HUMAN CAPITAL, MARRIAGE AND REGRESSION

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ABSTRACT

This paper proposes a simple search and bargaining model of marriage. In the young age, each person starts with an endowment of financial resources and an inherited cultural orientation. They acquire a marketable human capital and optimally modify their orientation using this endowment. In the second period of their lives, a search for the right spouse and then bargaining for the household orientation, with the chosen spouse, ensues. The resulting pattern of marriage is shown to evolve an unequal distribution of population across the cultural spectrum with considerable concentration in the middle or moderate region. We also illustrate our model using a preference for fertility and the resultant distribution of population.

NON-TECHNICAL SUMMARY

In this paper we have proposed a simple two period model of individual decision making that focuses on, and culminates in, marriage. We have considered marriage as a two person, a male and a female, Nash bargaining game where the payoffs to both parties depends on their marketable attribute and cultural orientation.

The first period of any person's lifetime is spent in acquiring the optimal levels of attributes where optimality is defined on the basis of his or her expectations in the marriage market next period. The second period is spent in searching for a suitable spouse and bargaining with her/him for the joint household cultural orientation. The couple finishes off by passing on a bequest of orientation and resources to the next generation.

Though, throughout the paper, we have discussed our model in terms of marriage, the results of this paper can be easily adapted to describe any situation involving a one-to-one matching. For example, a PhD student and potential supervisor.

The results that we demonstrate in this paper are very intuitive in the sense that people with higher inflexibility about cultural values end up with a restricted choice in the marriage market which leads to lower joint production in the household and hence low growth. Also, due to this lower expectation, the extremists may find remaining single the optimal decision and this too will contribute towards the depletion of the growth prospect on the ends of the cultural spectrum.

On the other hand, moderate people who are more flexible can search for a partner over a wider set and may expect a better outcome in the marital state. These findings in turn imply that the distribution of population will become more and more oriented towards moderate cultural position. That is, there will be regression along the cultural spectrum towards moderation.

In section 6, we illustrate our cultural orientation factor using an example of preference for children. Our intuitions carry over to this section in that we find a bimodal distribution of population with gradual depletion of one of the extremes and faster growth of the middle region. This section also justifies the oft-practised clannish behaviour that is observed in the marriage market and remarks on the consequences of change in popular taste in this context.

The aim of this paper has been to illustrate commonly observed behavioural pattern in the conventional marriage market where there are cultural differences and differences in flexibility of people to adapt to different orientation. The outcomes of the search and the bargaining model that we have described are very plausible and our findings can be adapted to situations where there are informational asymmetries between potential partners. For instance, suppose the male is not certain about the cultural orientation of the female, he only has information on the distribution of it. The exact information will only be revealed ex post. In that case, he will compute an estimate of the relevant parameter, using the distributional information and solve his marriage problem with this estimate. Of course, this is a very simplified statement of the problem that ensues with asymmetric information in the marriage market. We are not going into the details of this in the present paper.

I Introduction

The earliest game theoretic models of the family that explicitly recognises the presence of more than one agent with distinct preferences in a family is due to Manser and Brown (1980) and McElroy and Horney (1981). Since then, this strand of the literature has flourished and many interesting results are being actively discussed and demonstrated. For excellent surveys on the issues, technical results and empirical exercises related to this area see, respectively, Lundberg and Pollak (1996), Bergstrom (1994) and Behrman (1996).

In this paper, a bargaining model of the family, or more specifically that of a couple, is discussed. This model has both cooperative and non-cooperative elements. At the outset, given inherited resources in the young age, men and women choose their investment in education. Education generates two kinds of attributes. One is a marketable human capital that is also useful in household production and the other is change in the cultural outlook of the young from the one inherited from his/her parents. These investments are assumed to be irreversible in nature and have long lasting effects on the individuals market productivity, while single and joint household productivity, while married, respectively. The opportunity set of a couple is defined on the values of these two parameters for the two individuals constituting the couple. Of course, due to the partially cooperative nature of the model that is discussed here, efficiency is guaranteed and it’s only the distribution factor through cultural orientation that has to be bargained over. Obviously, the investment decisions with respect to educational cost allocations will depend on the expected bargaining problem to be faced in future by a youth. The resulting output is passed on to the next generation as bequest.

We finally look at the resultant distribution of cultural orientation and growth that evolves over time through repeated educational allocation and bargaining in each generation. We have also attempted an intuitive explanation of the incidence of dowry in the bargaining problem, as a solution to excessive distortion in bargaining outcomes within the household. Later, we have illustrated the cultural orientation factor using a model akin to Becker and Barro (1988) where the cultural orientation is manifested through a preference for quantity and quality of children (with an explicit trade-off between quantity and quality). Our discussion demonstrates the resulting population distribution according to human capital and cultural orientation if such a preference structure operates.

In this paper, we think of marriage as a contract with two kinds of input from each side and two kinds of common output that will be shared according to a specific rule depending on the value of the outputs. The inputs are characteristic attributes of the bride and the groom. The output is a common set of cultural orientation and joint household production for the family. One special case of our model is a situation where the input variables of interest are the agents' contribution to a family public good, human capital and wage earning activities. Konrad and Lommerud (2000) discuss such a model in their paper. Thus, our model can be thought of as a generalisation of theirs.

The marriage contract is well defined and simple in the sense that there is no ex-ante information asymmetry and no ex-post moral hazard problem. Our view of the contract is similar to the medieval Jewish marriage contract discussed in Davidovitch (1968), Goitein (1978), Becker (1991) etc. There, the payoffs to the two individuals are put down in precise terms, both for in-contract output and dissolution. These contracts are more like legal documents. Also, the costs involved in dissolving a marriage are implicitly stressed here. As we are not considering information issues, the problem of adverse selection (ex-ante) or dissolution (ex-post) is not considered. This information asymmetry case can be considered in a somewhat similar manner with the introduction of an element of uncertainty in the trait vector of the concerned parties. Ex-ante, the parties bargain over expected utility, and ex-post, after precise information is revealed, they renegotiate, with dissolution as a possible outcome. But we have not considered such a possibility in the present paper. This can of course be incorporated into the model in an implicit manner if we allow for a difference between the ex-ante and ex-post outside opportunities for both parties (As mentioned in Becker, 1991, outside option of the unmarried is different from that of the divorced,).

Now let us briefly describe the broad characteristics of our model. The threat point in the marriage bargaining game depends on (i) the divorce environment or the environment outside the scope of the contract. This was defined as the Extra-household environmental parameters (EEP) by McElroy (1990) and (ii) internal (ex-ante) or within marriage environment. That is, the characteristics of the contract as dictated by social norms. Like, for example, who receives or controls income within the marriage. These issues are discussed in terms of separate spheres bargaining by Lundberg and Pollak (1993).

The equilibrium outcome depends on (i) pre-play communication (e.g. negotiation among parents), (ii) social conventions, institutional factors etc. Also on the efficiency of the existing judicial system and its attitude towards such issues. And (iii) interaction between marital distribution (expectations) and marriage market (search problem). We do not consider direct search cost here. It's manifested indirectly only through the cost of difference in cultural orientation.

This model combines both elements of transferable utility (TU) game theoretic structure that has a somewhat public good like feature, which works through the sharing of a joint output, and a non-transferable utility (NTU) structure where the cultural orientation of the family, to be chosen, is the central issue. *Efficiency* is assumed through the structure of preferences and the opportunity set and Pareto optimality is ensured. Here we are focussing only on the *distribution* aspect. So, this is a co-operative model in that sense. The non-cooperative element is modelled through the cultural orientation decision. Hence, the conflict model is a NTU one rather than a TU game situation as in the private provision of public good model in Konrad and Lommerud (2000) etc. Of course, this implicit imposition of Pareto optimality in the cooperative set-up may not be very appealing to the non-cooperative game theorists. In that literature emphasis is more on self-selection (enforcement) rather than on binding agreements.

We first lay down the definitions and specifications of the functional forms for the various behavioural rules in Section 2. This section discusses relevant generalisation or specialisation imposed upon the model discussed in the paper. The subsequent discussions are often made using very special forms. We indicate where and to what extent relaxation of such specificity is permissible. The rest of the paper analyses the life time marriage problem for a typical individual period by period.

The sequencing of the model is as follows. In period 1, the individuals of both sex start with a given endowment and culture trait from their parents and they optimally choose their marketable human capital level and change in the cultural trait. The choice is made according to their expected payoff from marriage in the next period and subject to their budget constraint. The budget constraint is determined by the given endowment and the cost of generating human capital and cultural change.

In period 2, the search for a spouse begins and the bargain between the pair so selected by each other is struck. This decides the joint cultural standing of the family. The joint output of the family is automatically determined by an exogenously given household production function. The distribution depends on relative bargaining power depending on their outside option and cultural traits. Finally, the resultant family cultural position and the joint production is passed on to the children as a bequest.

As is usual in such models, we proceed to discuss the solution to the above problem by the method of backward induction. The second period problem, given the human capital and cultural traits, is discussed first in Sections 3 and 4. Here, the search problem and the bargaining solution are made explicit in two stages and the findings are discussed.

The fifth section looks at the investment problem in period 1. Here the response to these investments in terms of the bargaining solution in the next period is incorporated into the objective function. The optimal allocation problem given endowment and costs are discussed and conclusions are drawn.

Section 6 extends the bequest discussion in Section 3 to intergenerational considerations where the parental preference for fertility give rise to certain cultural dynamics and distribution of endowments across generations. This section also gives an intuitively plausible rationale for *clannish* behaviour with respect to marriage that is often observed in real life societies. Section 6 finishes with a discussion on change in taste parameters of the individuals and its consequences. Finally, we offer some concluding remarks in Section 7.

II Structure of the Model

There are two types of agents in our model, the male (*m*) and the female (*f*). Each agent has two attributes, namely (a) the level of human capital over and above basic education (*r*) and (b) the cultural orientation of the agents (measurable in continuous fashion) (θ). The characteristics of the male (female) are indicated by using a subscript *m* (*f*) with the attribute parameters represented by *r* and θ. So characteristic vectors of male and female are given by (r_m, θ_m) and (r_f, θ_f) respectively. It is to be noted that, unlike the agents' cultural orientation, which is non-marketable, the former attribute, *r*, is marketable in the sense that this augments the market wage that the agent receives and hence it affects the joint household production directly. This is given by a function $g(r_m, r_f)$ of the two agents' marketable attributes. Further, cultural orientation, like human capital, affect quality of life by affecting the utility of each agent derived from the joint household production, which is a function of the human capital of both the agents in the household. This we make more precise below.

There are two periods in our model. At the beginning of period 1, each agents' r = 0. However, each agent has a given cultural orientation inherited from his or her parents, given by θ_i^0, $i = m, f$, and is endowed with a resource e_i^0, $i = m, f$, also inherited from the parents. The agents must use the resource if they wish to acquire some human capital $r > 0$ or to change their cultural orientation from that inherited from their parents, θ_i , $i = m, f$.

We may now state the sequence of agents' decision problems for the two periods. In period 1, given the endowment of resources e_i^0, the agents must decide how to optimally allocate it between the acquisition of level of marketable attribute and change of cultural orientation. This optimality is determined from the cost structures for acquiring these, which we make explicit below. Then, in period 2, there are three steps or decisions to be taken. These are as follows. (a) Search for a suitable spouse of the other sex by each of the agents. (b) If search is successful, then bargain with the spouse about the joint household cultural orientation. (c) Leave bequest (financial and cultural) to the children.

To make our discussion of optimal choices in period 1 more precise, we now summarise the relevant notation and rephrase the above sequence of decisions in terms of these. In the first period each individual (*m* or *f*) is endowed with resource e_m^0 (e_f^0) and a cultural orientation θ_m^0 (θ_f^0) inherited from their parents. Both male (*m*) and female (*f*) acquire optimal levels of two attributes. In fact, it can be inferred from our earlier discussion that these two attributes completely characterise each agent in our model in period 2. These attributes are (i) marketable *r* and (ii) non-marketable θ. In this period, both type of agents choose their optimal level of r (r_m or r_f) and change of θ from the inherited θ_m^0 to some new optimal θ_m. This change in θ is denoted by $\Delta\theta = \left(\theta_m - \theta_m^0\right)$. The agents achieve these using their endowment e_m^0.

Consider $r \in R_+$, thinking of this as a non-negative wage earning potential factor, and $\theta \in [0, \pi/2]$. Here we are considering the cultural orientation factor as a directional variable. To keep the discussion intuitive, we define θ in terms of polar co-ordinates (in terms of angles with the horizontal). Hence the domain of θ. Ordering of θ along a line can be defined when the value is not important but differences between levels of values are considered to be so, as is mostly true here. We will mostly be concerned here with changes and differences in cultural orientation. Of course, actual values, to some extent, will be important, as made clearer below. We are simplifying our model considerably by assuming that θ is unidimensional. In reality, the situation is far more complex. Cultural orientation is typically a many faceted phenomena.

The cost of production for the marketable attribute *r* and the change in cultural orientation are both given by convex cost functions. Using a typical form of such a cost function, we can define the budget constraint as

$$e_m^0 \geq ar_m^2 + b\phi(\theta_m^0 - \pi/4)(\theta_m - \theta_m^0)^2 ,$$

where *a* > 0, *b* > 0, $\phi(\theta_m^0 - \pi/4)$ is the cost gradient due to cultural inflexibility. We assume that the function ϕ is increasing and symmetric in its argument. That is, $\phi(\theta_m^0 - \pi/4) = \phi(|\theta_m^0 - \pi/4|)$, $\phi' > 0$. That is, people with θ_m^0 near 0 or π/2 are more culturally inflexible in the sense that changing their θ, from these extreme values, is costlier.

The individuals' utility is given by the following two functions,

(i) Utility of *m* while single: $u_m^s = u_m^s(r_m, \theta_m)$ (similarly we may define u_f^s).

Assume that u_m^s is uniformly higher than u_f^s in the variable r. That is,

$u_m^s(r\ ,\theta\ ) > u_m^s(r\ ,\theta\ )\ \forall r \in R_+,\ \theta \in [0, \pi/2]$. This amounts to assuming, not very unrealistically, that the male fallback option is uniformly better than that for female.

And

(ii) Utility after marriage: $u_m^J = F_m(g(r_m, r_f), \psi(\theta_m, \theta_f))$ (similarly define u_f^J).

That is, we are assuming separability in r and θ. This can be explained simply by considering $g(r_m, r_f)$ as the new relevant marketable attribute level and $\psi(\theta_m, \theta_f)$ as the resultant cultural orientation value. That is, if they negotiate a marriage then they end up with two joint utility values given by u_m^J and u_f^J. (Here we are implicitly assuming monogamy. The case for polygyny can not be dealt with this simply.)

We also assume the following on the shape of the household production function *g*:

(i) $g_1 > 0, g_2 > 0, g_{11} < 0, g_{12} < 0, g_{22} < 0$. That is, we are assuming increasingness and concavity of the function *g* in its arguments.

(ii) $\psi(\theta_m, \theta_f) = \zeta(|\theta_m - \theta_f|, |\theta_m - \pi/4|, |\theta_f - \pi/4|)$: The function ψ is symmetric in the difference of its arguments and also dependent on the absolute difference between θ_m and θ_f and the centre position (π/4 in our co-ordinates). That is, how far you are from the centre is an important factor.

Here, $\zeta(0,t) = 1, \zeta_1 < 0, \zeta_2 < 0, \zeta_3 < 0, \zeta_{12} < 0, \zeta_{13} < 0.$ This ξ is the cultural conflict or inflexibility function that reduces utility when the θ value is extreme. That is, cultural contribution to utility is dependent on cultural extremity. Also, larger the difference $|\theta_m - \theta_f|$, the lower is joint utility. So in choosing a spouse, any individual will try to get a closer θ and a larger r.

(iii) $F_1 > 0, F_2 > 0.$ This assumption is clearly intuitive and very standard for utility functions. We need not elaborate on this here.

Though this is the general structure of u_i^J , we discuss our results using a special case of it that we make explicit and discuss in the next section. This do not reduce the generality of our results but substantially reduces algebraic monotonicity.

Note: One can introduce vector of cultural traits $\underline{\theta}$ and human capital $\underline{r}$ without impairing our analysis as long as the assumption of separability between $\underline{\theta}$ and $\underline{r}$ is retained. In that case, the bargaining set will be a suitably defined sphere with radius equal to household joint productivity $g(\underline{r_m}, \underline{r_f})$, and dimension equal to that of the vector of cultural traits $\underline{\theta}$. Again, the relevant part will be a higher dimensional arc on the surface of this sphere (in the first quadrant). But we abstain from attempting that in the present paper as this will complicate the algebra and make our diagrams abstract without changing our qualitative results in any significant manner.

II.A Certain issues not considered and simplifications assumed in this paper.

As mentioned earlier, we do not consider any ex-post informational asymmetry, i.e., once the marriage is contracted, there is no subsequent information revelation from either side. So we are assuming that (r, θ) is exactly known for and to both parties. This assumption simplifies our model to the extent that it rules out divorce (related issues are discussed in Becker 1991).

We also do not look into the production function of the household. How household chores are allocated, sharing or specialisation of activities etc. There is no uncertainty in joint production. Everything is netted out in the function u_i^J (this is sufficient information about household production). We can, however, introduce ex-post uncertainty in production to some extent without impairing the results if we assume that the involved parties are risk neutral. With this simplification, we have also ruled out reneging. There is no possibility of withdrawal of effort or capital in intermediate stages. We do not allow for truants or sleeping partners (Ref…). In summary, we are abstracting away from ex-post efficiency considerations here.

It is conventional wisdom that education has a liberalising effect, particularly in terms of promoting intermarriages. This would imply that the cost for producing a change in θ (particularly towards the centre) would be lower if the investment in *r* is high. That is, there is some complementarity in the production of $\Delta\theta$ and *r,* but there are studies that support the contrary viewpoint also. O'Leary and Finnas (2002) suggests that, in case of some well organised minorities in large cities, there may be implicit class bias in the provision of leisure and educational facilities that promotes intra-marriages with higher education. Social organisation of the population in question, the type of contacts that develops with higher education, being the crucial decisive factor. Thus, even if the production of $\Delta\theta$ and *r* are correlated, the direction of the relationship is not unambiguous. One can of course incorporate that possibility through the budget constraint equation, but we have not attempted it here due to this ambiguity.

III The bargaining problem in the Second Period

Here, and for the rest of the paper, we will discuss the problem from an *m*'s point of view. The other problem is exactly similar and hence not discussed separately here. The choice of *m* is purely random!

If a male with characteristic vector (r_m, θ_m) and a female with corresponding vector (r_f, θ_f) decide to get married, they can choose any joint outcome from the resulting opportunity set of joint household characteristics that becomes available to them, given by

$\mathrm{O} = \{(r,\theta) \mid 0 \le r \le g(r_m, r_f), 0 \le \theta \le \pi/2\}$. Given individual rationality and our assumptions on the objective function, they will actually choose from a subset of the boundary region of O, given by $\overline{\mathrm{O}} = \{(g(r_m, r_f), \theta) \mid \theta \text{ betwen } \theta_{\mathrm{m}} \text{ and } \theta_{\mathrm{f}}\}$. So, they will, in effect, bargain over the segment $[\theta_m, \theta_f]$ (or $[\theta_f, \theta_m]$ as the case may be). We assume that symmetric Nash bargaining is the solution concept being used. So, the resultant choice of the couple will be dictated by this solution concept.

So, the bargaining objective is $\underset{\theta}{Max}(u_m^J - u_m^s)(u_f^J - u_f^s)$

or

$$\underset{\theta}{Max}[g(r_m, r_f)Cos\{\phi(\theta_m - \pi/4)(\theta_m - \theta)\} - u_m^s(r_m)][g(r_m, r_f)Cos\{\phi(\theta_f - \pi/4)(\theta_f - \theta)\} - u_f^s(r_f)]$$

This equation also makes explicit the special case of the joint utility function that we are considering for our discussions. The general form of F_m (or F_f) is replaced by a simple product form and the special case of ψ is the cosine function with a cost gradient ϕ[1].

The following assumptions on the relevant function are made.

Cultural inflexibility function: ϕ:[0, π/4] $\to$ [0, 3] . $\phi' > 0$ and ϕ is symmetric in its argument (same assumption as that for the cost function). As $\theta_m \in [0, \pi/2]$, so $|\theta_m - \pi/4| \in [0, \pi/4]$, hence we have the domain as mentioned for ϕ. The range ensures that even for very large values of $|\theta_m - \theta|$, where $\theta \in$ [0, π/2], the benefit function do not start to contribute positively to *m*'s utility (as Cos (α) is $\le$ 0 for $\alpha \in$ [π/2, 3π/2]. ϕ is assumed to be increasing as the cost function is decreasing in the relevant range.

[1] Another special case of the general F function that may be more suitable if we want to avoid ϕ reaching zero and also want ϕ to be convex is given by

$\zeta(x,t) = e^{-xt}$, i.e., $\psi(\theta_m - \theta_f) = e^{-|\theta_m - \theta_f||\theta_m - \pi/4|}$.

The utility gradient here is same as the cost gradient in the budget equation. This is assumed for algebraic simplicity only. Our analysis does not change qualitatively otherwise.

The first order condition is given by

FOC: $$[gCos\{\phi(\theta_m - \pi/4)(\theta_m - \theta)\} - u_m^s(r_m)]gSin\{\phi(\theta_f - \pi/4)(\theta_f - \theta)\}\phi(\theta_f - \pi/4)$$
$$+[gCos\{\phi(\theta_f - \pi/4)(\theta_f - \theta)\} - u_f^s(r_f)]gSin\{\phi(\theta_m - \pi/4)(\theta_m - \theta)\}\phi(\theta_m - \pi/4) = 0$$

This expression is continuous with respect to θ and has opposite signs at θ_m and θ_f. Hence, by the *intermediate value theorem* (IVT), the FOC will be satisfied at some interior point. This implies a solution θ^* which will be a convex combination of θ_m and θ_f. Due to concavity of the objective function (involves the cosine function), the solution to the bargaining problem will be unique.

Note that, in obtaining a solution to this problem, we have implicitly assumed $g(r_m, r_f) > Max\{u_m(r_m), u_f(r_f)\}$. Otherwise, bargaining will not take place at all. (For details on Nash bargaining, see Aliprantis and Chakrabarti, 2000.)

[Fig. O about here]

We describe the bargaining problem using fig. O. The two orthogonal axes depict the two extreme orientations of culture possible (0 and π/2 in our notation). So we are using polar coordinates to describe the situation. The two rays $\overrightarrow{O\theta_m}$ and $\overrightarrow{O\theta_f}$ shows the cultural position of the two parties concerned. The segments Or_m and Or_f give the stand-alone utility of m and f respectively. So these two points depict the outside opportunity of the parties. The radius given by OM (or OF) is the magnitude of joint production $g(r_m, r_f)$. So the arc MF is actually the bargaining set. The resulting Nash bargaining solution be given by a typical point, say θ*.

III.A A Related Issue: Dowry

We now discuss a slightly different but also very important consequence of this marital bargaining problem, namely the incidences like dowry and bride price. We view these as distortions in the payoff structure of our bargaining game.

Now we may quantify distortion by the following simple measure, which depends on the characteristics of the couple.

$$d(\theta_f, \theta_m; r_f, r_m) = \frac{\left|(\theta_m + \theta_f) - 2\theta^*\right|}{\left|\theta_m - \theta_f\right|} \in [0,1].$$

If the bargaining power of the two parties are more or less equal, then the resulting orientation, θ*, is close to $(\theta_m + \theta_f)/2$, the average position. In that case, this measure of distortion assumes a value close to 0. When one of the parties (m or f) is weak compared to the other in terms of bargaining power, then the resultant θ* is closer to θ_m or θ_f and *d* becomes close to 1, indicating a high distortion.

To decrease distortion, as measured by *d*, parents of the weaker side (say f) may offer extra money as dowry, D(*d*), as a decreasing function of the extent of distortion, *d,* to the other party (in this case, m) so that it becomes incentive compatible for m to settle for a θ* which is closer to θ_f than the one which would have resulted in the absence of any dowry payment. With this additional incentive the payoff for m, if he enters the contract, becomes $g(.)Cos(.) + D(d)$, where the first term increases as m moves to his unconstrained choice of θ* (closer to θ_m) but then *d* also increases and hence the second term decreases. So, the modified optimal choice for m now will be closer to θ_f than the original one. Thus, for m, more the resultant distortion, the less is the amount of dowry paid to him by the parents of f. Hence, a dowry payment in this situation mitigates the adverse conditions faced by a spouse who is comparatively weak.

The dowry incidence is described, using fig. O, in the following way. Suppose the resulting Nash bargaining solution is at the point c where the resulting joint θ is very biased towards one of the partners. This will hurt the other party. To mitigate this adverse selection, the other party's parents may pump in D amount of money to achieve situation d, which is better for the disadvantaged person.

This may imply that all of the endowment may not be used to generate $(r_f, \Delta\theta_f)$, instead, a part of it may be liquidated in financial terms to enable dowry payment to ensure a more equitable solution in the next stage (Ref.: Mukherjee and Mondal, 2000). Here we do not consider how dowry is facilitated. Whether the payment requires the existence of a credit market. We just think of this as a completely exogenous mechanism used by the relevant parties.

So, to get back to our earlier discussion, given (r_m, θ_m), m obtains an optimal u_m^J. u_m^J depends on (r_m, θ_m) and (r_f, θ_f). Now, unconstrained choice of (r_f, θ_f) implies m will choose $\theta_f = \theta_m = \theta^*$ and maximum possible r_f. So, if the availability of r_f were independent of the choice of θ_f, then there would have been no conflict between productivity and cultural orientation and efficiency would have been obvious. But, there is a search cost that makes such a first best choice infeasible. We discuss this in detail in the next section.

IV The Search Problem in the Second Period

The key assumption here is that the r_f that *m* obtains in expected terms is determined by supply of available brides. That is, the distribution of population. The closer θ_f he wants (smaller interval around θ_m); the lower is the expected r_f (because there is a smaller set to choose from)[2]. That is, there is a trade-off between cultural harmony and joint output. More precisely, we are assuming that the expected value of r_f obtained by *m* is increasing in $|\theta_m - \theta_f|$ (similarly for *f*). More precisely, $Er_f = r(\theta_m - \theta)$ for *m* if he searches for a bride with cultural parameter in the interval $[\theta_m, \theta]$. Here *E* is the expectation operator and *r* is an increasing function. We again assume that this expectation function is symmetric, that is, it does not matter whether *m* searches for lower values of θ_f than θ_m or higher ones. It's only the absolute difference that is relevant.

So, we now modify the bargaining objective function discussed above, in expected terms, to

$$Eu_m(\theta; \theta_m, r_m) = g(r_m, r(\theta_m - \theta))Cos\{\phi(\theta_m - \pi/4)(\theta_m - \theta)\}, \qquad \text{……(OF)}$$

if *m* allows the search for cultural attribute up to θ.

[2] The implicit assumption here is that the population distribution has a density function that is strictly positive over the entire support.

Then the bargaining problem with the wife, in expected terms, yields the following implication.

Proposition 1: ***With cultural inflexibility, harmony sought increases but productivity of the mate goes down in expected terms.***

Proof: The bargaining objective function is given by (OF). The FOC when maximising the objective with respect to θ is given by the following equation.

$$g(.)Sin\{..\}\phi(\theta_m - \pi/4) - g_2 r'Cos\{..\} = 0,$$

where g_2 and r' are positive.

For $\theta \approx \theta_m$, the expression is < 0 as the first term is small and the second term is large, positive. As $|\theta - \theta_m|$ increases, Sin{…} term also increases and g(.) increases (as $g_1 > 0$). Hence, the first term increases. Also, as Cos{…} term decreases and g_2 decreases ($g_{22} < 0$ by assumption), the second term goes down. In fact, the second term eventually becomes < 0 when the argument in Cos{…} term becomes > π/2. Hence, for that range, the whole expression will become positive. So, by IVT, the solution to the FOC will be obtained in some intermediate point.

Now, to establish the proposition, we need to look at the *Comparative statics with respect to* $|\theta_m - \pi/4|$. Differentiating the FOC with respect to $|\theta_m - \pi/4|$, one obtains the following expression.

$$g(.)Cos((\theta_m - \theta)\phi(\theta_m - \pi/4))\phi'(\theta_m - \pi/4) + g(.)Sin(.)\phi'(.) + g_2 r'Sin(.)\phi'(.)$$

This expression is positive for any value of the relevant arguments (by assumption). As, initially the LHS of FOC is negative and then positive for larger values of θ, here, when $|\theta_m - \pi/4|$ increases, the cross over from negative to positive will happen for a smaller θ now. Hence, to restore the equality in the FOC, one must reduce the value of θ. That is, the increase of the Sin{…} term and decrease of the Cos{…} term is faster, hence solution θ* will be obtained closer to θ_m as $|\theta_m - \pi/4|$ increases.

To summarise the line of reasoning, $(\theta_m - \pi/4)$ higher implies that the search cost or inflexibility is higher. That in turn implies that $|\theta^* - \theta_m|$ is lower and hence so also is $r(\theta_m - \theta^*)$. Hence, we also have a lower value for $g(.)$. That is, in expected terms, household productivity is lower. Thus we have the result. ■

IV.A Actual matching in expected terms (Self-selection or Nash Equilibrium)

We now discuss the mechanism of how (r_m, θ_m) obtain the optimal choices (r_f*, θ_f*) as a solution to (OF) in expected terms as a function of (r_m, θ_m). The solution depends on r' and ϕ' (the slopes of the two functions). If ϕ is very responsive (ϕ' is large) then $|\theta_m - \theta_f *|$ will be small, in expected terms, and this will imply that r_f will be small $\Rightarrow g(r_m, r_f)$ will be small.

We now consider the Bargaining equilibrium. The objective is to

$$\underset{\theta \geq \theta_m}{Max}\, g(r_m, r(\theta_m - \theta))Cos\{\phi(\theta_m - \pi/4)(\theta_m - \theta)\}.$$

(Due to symmetry, it is enough to consider $\theta \geq \theta_m$ only). Solution is given by the equation:

$$\tan\{\phi(\theta_m - \pi/4)(\theta_m - \theta)\} = \frac{g_2}{g} \frac{r'}{\phi\left[1 + \frac{\phi'}{\phi}(\theta_m - \theta)\right]}. \qquad \text{....... } \mathbf{(B)}$$

So solution depends on the elasticity of ϕ and responsiveness of r.

Throughout the rest of the paper we will assume that function ϕ has a moderately high elasticity at least, compared to the responsiveness of the function r. This assumption is commensurate with the value judgement that, in the margin, cultural harmony is more important for a couple than household production efficiency.

Fig. S describes matching patterns across the cultural spectrum. Due to symmetry, we consider only the difference between θ and π/4 (the center). Along the horizontal axis, Zone (A) is the culturally moderate people (with θ close to π/4) and Zone (B) shows the extremists (with θ close to 0 or π/2). The vertical axis depicts r. We consider four cases according to high or low r in zone A and B. That is, we will consider 4 types of individuals.

[Figure S about here]

Ai: culturally moderate and high productivity, $|\theta_m - \pi/4|$ is small and r_m is large

As $g_{12} < 0,$ the ratio $\frac{g_2}{g}$ in the RHS of (B) will be small. The other term, given the fact that $|\theta_m - \pi/4|$ is small, will be larger, but given the assumption taken, not very much so. Hence, the product will be of moderate magnitude. So, these people will not have large incentive to look for a very high r_f. Instead, they will go for cultural harmony, so resultant $|\theta_m - \theta_f|$ will be small. So, here (r_m, θ_m) will match with a small r_f and θ_f such that $|\theta_m - \theta_f|$ is small.

This is depicted by the ray $(Ai) \rightarrow (Aii)$ in fig. S.

Aii: culturally moderate and low productivity, $|\theta_m - \pi/4|$ is small and r_m is small

By a similar argument, here incentive for flexibility will be higher (as $\frac{g_2}{g}$ is now larger), so here (r_m, θ_m) will match with a large r_f and will allow for a θ_f such that $|\theta_m - \theta_f|$ is larger.

So we obtain one self-selecting combination here: (r_m, θ_m) and (r_f, θ_f) with $|r_m - r_f|$ large and $|\theta_m - \theta_f|$ small. That is, the spouses are culturally similar but with highly different productivity potential. This is the ray $(Aii) \rightarrow (Ai)$ in fig. S.

The other possibility when $|\theta_m - \theta_f|$ is actually large, is depicted by the ray $(Aii) \rightarrow (Bi)$ in the diagram.

Bi: culturally extreme and high productivity, $|\theta_m - \pi/4|$ is large and r_m is large

Here again incentive for looking for a high r_f is small and also the fallback option is much stronger (due to high conflict cost). So these persons will either choose a (r_f, θ_f) with a small r_f and $\theta_f \approx \theta_m$, the case shown diagrammatically by the ray $(Bi) \to (Bii)$ in fig. S. Or they will stay single. This is shown by the horizontal ray from (Bi) to the left.

Bii: culturally extreme and low productivity, $|\theta_m - \pi/4|$ is large and r_m is small

This is similar to the case (Aii), only now span of search will be smaller (due to higher conflict cost). So the relevant rays are $(Bii) \to (Bi)$ and from (Bii) to the right of zone B.

So here we get another matching pair like the (A) case but possibility of mismatch is higher here (probability of staying single in now higher). So over time population in the zone (Aii) and (Bi) will decrease and this will result in the 3 peaks of [fig P], to be discussed below, to become more prominent over time.

[Fig S] also depicts an *implied preference structure* for each type of individuals. From the above discussion, the following broad qualitative rule is apparent.

Proposition 2: ***The implied inflexibility of high r people is more and that of the low r people is less.***

This discussion once again brings us to the issue of Dowry incidence and exploitation. In the situation depicted by (Bii), for a female with low r_f and extreme θ_f, the likelihood of dowry incidence is high. If this (r_f, θ_f) is matched with an m with high r_m and not very close θ_m, then distortion *d* may become too high and thence an exogenous payment of dowry may be deemed necessary.

This problem of exploitation can be mitigated if policies can improve the outside option for the f, u_f^s, or make the contribution of r_f more effective for the household joint production function $g(r_m, r_f)$. So polices that increase g_2 and u_f^s should be devised. This might reduce social exploitation in terms of dowry incidence or social insecurity of single women. This problem is also present for people with moderate θ, but in a less acute sense. For them there is more room for bargaining as the persons concerned are more culturally flexible and hence they have a larger set to choose from.

IV.B Effect of distribution of *r* for any θ: Effect on Er_f and corresponding search problem.

We will now discuss the issue of distribution effects. That is, we look at the effect of the distribution of *r* in the population on the expectation of a spouse in the search problem. We will parameterise this situation through the function *r*. We show that the responsiveness of this function (magnitude of *r'*) plays an important role here.

Let us consider the situation when *r* is very responsive (*r'* has a high magnitude). Then, allowing for a wider range of θ will improve Er_f by a large amount in (B). That is, the RHS of (B) will be large (given ϕ). This implies that, given $(\theta_m - \pi/4)$, $|\theta_m - \theta_f|$ will be larger. So we will observe more flexibility in this case, as it is incentive compatible for the searching spouse. Thus, the following result is obtained.

Proposition 3: ***In equilibrium, from the first order conditions for determining r and θ (see below) and when the productivity function r is more responsive, the move towards the centre will be more pronounced. There will be more incentive to expand $|\theta_m - \theta_f|$ starting from the extreme regions.***

V Period 1: Human capital generation r_m and choice of change in culture Δθ

Let us now focus on the decision problem in period 1 in the light of all the discussions that we made about the period 2 problem. Given the behaviour of the agents in period two, with their characteristics as given; we now discuss how they choose these characteristics optimally in period 1. To do so, let us first look at the payoff for the agents, in period 2, given their chosen levels of characteristics in period 1.

More precisely, given (r_m, θ_m), in period 2, m obtains

$$Eu_m(\theta_m, r_m) = g(r_m, r_f *(\theta_m, r_m))Cos\{\phi(\theta_m - \pi/4)(\theta_m - \theta_f *(\theta_m, r_m))\}.$$

In period 1, m start with endowment e_m^0 and orientation θ_m^0. Budget equation for generating r_m and move from θ_m^0 to θ_m, as discussed earlier, is

$$e_m^0 \geq ar_m^2 + b\phi(\theta_m^0 - \pi/4)(\theta_m - \theta_m^0)^2.$$

So objective function is:

$$Eu_m(r_m, \theta_m) - \lambda\left[e(r_m, \theta_m) - e_m^0\right] =$$

$$g(r_m, r_f *(\theta_m - \theta_f *))Cos\{\phi(\theta_m - \pi/4)(\theta_m - \theta_f *)\} - \lambda[ar_m^2 + b\phi(\theta_m^0 - \pi/4)(\theta_m - \theta_m^0)^2 - e_m^0]$$

Thus, the first order conditions (FOC) are,

$$\left[g_1 + g_2 \frac{\partial r_f *}{\partial r_m}\right]Cos\{...\} - \lambda.2ar_m = 0 \qquad \text{........... (r)}$$

and

$$g_2 r_f * \theta_f *' Cos\{...\} - g(.)Sin\{...\}\left[\phi(\theta_m - \pi/4)(1 - \theta_f *') + (\theta_m - \theta_f *)\phi'(\theta_m - \pi/4)\right]$$
$$- \lambda.2b\phi(\theta_m^0 - \pi/4)(\theta_m - \theta_m^0) = 0 \qquad \text{............}(\theta)$$

We will now discuss the solutions of the FOCs This is facilitated by considering the following two cases.

A. $\left|\theta_m^0 - \pi/4\right|$ **is large.**

We continue with the assumption that the function ϕ is responsive so that ϕ'has at least a moderately large value. Then $\left|\theta_m - \theta_f *\right|$ will be small from Stage 2(a) solutions. Costs will be higher, as here $\phi(\theta_m^0 - \pi/4)$ is large. This will have the following sequence of implications.

First, $\left|\theta_m - \theta_m^0\right|$ will be small, so $\left|\theta_m - \pi/4\right|$ will also be large, and hence the first term in (θ) will be small. Now, due to concavity of g, the rate of increase in r_m will also be smaller. So $\left|\theta_m^0 - \pi/4\right|$ being high will finally imply that the increase in r_m will be small. Below, we will now consider two sub-cases.

(Ai) ϕ is *very* responsive (that is, $\frac{\phi'}{\phi}$ is very large) so that the *Sin{…}* term in (θ) becomes < 0.

Then, in (θ), with the first term being small anyway, the second and third terms will have opposite signs and offset each other. So $\left|\theta_m - \theta_m^0\right|$ will tend to be slightly larger. Move towards the centre will be slightly more pronounced.

The effect of a very responsive ϕ will be to make the individuals very risk averse in terms of cultural conflict. So he will allocate most of his budget to Δθ and hence will end up with a moderate r_m as given by (r).

Here, resulting $r_f *$ will also be moderate. Bargaining solution (hence marriage) is more likely to be feasible due to moderate θ_m.

(Aii) ϕ is moderately responsive so that the *Sin{…}* term is still > 0.

Then both second and third terms will have the same sign and hence, both must be small for (θ) to hold. This will imply that $\left|\theta_m - \theta_m^0\right|$ will be very small and hence r_m will be relatively large. More Budget will be allocated to human capital formation in this case. So $\left|\theta_m - \pi/4\right|$ remains very large. So, resulting $r_f *$ will be very small (as it's the result of searching over a very small interval). So g(…) is also small. This will imply that the stand-alone option is better or, as additional incentive, very high dowry incidence will ensue.

Note that here, for *f* with a high r_f and high $\left|\theta_f - 45\right|$, the solution is less likely to be stand-alone as $u_f^s < u_m^s$ uniformly. It can be checked that this result is robust; as long as u_f^s is not very quickly increasing in $|\theta_f - \pi/4|$, that is, the magnitude of $\frac{\partial u_f^s}{\partial \theta_f}$ is not very large for θ_f near the two extremes. Also note that the case (Aii) is consistent with Becker's (1991) result of negative optimal sorting (pp. 119-20) when the characteristic traits of the agents, under consideration, are substitutes.

We now discuss the other possibility.

B. $|\theta_m^0 - \pi/4|$ **is small.**

Since $|\theta_m^0 - \pi/4|$ is small, it is always incentive compatible for the agents to achieve θ_m such that $|\theta_m - \pi/4| < |\theta_m^0 - \pi/4|$ (moving closer to the centre or more moderate cultural orientation), as this decreases costs. Hence, the *Cos{…}* term will increase, making the objective value larger.

So we will observe $|\theta_m - \pi/4|$ small and hence $|\theta_m - \theta_m^0|$ also small. This implies that the increase in r_m will be large, from (r), as most of the budget will be spent on human capital formation. Also search cost in terms of cultural conflict is now lower. This will imply that r_f will be large in expected terms and so $g(r_m, r_f)$ will also be larger.

Hence, in (θ), both first and second term will be large. This will generate a second round reinforcement on the dampening effect on θ_m change. So actual change in θ_m will be even smaller and hence $g(r_m, r_f)$ will be larger still. So, marriage with efficiency and moderate cultural conflict is likely in this situation.

We now summarise the findings of our above discussion on the choice problem in Period 1 in the proposition below.

Proposition 4:

(a) Agents with extreme cultural orientation will do one of two things:

1. *Either they will remain single with high r obtained and negligible change in θ. For them, in this case, the outside option is better, the participation constraint for marriage being violated.*

2. *Or, they will invest highly in $\Delta\theta$ and moderately in r to end up marrying a person with a moderate r and more centred θ.*

(b) For the culturally moderate people, *marriage is more likely, with higher joint product and centrist culture.*

[Figure M about here]

The situation is pictorially represented in fig. M. The two extreme ends will generate some "single" options (the rays moving outwards from the cultural axis). Some will end up marrying close θ but moderate r people (the rays going vertically) and others will invest less in r and move inward (the down bending inward moving rays). In the moderate zone, the matchings are more likely to find closer θ and higher r (the two rays moving vertically upwards) and fewer matchings with lower r (the downward bending ray).

V.A Period 2(c): The bequest decision

In this sub-period, joint product is left as a bequest for the children. So this is the endowment for the next generation. Specifically, any couple with pair of characteristic vectors $((r_m, \theta_m), (r_f, \theta_f))$ leaves behind cultural factor $\theta^*(\theta_m, \theta_f)$ and resource g$((r_m, \theta_m), (r_f, \theta_f))$ for the children to use as their initial endowment.

Here we abstract away from the actual bequest mechanism (infrastructure, investment in basic education, available funds etc.) and also the problem of distribution if there are multiple offspring (see supplementary section VI.A).

We summarise our findings on the broad qualitative characteristics of the resulting distribution of population in the proposition below.

Proposition 5:

(a) *There will be a cluster of moderate θ families with high endowments for the next generation. They will have an easier search problem again and hence will remain moderate (in terms of cultural orientation) and this population will enjoy a high rate of growth over generations.*

(b) *Some of the extremists will remain single. So no transmission of cultural attitudes to the next generation.*

(c) *Other extremists will have moderate joint production from marriage and some movement of θ. Those who move outward (towards the extremes) will have higher chance of producing children who in turn stay single. So many outward movements will imply a decrease in the population of that segment (in expected terms).*

(d) *Among the extremists, those who move inwards will gradually move to the centre and gain in efficiency over generations.*

The eventual distribution of the population will be as shown in figure P with 3 peaks. The peak at the moderate zone will be the more pronounced with smaller peaks at the ends.

[Figure P about here]

The peaks in fig. P will be less pronounced if the function Er_f is very responsive or g is not very concave (closer to linearity). In that case the resultant distribution will be flatter.

VI Extensions

In this section, we will focus on slightly more specific versions of the model discussed so far. We will look at some particular kind of preference of the agents and dynamics consequent upon it below. In particular, we focus on the cultural aspect in the following discussion.

VI.A Cultural trait related to fertility preference and resultant endowment distribution

In the first variation of our theme, we will now consider the situation where the preference structure of the couple explicitly recognises the possibility of multiple offspring. This is motivated by a model in Becker (1991).

To discuss this problem in a proper setting, we assume that the cultural trait parameter θ imposes an implied preference of the couple for their number of offspring. We assume that θ* effects the couple's preference for their ideal number of offspring or in terms of expected quality of each offspring. We can talk about the preference structure consequent upon quality or quantity of children interchangeably here because there is a trade-off between quantity and quality of offspring due to the family budget constraint. Parents need to spend from their resources to train each child, so a large number of children imply lower per capita allocation of resources[3]. This situation is described in figure T where the horizontal axis shows the number of children (n) and the vertical axis shows the quality of each child (q). The preference of the couple is illustrated by the curve AB. People with a small θ* will prefer to be near A and people with θ* close to π/2 will prefer B. The intermediate zone depicts the preferred position of people with intermediate values of θ*. One can consider the problem of distributing the joint product g $((r_m, \theta_m), (r_f, \theta_f))$ among a number of children where the quantity and quality will depend on $\theta^*(\theta_m, \theta_f)$. (This trade-off and consequent choice problem is discussed in Becker, 1991, Chapter 5 and its supplement.)

[Figure T about here]

[3] Many empirical studies have documented this trade-off. See the survey by Haverman and Wolfe (1995).

So we assume that θ* is positively related to the preferred number of children (or, which is same due to the budget constraint, inversely related to the quality of each child). Then arguing from Figure P and Figure T, one can deduce that the families towards one end of the spectrum will produce very few but high quality children (with high endowment). Although their budget will not be as generous for each child, due to the higher cost gradient for extreme θ people, as the moderate people who will also produce high quality moderate number of children. The people at the other end will do badly in terms of per capita quality because they have only a moderate budget and will end up distributing this into the training of many children. So the result will be of poor quality.

Proposition 6: *Moderate people will achieve higher quality and extreme types, on average, will do worse.*

[Figure P(T) about here]

The situation that results can be depicted by figure P(T) in terms of bequests for, and hence human capital of, the next generation. So, the population with a low θ will have a smaller population of high quality children in the next generation. The moderate people will grow at the highest rate both due to large number of offspring (in expected terms) and high quality of each child. The very high θ population (near $\pi / 2$) will be numerous but of very poor quality. Thus, there will now be two peaks instead of 3 as in Fig. P. The density of population will be higher in the middle peak than the left peak.

VI.B Clannish behaviour of families and resultant marital behaviour

We will now focus on a different kind of cultural dynamics that can be considered within the scope of our model and which describes a phenomenon that is often observed in certain sections of the population. To be more precise, we will now adopt our model to the situation where people with extreme cultural orientation (for whom $|\theta - \pi / 4|$ is large) are involved in the marital search process.

Before we start our discussion proper of marital processes, we take care of a few preliminaries. Below, we reproduce a few definitions and notation from the game theoretic matching literature. An excellent survey of the literature is provided in Roth and Sotomayor (1990) and we borrow from them here.

We now think of families who are going to be matched with each other in the marriage market. This is akin to the more traditional view of marriage, which favours the outlook that marriages are between families and not between individuals. To make the discussion precise, consider $F = \{f_1, ..., f_m\}$ to be a set of families that are present in the marriage market. That is, each of these families is searching for a suitable partner for one of the family members who is single.

A **matching** for *F* is a mapping $\mu : F \to F$ such that

(i) $\mu(f_i) = f_j \in F \setminus \{f_i\}$ and $\mu(f_j) = f_i$ depicts a marriage being contracted, (So, for a successful matching, we always have $\mu(\mu(f_i)) = f_i$.)

and

(ii) $\mu(f_i) = f_i$ depicts a family that is unable to find a match.

We now focus on the section of the population for whom $|\theta - \pi/4|$ is large. For such people, as search cost is high, if once an agent finds a good match then he/she will tend to have a repeated matching relation across generations with the same family from which the match was found, without incurring the search cost again. In the first few generations, the families will invoke the usual search procedure and identify a few families that match their characteristics. There will be some self-selecting pairs. That is, a set $F' = \{f_1, f_2, ..., f_k\} \subset F$ is found such that the stable matching μ becomes a correspondence defined by $\mu(f_i) = F' \setminus \{f_i\} \ \forall \ f_i \in F'$. That is, the families are all pair wise mutually compatible for marriage within *F'*. The members of *F'* will then tend to have marital ties only within the set.

This suggests a definition of stability for sets of families with respect to the marital matching game.

A set $F' \subset F$ is called **stable** if

(i) $\mu(f_i) \subseteq f' \forall f_i \in F'$ with $\mu(\mu(f_i)) \ni f_i$

and

(ii) if $\mu(\mu(f_i)) = f_i$ for some $f_i \in F'$ then f_i prefers to stay single rather than trying a matching even with some $f_j \in F \setminus F'$. That is, the outside options are not credible for this agent.

We call such stable sets *clans*.

That is, we have now described an intergenerational marital search and matching process through which a group is identified where stable matching can take place. Over time families find each other that are suited with them in terms of θ and they tend to form groups (*clans*) with respect to marriage.

The above discussion is certainly different from the usual strategic literature on matching games that stresses on the manipulability of the matching problem. (Related results can be found in Roth and Sotomayor, 1990, Sonmez, 1997.) In the present paper, this was not our focus of discussion, at least explicitly. But implicitly, through focussing on self-selecting pairs and stable matching sets, we fall into this category of discussion.

VI.C Change in taste and consequent dynamics

With increasing volume of trade between countries and liberalisation of many national economies in the recent past, the cultural barriers across religious, ethnic and geographic borders are gradually fading. There is increasingly more cultural homogeneity worldwide. This has very strong efficiency consequences for our marriage model. With increasing cultural homogeneity, the set of admissible spouses is enlarging for everybody. This will result in more homogenous choices, in equilibrium, with higher efficiency.

On the other hand, with opening up of trade and increasing variety of imports, the tastes of the people are undergoing changes at a faster rate. This, in contrast, has some adverse implications for the marriage market. To see this, we need to think of our model in a dynamic set-up. In terms of our model, we incorporate the change in taste by postulating that the utility function of the spouses, u_m^J and u_f^J, are dependent on some external dynamic factors, like local market conditions, access to information etc. In that case, the ex ante equilibrium solution may no longer be optimal ex post, in some future period, for at least one of the partners. Then, the possibility of dissolution will arise and we will observe divorces. This conclusion is empirically borne out by the increasing divorce rate situation in the developed industrialised countries.

If dissolution is costly, as a second round consequence of the change in market conditions, we will observe that fewer couples would be entering into the kind of strict marriage contracts we have been considering so far. We should observe fewer formal marriages and/or temporary non-binding contracts, like living together, being struck between relevant parties. This might have major effects on the demographics of a population but that is beyond the scope of this paper.

VII Conclusion

In this paper we have proposed a simple two period model of individual decision making that focuses on, and culminates in, marriage. We have considered marriage as a two person, a male and a female, Nash bargaining game where the payoffs to both parties depends on their marketable attribute and cultural orientation.

The first period of any person's lifetime is spent in acquiring the optimal levels of attributes where optimality is defined on the basis of his or her expectations in the marriage market next period. The second period is spent in searching for a suitable spouse and bargaining with her/him for the joint household cultural orientation. The couple finishes off by passing on a bequest of orientation and resources to the next generation.

Though, throughout the paper, we have discussed our model in terms of marriage, the results of this paper can be easily adapted to describe any situation involving a one-to-one matching. For example, a PhD student and potential supervisor.

The results that we demonstrate in this paper are very intuitive in the sense that people with higher inflexibility about cultural values end up with a restricted choice in the marriage market which leads to lower joint production in the household and hence low growth. Also, due to this lower expectation, the extremists may find remaining single the optimal decision and this too will contribute towards the depletion of the growth prospect on the ends of the cultural spectrum.

On the other hand, moderate people who are more flexible can search for a partner over a wider set and may expect a better outcome in the marital state. These findings in turn imply that the distribution of population will become more and more oriented towards moderate cultural position. That is, there will be regression along the cultural spectrum towards moderation.

In section 6, we illustrate our cultural orientation factor using an example of preference for children. Our intuitions carry over to this section in that we find a bimodal distribution of population with gradual depletion of one of the extremes and faster growth of the middle region. This section also justifies the oft-practised clannish behaviour that is observed in the marriage market and remarks on the consequences of change in popular taste in this context.

The aim of this paper has been to illustrate commonly observed behavioural pattern in the conventional marriage market where there are cultural differences and differences in flexibility of people to adapt to different orientation. The outcomes of the search and the bargaining model that we have described are very plausible and our findings can be adapted to situations where there are informational asymmetries between potential partners. For instance, suppose m *is not certain about the cultural orientation of* f, θ_f *; he only has information on the distribution of* θ_f *. The exact information will only be revealed ex post. In that case, m will compute an estimate of* θ_f *, say* $\hat{\theta}_f$ *, using the distributional information and solve his marriage problem with this estimate. Of course, this is a very simplified statement of the problem that ensues with asymmetric information in the marriage market. We are not going into the details of this in the present paper.*

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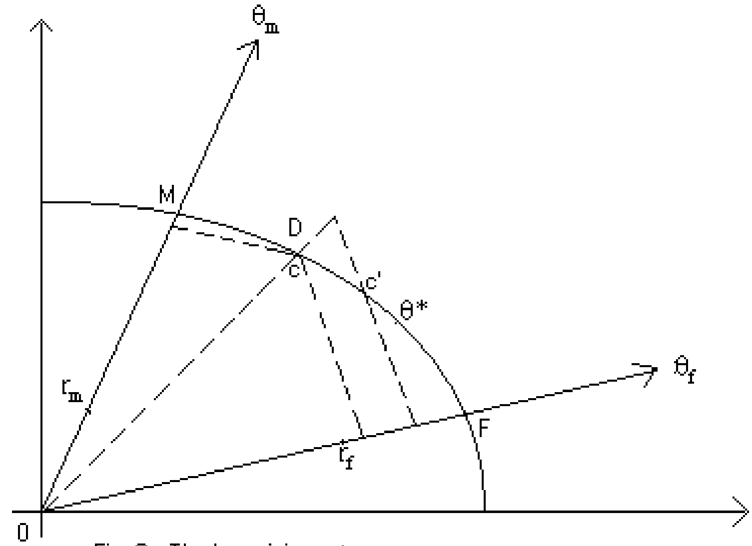

Fig. 0 : The bargaining set

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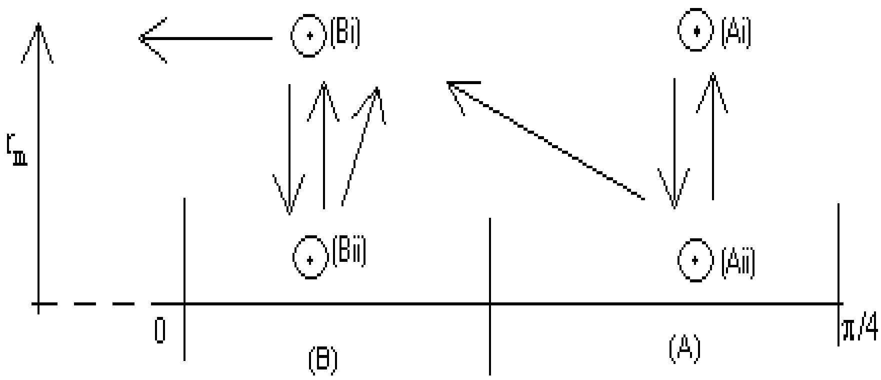

Fig. S : The Matching Patterns across the cultural spectrum

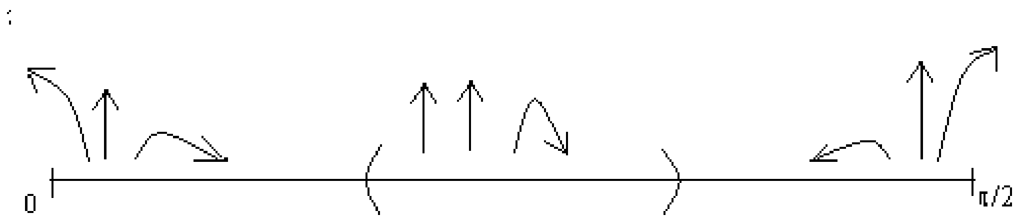

Fig. M : Movement of population along the culture axis

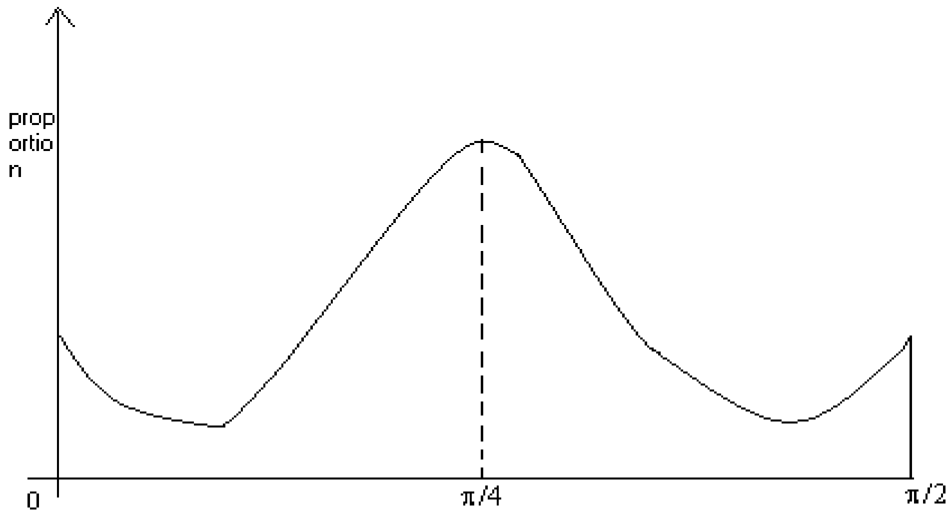

Fig P : Long rum distribution of population along the culture axis

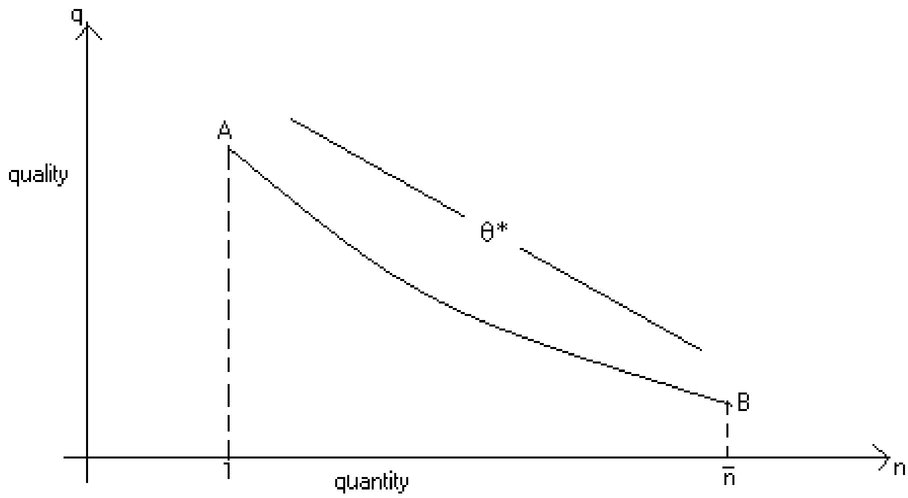

Fig T : Illustration of cultural orientation: tradeoff between quantity and quality of children

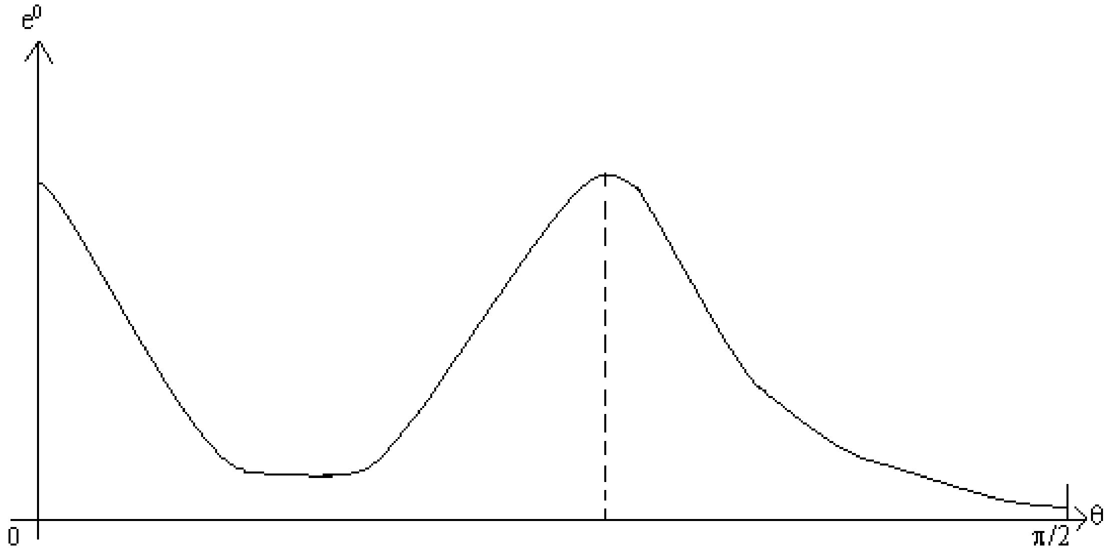

Fig P(T) : Distribution of population with fertility preference