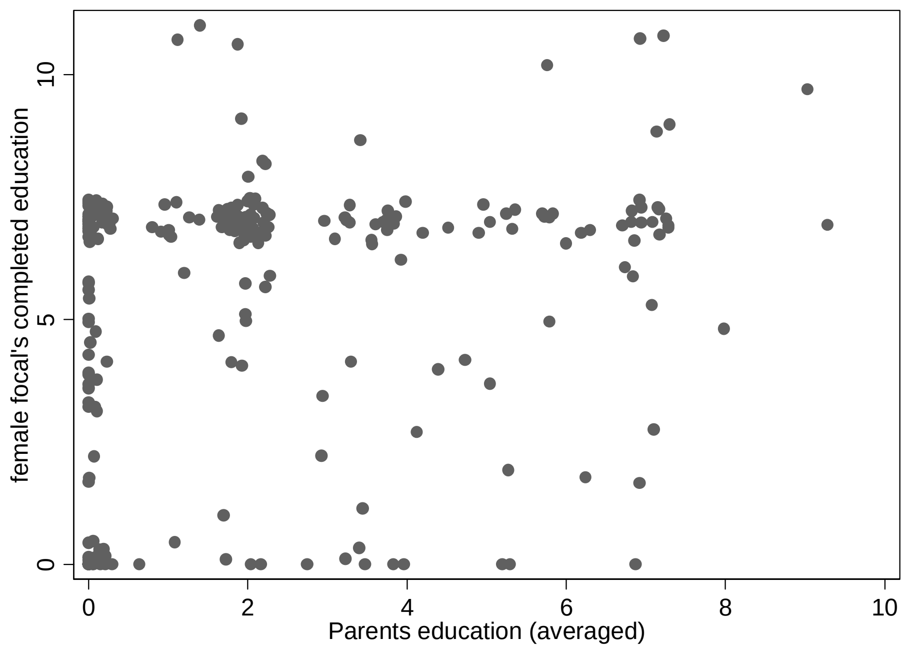


**Figure 1b Men's education**

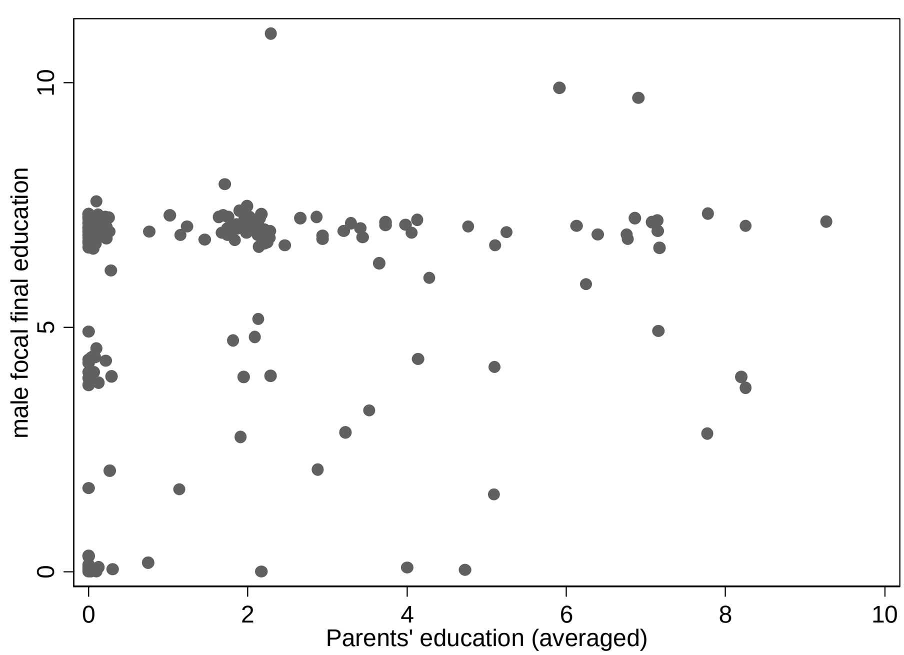

**Figure 2a. Women's fertility (all)**

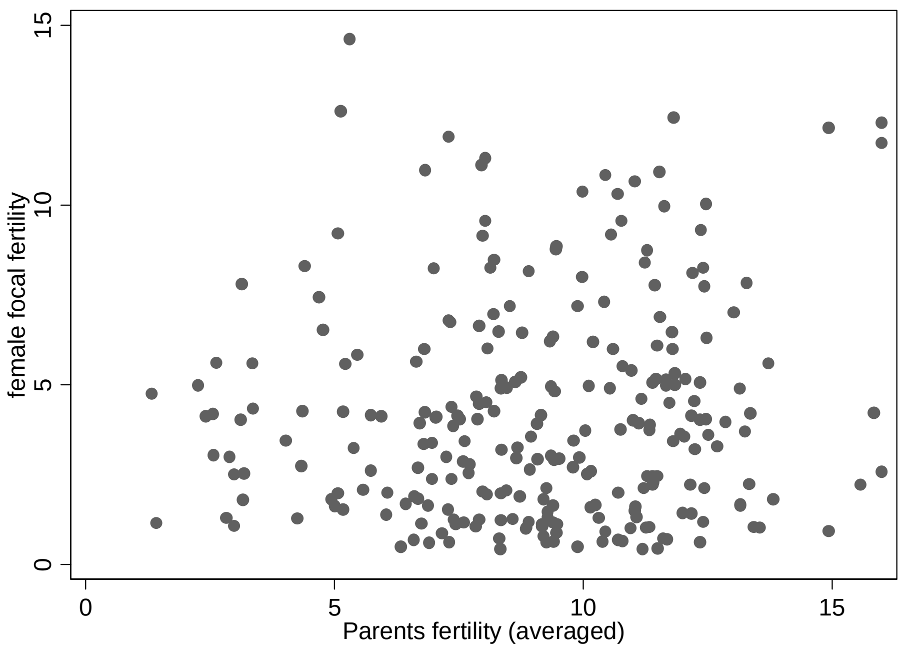


**Figure 2b. Women's fertility (>45 years)**

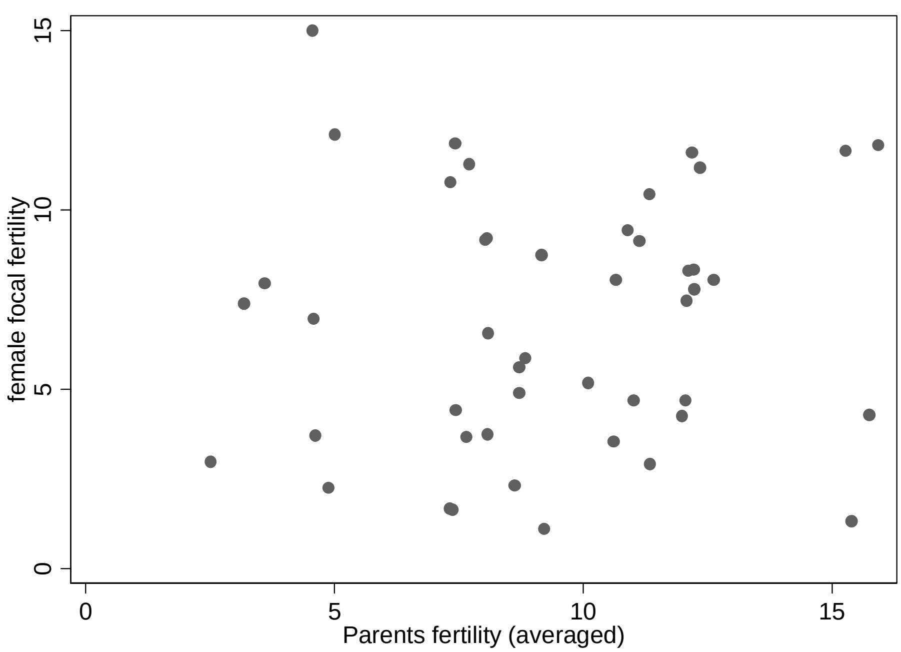

**Figure 2c. Men's fertility (all)**

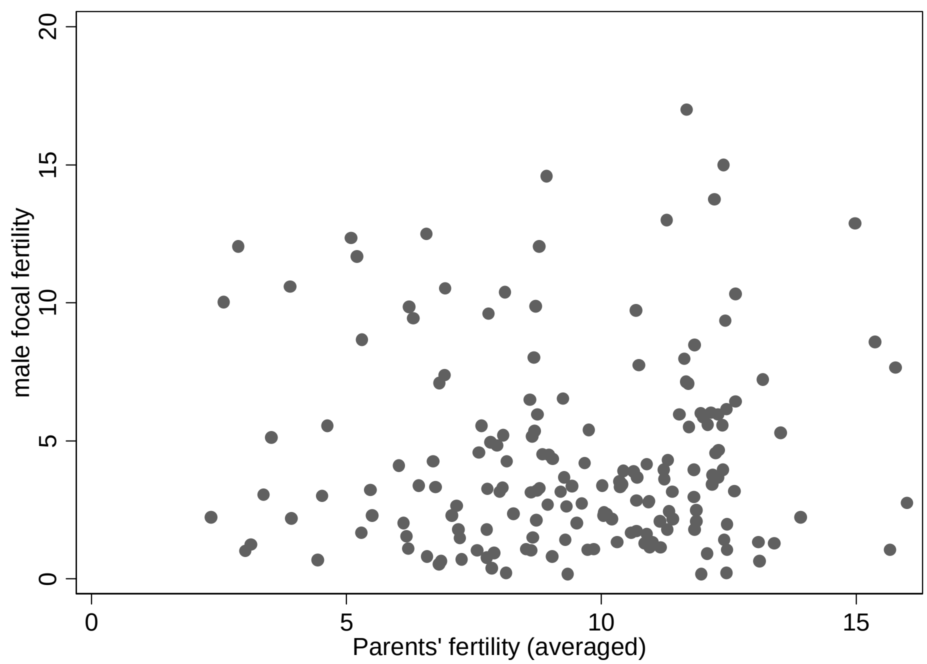


**Figure 2d. Men's fertility (>55 years)**

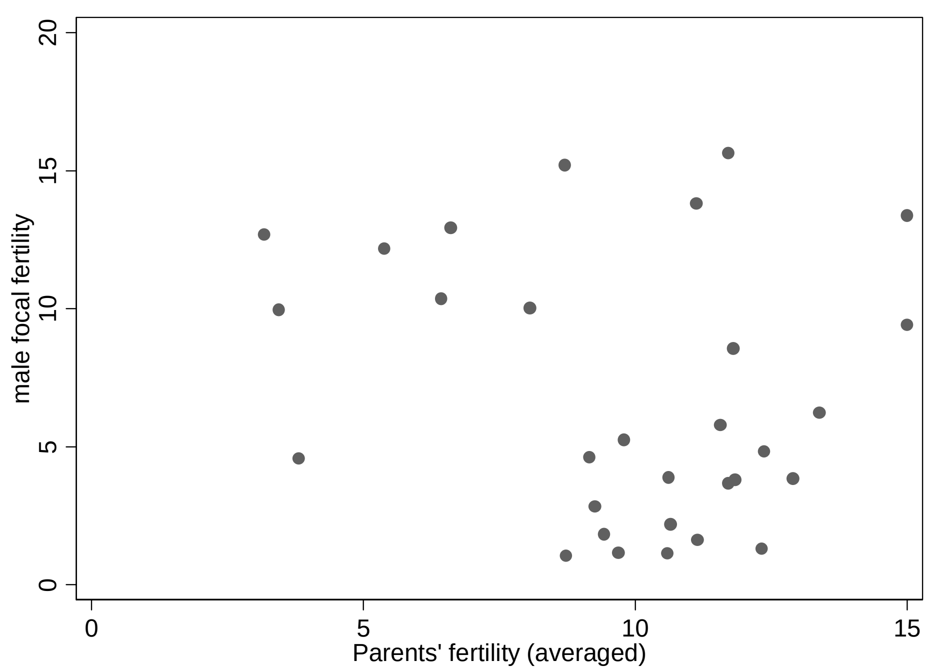

**Figure 3a. Women's surviving offspring (all)**

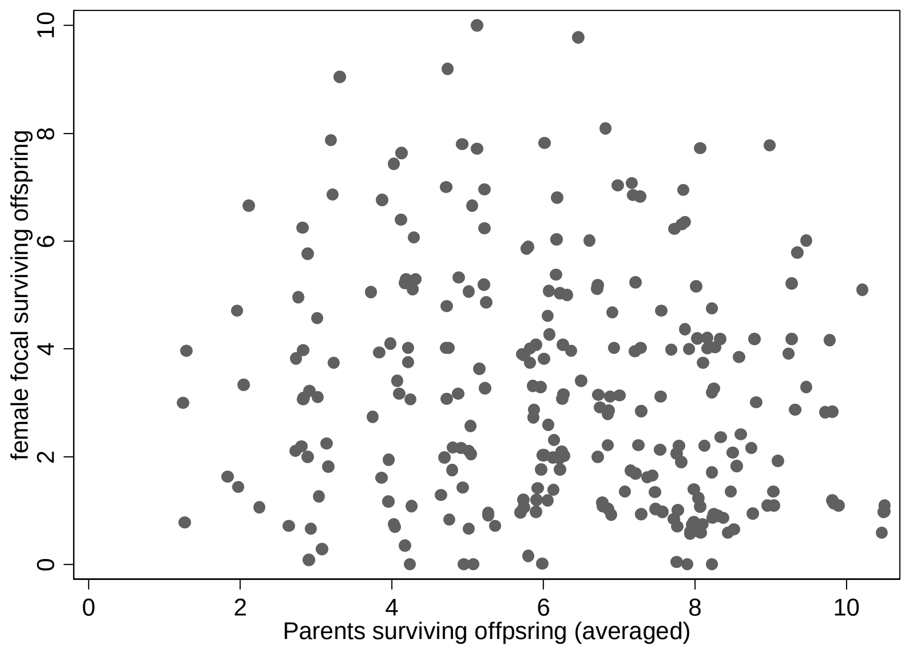


**Figure 3b. Women's surviving offspring (>45 years)**

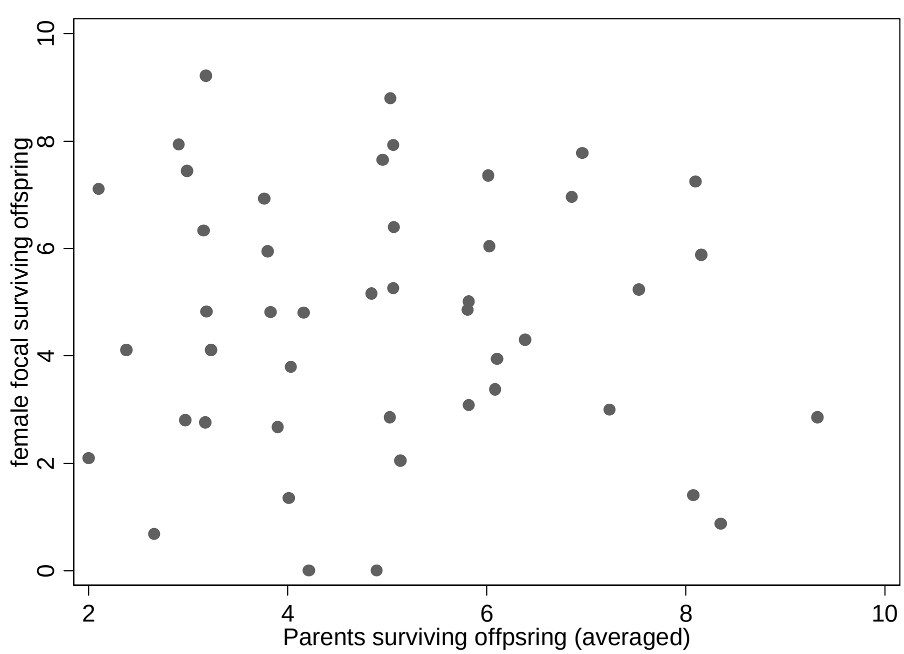

**Figure 3c. Men's surviving offspring (all)**

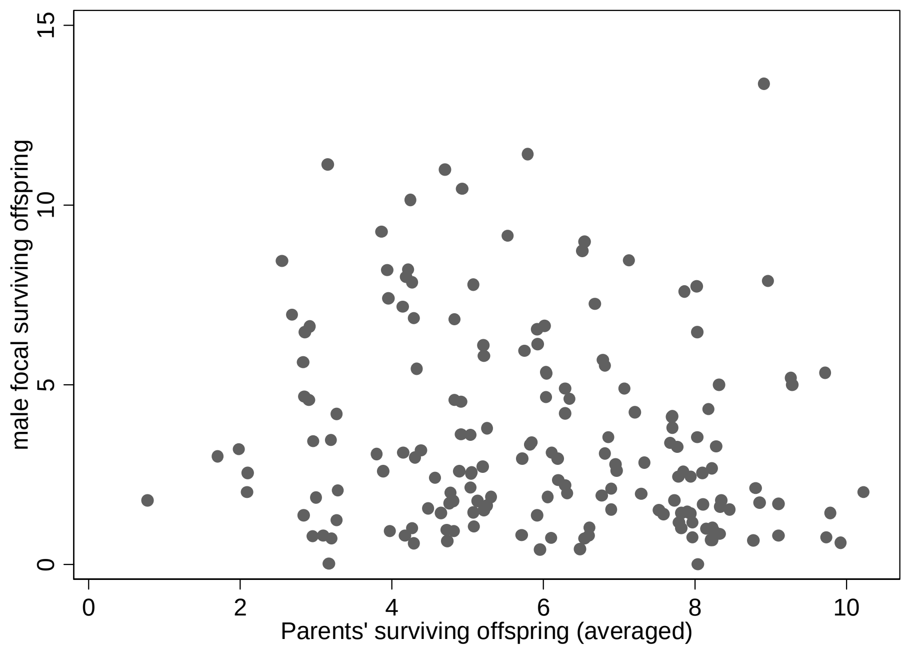


**Figure 3d. Men's surviving offspring (>55 years)**