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Age of Marriage and Fertility: A Policy Review

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The average age at which women marry and the number of children they produce tend to be negatively correlated. This negative relationship has received a good deal of attention from social scientists over the past several decades, and it has on occasion been suggested that if governments could find a way to raise the average age of marriage, the result would be a significant reduction in completed fertility.[1] Since reduction of population growth rates is an explicit policy of many developing nations, particularly Pakistan, it seems worth taking a closer look at age of marriage as a policy tool.

Raising the average age of marriage through, say, an act of legislation is likely to be a difficult task, but the issue under consideration in this paper is not feasibility, but advisability based on existing empirical evidence. The basic question is: Regardless of how difficult it is to alter the age at which couples marry, does the available evidence offer any support for attempting to do so? Although the causes and consequences of human behaviour are notoriously difficult to pin down, the following analysis suggests that the answer as of this point in time is no.

The reason for this negative response is not that there is no relationship between age of marriage and fertility, but rather that the statistical methodologies used to estimate this relationship leave the direction of causation between the two variables in doubt. The problem is one of appropriate methods for predicting the effect on individual behaviour of proposed policies, and in that sense this paper is primarily a methodological exercise.

The Problem in Theory

Several authors have recently proposed a framework for analysing the fertility behaviour of individuals based on the presumption that children are

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[1]See Gulati [4] for a recent opposing view.

not showered on households in some random fashion, but are in part the result of implicit or explicit decision making by parents.[2] This framework suggests that many of the factors that bear on parental decisions to purchase consumption items from the market place (food, consumer durables, and so on) should also affect their "purchase" of children. Among the most important of these factors is the price that parents must pay in order to have and raise another child and the amount of resources that parents have at their disposal, that is, family income. If children are like other items consumed (produced) by the household, then as the cost of having and rearing children rises, holding income constant, the number of children desired and produced by parents will decline. Conversely, if the cost of children remains unchanged, but family income rises for unexpected reasons, then parents will want to, and indeed will, consume (produce) more children as long as children are normal goods in the economic sense of the term.

Why then in many countries do rich families have fewer children than poor families? This question has served as the focus for much of the recent empirical research on determinants of fertility and one possible answer is that, for many reasons, the price (cost) of children and family income may be, on average, highly positively correlated. One source of this positive correlation is that a major component in the cost of having and raising a child is the opportunity cost of the mother's time. In relatively wealthy families, wives tend to be well educated, highly productive in other activities and, thus, their time is worth more than is the time of wives who live in relatively poor families. Since the raising of children is thought to require a significant portion of wife's time, the more valuable is that time, the more costly are children relative to other items that the household consumes.[3]

While this theory is reasonably well accepted when applied to developed societies in which a substantial proportion of the married population uses or has used some form of modern contraception, it is often viewed with considerable skepticism when the setting is a traditional or "natural fertility" population. This paper is not the appropriate forum in which to pursue this debate, but some justification for the use of this model is in order. The gist of the criticism leveled at the use of these models in traditional societies is that people do not think rationally or consciously about desired family size, and even if they did, they do not consciously link that goal with, say, decisions on what age to marry (or marry off their children). Partly, this is a "proof of the pudding is in the eating" issue; that is, whether the theory is useful in studying fertility in developing nations like Pakistan depends on whether it provides a framework or language that helps us to understand some of the regularities observed in the behaviour of families and individuals living in those nations. This is an empirical question, not resolvable by debating the merits of the theory. And partly, the issue centers on what one means by "rationality", "conscious decision making" and the like. As Yoram Ben-Porath [2] puts it;

> "The economic theory of household choice does not claim that each individual goes through an explicit calculus of pleasure and pain as a

[2] See, especially, Willis [7], Ben-Porath [2] and De Tray [3].

[3] As long as the production of children uses relatively more time of wifes than does the production of other items consumed by the family, the relative price of children will rise as the opportunity cost of wife's time increases.

> guide to behaviour and this is certainly true when it is applied to fertility. It is recognized that the process each individual goes through is very complicated and varies among individuals. The assumption is that one possible way of capturing and making sense out of common elements of behaviour is to derive propositions as if people were acting according to a specific rule—maximizing a utility function subject to a budget constraint. There is no guarantee, of course, that this is a good strategy". [2, P. 303].

The point is that whether individuals consciously make decisions about the number of children they have or whether those decisions are imbedded in the fabric of the society in which couples live does not determine the applicability of economic models of the household to fertility. What is important, and about all that is important, is that households and individuals face real time and resource constraints, which seems hard to deny especially in developing nations, and that having and rearing children use up a significant portion of those resources, which seems equally hard to deny.

The assumption that the value of a wife's time is higher in wealthy families than in poor families is also often questioned in the context of developing nations where few wives work, especially among the higher socio-economic groups. However, the critical issue is not how wives allocate their time, but the value of that time. Thus it is only necessary that wives in high income families have characteristics that would imply relatively high wage rates if they decided to work. For example, if education of women and the market wages they can earn are positively correlated, and relatively wealthy men tend to marry well educated wives, then it follows that the price of children will be positively correlated with family wealth or income. Based on existing empirical evidence, both these conditions hold in Pakistan. In the Impact data on which this study is based, there is a strong positive correlation between husband's education and the education of his wife (the correlation between the two variables is 0.36, which is high for micro data); and, a soon to be completed study of the earning of working women in Rawalpindi indicates significant and positive rates of return to female schooling.

The preceding theory leads to the following general model of the determinants of fertility:

$$C = f(I, P_c, OF)$$

where C is a measure of the household's fertility experience (children ever-born, living children, or others), P_c is the cost associated with having an additional child, and OF represents a host of other factors that are thought to affect fertility (fecundity, availability of birth control knowledge etc.). Existing data, and in some cases any conceivable data, seldom supply all the desired explanatory variables and as a consequence, empirical work must often depend for measures of income and the price of children on whatever proxies are available in the data. The standard compromise often looks something like:

> C = f [husband's income or other income-related characteristics of the family; market wage rates of husband and wife or, if not available, the amount of schooling each has received; community related factors that may influence fertility (Urban

residence, where grew up, access to birth control information, etc.); other explanatory variables].

Under the heading of other explanatory variables fall such family characteristics as age of marriage, child mortality experience, perceptions, and so on. The criteria for selecting these variables depends on the purpose of the analysis, but, in a policy context, one of the major guidelines should be that the direction of causation flows from them to fertility and not from fertility to them,[4] that is, that the variable in question is exogenous to the fertility decision. This is an old issue—causation versus correlation—but when one is attempting to assess the policy impact of a certain action, it is of fundamental importance. The problem is that correlations, even partial correlations supplied by multivariate analysis, between two variables, a and b do not tell the researcher or policy-maker whether the flow of causation is from a to b, from b to a, or from each to the other. Without this information, we have no way of doing what we set out to do: assessing the consequence of a policy-induced change in one of these variables on the average magnitude of the other.

For age of marriage to meet this exogeneity test, young people or their parents must decide or act as if they decide first on an optimal age of marriage, and only then on the number of children that they want to have. In this case, referred to hereafter as the exposure model, the mechanism through which an increase in age of marriage reduces fertility is one of a reduction in the period over which women are at risk of becoming pregnant, and at the extremes of the age of marriage distribution, this mechanism would clearly be at work. A 35 year old woman who married at 30 is likely to have fewer children than a comparable woman who married at 16 simply because she has had fewer years in which to be pregnant. But, raising the age of marriage (either minimum or average) from 16 to 30 is not a viable policy option, so the question remains: would a policy that effectively raised the average age of marriage from, say, 16 to 20 have a significant influence on the number of children that couples have?

In the preceding discussion, age of marriage was viewed as a predetermined or exogenous variable with respect to decisions on numbers of children, but there is an alternative view that deserves consideration. When couples marry, they may do so, not simply for the sake of being married, but in order to have access to certain consumption patterns not available to them if they remained single. A prime example is the production and consumption of "own children". From this perspective, the demand for marriage is derived from couples' desires for, among other things, having and raising their own children. Thus, far from being a predetermined or exogenous vairable with respect to fertility, age of marriage (and frequency of marriage, divorce rates, spacing of children, etc.) may well be *a function of* a couple's demand for children. Couples who want, on average, relatively large numbers of children will marry early in order to increase the probability of attaining that goal, while couples who want small families will marry late in order to reduce fertility.

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[4]There are well known methods for dealing with dual or simultaneous relationships —see Nerlove and Schultz [6], for example—but they have seldom if even been used to analyse the effect of age of marriage on fertility and for that reason I ignore them here.

In this capacity, age of marriage serves as a fertility regulating device, one that is likely to be particularly important in traditional and developing societies.[5]

If it should turn out empirically that the major thrust of the observed relationship between fertility and age of marriage is from the former to the latter, then policies to reduce population growth through increases in age of marriage are not likely to be successful. If couples marry young in order to have large families, raising the age of marriage by three or four years may have as a secondary effect at slight reduction in completed fertility, but its primary effect will be to cause people to try and space their children more closely together, so that they can still attain their *unchanged* desired family size goals.[6] In contract, if flow of causation is from age of marriage to fertility, then such policies are much more likely to succeed in reducing population growth. In the following sections we consider several tests of which of these views is more in accord with the Pakistan experience.

Age of Marriage and Completed Fertility

The following empirical analysis is based on a highly simplified model of completed family size. In this model, the number of children ever born to a woman who has completed or is nearing the end of her child-bearing period is a function of the following proxies for family income and relative prices:

Wealth Variables	*Definition*
Pucca	equals 1 if house type is pucca
Electricity	equals 1 if house had electricity
Husband's Education	0: cannot read or write 1: can read, not write 2: can read, write, grades 0-1 3: can read, write, grades 2-5 4: can read, write, grades 6-9 5: can read, write, grades 10+ 6: can read, write, education other
Price Variables	
Wife's Education	see husband's education for codes
Rural 1	rural residents who visit towns frequently or occasionally
Rural 2	rural residents who seldom or never visit towns

[5]These statments should not be taken to imply that desires for fertility are the only determinant of age of marriage; fertility may be one among many influences on the average age at which couples marry, but the point is that the flow of causation may at least in part be from fertility desires to age of marrige and not strictly the other way around.

[6]If the costs associated with spacing children more closely together were substantial an increase in age of marriage could reduce desired family size; mainly for simplicity, this possibility is ignored in the discussion that follows.

Other Variables

Age Married	age married to current husband
Age	current age of wife
Mortality	ratio of child deaths to children ever born

The choice of these variables is a function almost solely of the non-availability of better measures of wealth and prices in the data used for this analysis (see below).

Most of these variables are self-explanatory and their postulated effect on fertility depends on their correlation with family wealth or the price of children. For example, the better is the housing type, the more wealthy is the couple; if children are normal goods, then pucca should have a positive influence on completed fertility (other housing types make up the "left out" group in this case and are assumed to be of lower quality than pucca). Similarly, families with electricity are assumed to be wealthier than other families. And, husband's education is used in the standard sense as a proxy for his income-earning ability.

The price variables are equally crude, but frequently used, proxies for the conceptual variables of interest. Wife's education is assumed to reflect the value of her time and thus, the more educated is a wife, the more costly are children and the lower is completed fertility. The two rural variables are included to capture the differences in food and housing prices between urban and rural areas (the omitted group, that is, the group against which these variables are compared is those living in an urban area).[7]

Of the other variables in the model, age married is the policy variable under consideration, age is included to capture both cohort effects and the fact that some of the younger women in the sample may have additional children in the future, and mortality controls for differences in infant and child mortality among couples in the sample.

The sample for this analysis is drawn from the 1968-69 National Impact Survey of Pakistan (see, The National Impact Survey Report for a description of the basic data) and consists of currently married women between the ages of 35 and 49. Summary statistics for the variables used in the analysis are given in Table 1. Basic regression results appear in Table 2. All regressions are calculated using ordinary least squares (OLS) techniques.

Most of the control variables behave as expected given their proxy status. For example, in eq.1, the wealth measures are all positively associated with children ever born, and wife's education, as a proxy for the cost of children, has a significant negative influence on the number of children couples have. The two rural measures have the anticipated positive sign, but neither is significant at conventional levels. And finally, the positive coefficient for age is consistant with a secular decline in fertility and with the fact that younger women in this sample have not yet completed their fertility.

[7]The presumption is that those couples who visit town frequently or occasionally (rural 1) on average live closer to urban areas than do those who seldom or never visit towns (rural 2).

Table 1

Summary Statistics

Variables	Mean	Standard Deviation
Dependent Variables:		
Children ever born	6.74	2.6
Living children	4.97	2.2
Explanatory Variables:		
Pucca	0.31	
Electricity	0.30	
Husband's Education	1.48	1.9
Wife's Education	0.31	0.99
Rural 1	0.37	
Rural 2	0.20	
Age Married	16.2	3.2
Age	39.9	3.8
Mortality	0.24	0.21

That age of marriage is negatively and significantly associated with completed fertility is in itself noteworthy, given the findings of several other recent studies of Pakistan fertility [1,5]. For example, in Afzal, Khan and Chaudhry (AKC) [1], the authors find that age of marriage has no effect on the number of children ever born to a sample Lahore women (see Appendix for a brief discussion of why the AKC results differ so dramatically from those presented here).[8]

If we were confident that the direction of causation was only from age of marriage to fertility, then the results given by eq.1 in Table 2 might encourage policy makers to devote serious efforts to raising the age of marriage in Pakistan. The regression indicates that a movement in the average age of marriage from 15.2 to 19.2 would bring about a 0.54 decline in the average number of children ever born which is equivalent to an 8 percent decline in complete fertility. As appealing as this picture may be, it depends rather strongly on the assumption that the causal flow between age of marriage and fertility is undirectional, that family size desires do not affect the average age at which couples marry.

[8]The authors of the second study cited above state in their concluding remarks that "(age of marriage) seems to have no relevance for completed family size", [5, p. 28], even though their regression results show a coefficient on age of marriage of —0.87 with an associated t-ratio of —2.49 (Table 4.4).

Table 2

Regression Results

n = 861

Explanatory Variable:[a]	Dependent Variable			
	Ceb	Age Married	Ceb	Living children
	eq. 1	eq. 2	eq. 3	eq. 4
1. Pucca	0.60	0.59	0.62	0.57
	(2.5)	(1.9)	(2.6)	(3.0)
2. Electricity	0.65	0.03	0.65	0.56
	(2.7)	(0.1)	(2.7)	(2.9)
3. Husband's Education	0.36	0.02	0.36	0.30
	(1.9)	(0.3)	(1.9)	(2.0)
4. (Husband's Education)^2	—0.09		—0.09	—0.07
	(— 2.1)		(— 2.1)	(—2.2)
5. Wife's Education	—0.25	0.43	—0.27	—0.23
	(—2.7)	(3.6)	(—2.8)	(—3.1)
6. Rural 1	0.27	0.59	0.28	0.25
	(1.2)	(2.0)	(1.2)	(1.4)
7. Rural 2	0.1	0.57	0.13	0.14
	(0.4)	(1.6)	(0.5)	(0.7)
8. Age	0.06		0.06	0.04
	(2.9)		(2.8)	(2.6)
9. Age Married	—0.18		—0.15	—0.14
	(—7.1)		(—4.3)	(—6.9)
10. Mortality	2.50	—1.22	5.24	—4.49
	(6.2)	(—2.3)	(2.6)	(—14.1)
11. (9)×(10)			—0.17	
			(—1.4)	
12. Intercept	6.2	15.8	5.7	6.2
R^2	0.15	0.04	0.15	0.26
F	14.6	4.6	13.4	29.19

[a]t-ratios in parentheses.

To test this hypothesis, consider the following proposition. What couples ultimately desire are not births but living children. Holding other factors constant, especially family income and the cost of children, families who live in areas of high infant and child mortality will attempt to compensate for their expected child losses by planning to have more births. If age of marrige is partially determined by desired births, then other things the same, families who live in regimes of high mortality will tend to marry early *in order to* increase their prospects for having more births. In addition, where mortality is high, parents will use age of marriage as a means of fertility regulation to a greater extent than where mortality is low, implying that the effect of age of marriage on fertility should vary systematically with the level of mortality that couples anticipate. Note that the "exposure" model of predicts no such relationship.

An initial test of the endogeneity of age of marriage is given in eq. 2, (Table 2) where age of marriage is treated as the dependent variable and mortality as an explanatory variable. The assumption underlying this test is that the actual infant and child mortality of the family *on average* reflects the mortality experience that couples expected at the beginning of their child-bearing period. As would be predicted if fertility and age of marriage were jointly determined (or if fertility determined age of marriage but not the other way around), mortality exerts a significant negative influence on the age at which couples choose to marry. In other words, controlling for other factors that affect the demand for children (prices and income) couples who live in areas where infant and child mortality is relatively high marry earlier than those living in low infant mortality areas.

A counter argument to this rejection of the exposure model is that there is no causal flow from fertility to age of marrige, and that what we see in eq. 2 is simply a spurious correlation, not a reflection of causation. In a concrete form, this argument might run something like: Mortality tends to be high in traditional families as compared to more economically advanced families and traditional families also tend to marry off their children at a younger age than do other families.[9] What eq. 2 shows is only that there is a correlation between two well-known characteristics of traditional households. This and related arguments are partly off the mark because of the inclusion in the regression of background variables such as education, family location, and family wealth proxies that should control to some extent for inherent differences between traditional and nontraditional households, but they do suggest that a more subtle test of the endogeneity of age of marriage might be in order.

A second test of the influence of desired family size on age of marriage can be drawn from the following logic. Age of marriage is partly influenced by family size desires and family desires are conditioned on, among other factors, the expected mortality experiences of couples. So, in areas where infant and child mortality are high, couples will not only marry at relatively early ages, but will also attempt to space their children closer together in order to improve their chances of achieving their living children goals. This implies that the relationship between age of marriage and fertility should depend on couples' expected mortality experiences; that is, the effect of age of marriage on

[9]Whether this is true for Pakistan is an empirical issue not pursued in this paper.

fertility should vary with mortality levels. This postulated interaction between age of marriage (AM) and mortality can be tested with the following regression specification, again, under the assumption that actual mortality experiences reflect prior expectations:

$$ceb = a_1AM+a_2M+a_3(AM)(M) + \ldots.$$

Where M is children mortality. The effect of age of marriage on children ever born is now (a_1+a_3M) and varies with the mortality experience of the family. If the interaction hypothesis is correct, a_3 will be negative implying that the effect of age of marriage on completed fertility is stronger, more negative, the higher is infant mortality.

The interaction hypothesis receives initial support from eq. 3 in Table 2 and additional support from eq. 4 in which living children and not children ever born is the dependant variable. Both equations suggest that couples use age of marriage to achieve their desired family size goals, and thus that the direction of causation flows not just from age of marriage to fertility, but also from fertility to age of marriage. In the first of these equations, the sign of the interaction variable (a_3) is indeed negative although weakly significant (at the 10 percent level if a one-tailed test is employed). In the second, the effect of age of marriage on living children is quantitatively smaller than is its effect on children ever born, an indication of the compensation role of age of marriage when infant mortality is high.[10]

Although the magnitude of the interaction term is not large, it should be kept in mind that there are a number of forces at work in these data that will tend to bias the regression results against the interaction hypothesis. Migration and rapid declines in infant and child mortality would both make expected and actual mortality experiences differ. In other words, the rapid demographic transition that Pakistan is now experiencing will work against finding an interaction effect between mortality and age of marriage. The findings presented above are thus somewhat stronger evidence in favour of the interaction hypothesis than the magnitude of the coefficient, or its significance level, indicates.

Policy Conclusions

The major conclusion that one can draw from the preceding results is that simple, ordinary-least-squares estimates of the effect of age of marriage on fertility may be seriously biased because of the dual or simultaneous nature of the underlying relationship. Although the case is not hopeless,—there are econometric methods for dealing with simultaneous relationships—, until we develop a theory that offers a means of identifying both an age of marriage equation and a fertility equation, the prospect for estimating the effect of a policy-induced increased in age of marriage on fertility is dim. The point is that, with the econometric and statistical techniques that past studies have employed, there is no way of determining whether the partial correlation between age of marriage and fertility is due to only the effect of fertility on age of marriage, only

[10]The interdependence between children ever born, living children, and mortality means that eqs. 1 and 4 are really telling the same story only in slightly different regression forms. As a consequence, although I have not tested it directly, the difference between the age of marriage coefficients in the two equations should be statistically significant at about the same level as is the t-ratio for the coefficient on the interaction term in eq. 3.

the effect of age of marriage on fertility, or to some intermediate situation in which each acts on the other. All these stories are consistent with the bulk of empirical research on the relationship between age of marriage and completed fertility and from none of this work, including that presented above, can one draw the necessary information to evaluate age of marriage as a policy tool to slow population growth rates. This is not to say that such information will never be available, but only to caution policy makers that it is not *now* available.

Appendix

If couples in a given sample have *not yet* completed their fertility, then one might postulate the following model to describe their current fertility status:

$$ceb = a_1A+a_2DM+a_3AM+a_4OF+u$$

where ceb is children ever born, A is current age, DM is duration of marriage, AM is age of marriage, OF is a vector of other factors, and u is a random error term. This model is not estimable for the obvious reason that A=DM+AM. The Afzal, Khan and Chaudhry (AKC) [1] solution to this problem is to drop age and calculate:

$$ceb = b_1\ DM+b_2\ AM+\ldots$$

This specification is difficult to interpret since age of marriage and duration of marriage measure much the same phenomenon with respect to completed fertility (in order to be married longer at a given age, a woman must necessarily marry younger, and vice versa), and it can be shown that it will produce an estimate of a_3 (the true effect of age of marriage on completed fertility) that is positively biased. Since A=DM+AM,[11] the AKC model can be re-written in the following form:

$$\begin{aligned} ceb &= a_1\ (DM+AM)+a_2\ DM+a_3\ AM+\ldots \\ &= (a_1+a_2)\ DM+(a_1+a_3)\ AM+\ldots \end{aligned}$$

where $(a_1+a_2)=b_1$ and $(a_1+a_3)=b_2$. If, as seems likely, Pakistan has experienced a secular decline in completed fertility, then $a_1>0$; if $a_3<0$ then the AKC estimate of the effect of age of marriage on completed fertility (b_2) could be zero or even positive when the true effect is negative.

[11]This equality does not hold strictly in the Lahore sample analyzed by AKC [1] since that was a sample of ever married rather than currently married women. However, the argument in the text of this appendix will still hold for the majority of the women in that sample, so this point is ignored in the discussion that follows.

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