

## Desirable Properties of an Unconventional Population Control Policy\*

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In recent times, a great deal of concern has been expressed about the authoritarian population control policies adopted by Asian countries such as Vietnam, India, and particularly China. In Vietnam, after many years of encouraging family planning, in 1988, the government formally put in place a comprehensive population control policy that called on most parents to restrict themselves to one or two children. As noted by Goodkind (1995), enforcement mechanisms used by the government to enforce its policy have included strong social pressure, fines, and for government cadres, loss of jobs.

Although population control policies in India are now largely voluntary, this was not always the case. In particular, in the aftermath of the declaration of a state of emergency on 26 June 1975, the Congress government of Indira Gandhi began to implement its draconian population control policy with uncommon zeal. As Gwatkin (1979) and Pai Panandiker and Umashankar (1994) have pointed out, the number of *sterilizations* rose from 1.3 million in 1974-1975 to 2.6 million in 1975-1976 and then shot up to 8.1 million in 1976-1977. In this context, it is important to recognize that the "government focused almost entirely on use of sterilization to reduce fertility; IUD and condom use showed little increase" (Panandiker and Umashankar 1994: 91). As a result of the overzealous implementation of sterilization targets, there was popular discontent against the government's policy and this discontent frequently led to widespread violence. The net result of all this was that the Congress government of Indira Gandhi lost the next general election in 1977,

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the Janata Party came to power and this party promptly instituted a *voluntary* population control policy.

The Vietnamese and the Indian experiences notwithstanding, no population control policy in recent times has achieved as much notoriety as has the Chinese "one child policy." The rapid population growth that occurred after the Communist Party came to power in China put a strain on the government's efforts to assist its people. So, with the twin aims of combating pervasive poverty and improving the quality of people's lives, the one child policy was adopted in 1979. Although this policy has occasionally been praised, it has, just as frequently, been reviled as a tool for human rights abuses. In this regard, Johansson and Nygren (1991) and Johnson (1996) have persuasively argued that the one child policy has led to widespread female infant abandonment, to female infanticide, and to the resultant problem of "missing girls".<sup>1</sup> In addition, Faison (1997) and others have pointed out that some Chinese couples have exploited loopholes in the law and have thereby effectively broken the one child rule. In sum, even though the one child policy has had some success in decelerating population growth in China, the price of this success "in China has indeed been high in recent years" (Johnson 1996: 91).

Thus far, we have been talking about population and population control policy at the level of a nation. This notwithstanding, even within a continent such as Asia, there are two kinds of *spatial variation* in population patterns and it is important to be aware of these differences. First, within the continent of Asia, there is substantial *inter-country* variation in aggregate population levels and in population growth rates. For instance, at the high end, the total populations of China and India in 2001 were 1271.9 million and 1033.4 million respectively. Further, the average annual percentage growth rates in the populations of China and India between 1990 and 2001 were 1% and 1.8% respectively. In contrast, at the low end, the total populations of South Korea and Malaysia in 2001 were 47.6 million and 23.8 million respectively. Finally, the mean annual percentage growth rates in the populations of South Korea and Malaysia between 1990 and 2001 were 1% and 2.4% respectively.<sup>2</sup>

The second kind of spatial variation within Asia is the *intra-country* difference in population patterns. For instance, in China, Yu (1990) has noted that the total fertility rate per woman in 1981 in Zhejiang province (a coastal province) was 1.982, in Hunan province (a middle province) it was 2.833, and in Xinjiang province (an inland province) it was 3.883. Similarly, in the case of India, researchers have noted the differential performances of Indian states in reaching replacement levels of fertility. In particular, whereas states such as Kerala and Tamil Nadu have already reached the replacement level of fertility, other states like Uttar Pradesh and Bihar have accomplished relatively little on this measure.<sup>3</sup> Given these two

1. See Sen (1990, 2001) Agnihotri et al (2002), and Klasen and Wink (2002) for additional discussions of this important problem.

2. The population numbers in this paragraph are taken from World Bank (2003).

3. For more details on these matters go to <http://www.ficci-sedf.org/fsedf/population3.htm>

sources of spatial variation in population patterns, the reader should note that even though our subsequent discussion will be at the level of a nation, one could conduct a similar discussion either in terms of provinces (for China) or in terms of states (for India).

The draconian Chinese and Indian population control policies that we have alluded to have enjoyed differential success and this can be attributed, in large part, to the different forms of government in these two countries. In China, the Communist regime could and did use coercive tactics to enforce its "one child policy." Due to the use of strict control measures on a sustained basis, relative to India, China has succeeded in decelerating its rate of population growth. In marked contrast, in democratic India, the severe population control measures of Sanjay Gandhi—adopted in the mid-1970s—resulted in the comprehensive defeat of the Congress party in the 1977 general election. Further, within a country such as India, the differential performances of Indian states such as Kerala and Uttar Pradesh on several demographic measures can be ascribed to the differential emphases placed in Kerala and in Uttar Pradesh on the salience of female education and on the role of women outside the household.<sup>4</sup>

In addition to the factors discussed in the previous paragraph, the less than complete success of the earlier Indian and the later Chinese population control policies can be explained by the insensitivity of these policies to a key cultural factor, namely, the desire to have *male* children. In fact, the existence of this factor is not limited to India and China. In many Asian nations, and certainly in several parts of China, "girls occupy a structurally marginal place in a patrilineal kinship and family system..." (Johnson 1996: 79).<sup>5</sup> As a result, relative to boys, girls face a much greater risk of being abandoned and even killed. This is a significant point and, today, there is general agreement among scholars that population control policies that fail to take relevant cultural factors into account are bound to fail eventually.

Given the definite desire for male children in some of the most populous countries of the world, it seems clear that meaningful population control policies need to account for this cultural factor explicitly. Therefore, we propose the following unconventional population control policy (hereafter referred to as Policy CS): Allow any married couple to have children up to the first male child; at this point the couple in question must stop having children. Clearly, Policy CS is culturally sensitive because it overtly accounts for the male child bias. Because the

4. The important role of female education in reducing fertility should be noted by the reader. Many studies such as Dasgupta (1993), Basu and Jeffrey (1996), and Dreze and Sen (1997) have shown that female education tends to reduce family size. Why? There are at least three reasons. First, educated women are more likely to take actions to resist the burden of multiple pregnancies. Second, educated women are less likely to be dependent on their sons as a source of social status and this is likely to lead to a reduction in the desired family size. Finally, the opportunity cost of time tends to be comparatively high for educated women and this creates an incentive to minimize time consuming activities such as child bearing and child rearing.

5. For more on this issue see Bardhan (1982) and Abeykoon (1995).

purpose of this note is not to analyze the subject of replacement *per se*, the proposed Policy CS is not directly concerned with the desire of many species, including humans, to replace themselves. Even so, as we point out in the third section, in the long run, Policy CS is culturally sensitive even on this "replacement" dimension.

Now, at first glance, it does seem as though the use of Policy CS will lead to a skewed sex ratio in the overall population. Is this, in fact, the case? The purpose of this note is to answer this question and to discuss certain related issues. The rest of this note is organized as follows. The first section contains a primer on a basic mathematical result known as the elementary renewal theorem.<sup>6</sup> The second section uses this theorem to demonstrate that Policy CS is desirable, *inter alia*, because it leads to an equal proportion of females and males in the overall population. The third section discusses the implications of this finding. The final section concludes and discusses ways in which the research of this note might be extended.

## The Theoretical Framework

### A Primer on the Elementary Renewal Theorem

A counting or renewal process  $\{N(t): t \geq 0\}$  is a non-negative and integer valued stochastic process that records the successive occurrences or counts of a particular event during the time interval  $[0, t]$ . The times between successive events are positive, independent, and identically distributed random variables denoted by  $\{X_i\}_{i=1}^{\infty}$ . Let us denote the common expectation of these inter-occurrence times by  $\mu$ . In other words,  $\mu = E[X_i]$ . A key quantity of interest in renewal theory is the expected number of counts or renewals,  $E[N(t)]$ , in the time interval  $[0, t]$ . This expectation is typically called the renewal function and in the rest of this note we shall denote the renewal function by  $M(t) = E[N(t)]$ .

As Taylor and Karlin (1998: 437) have pointed out, the Poisson process is the only continuous time renewal process whose renewal function is exactly linear. For all other renewal processes, the pertinent renewal function is only asymptotically linear. The elementary renewal theorem shows us the exact nature of this asymptotic linearity. Specifically, this theorem tells us that

$$\lim_{t \rightarrow \infty} \frac{M(t)}{t} = \lim_{t \rightarrow \infty} \frac{E[N(t)]}{t} = \frac{1}{\mu} \quad (1)$$

In words, the elementary renewal theorem tells us that the long run average number of renewals per unit time,  $\lim_{t \rightarrow \infty} M(t)/t$  is equal to the reciprocal of the average inter-occurrence time  $1/\mu$ . Now, if we think of the  $X_i$ 's as the lifetimes of a me-

chanical item such as a lightbulb before this lightbulb fails, then  $1/\mu$  is the reciprocal of the average life of a lightbulb. Further, in this lightbulb example, the elementary renewal theorem tells us that because a lightbulb lasts, on average,  $\mu$  time units, in the long run, lightbulbs will need to be replaced at the rate of  $1/\mu$  per unit time. We now use the elementary renewal theorem to show that our proposed Policy CS is desirable in the sense that it leads to an equal proportion of females and males in the overall population.

### One Desirable Property

Recall the essence of the proposed Policy CS. This policy would permit any married couple to have children up to the first male child; at this point the couple in question must stop having children. Following Jacobsen et al (1999), for an arbitrary married couple in the country under study, we assume that female and male children are equally likely.<sup>7</sup> We denote the number of children in any family by the random variable  $N$ . The outstanding question before us is this: In the overall population, what proportion of all children are male?

To answer this question, let us first form a renewal process by listing the children, family after family. We get

$$\begin{array}{llllll} \text{Children} & FM & FFFM & M & M & FM, \dots, \\ \text{Family} & \#1 & \#2 & \#3 & \#4 & \#5, \dots, \end{array} \quad \begin{array}{l} (2) \\ (3) \end{array}$$

where  $F$  and  $M$  denote female and male children respectively. Because of the equally likely assumption of the previous paragraph, the expected number of children in a family is two. Using the notation from above, we have  $E[\text{number of children per family}] = 1/\mu$ . Now, by a simple application of the elementary renewal theorem (see equation (1)), it follows that the long run proportion of males in the overall population is  $1/\mu = 1/2$ . We have just demonstrated that if Policy CS is implemented then, in the long run, this policy will lead to an equal proportion of females and males in the overall national population.

### Discussion

The first and most important reason for adopting policy CS is that this policy explicitly accounts for the desire to have male children. Consequently, on this ground, Policy CS is obviously culturally acceptable. Further, because of this cultural acceptability, Policy CS should also be politically acceptable. Now, given

6. Lucid textbook accounts of the elementary renewal theorem can be found in Ross (1996, 2003) and in Taylor and Karlin (1998).

7. From an empirical standpoint, this "equally likely" assumption can also be supported by making use of "sex ratio at birth" data in countries without population controls. For additional details on this point, the reader should consult the many references in the Jacobsen et al (1999) paper.



the first section discussion of the cultural sensitivity of a policy on the replacement dimension, note that replacement requires at least two children per married couple. The second reason for wanting to adopt Policy CS stems from the above analysis. From this analysis we know that  $E[\text{number of children per family}] = \mu = 2$ . This tells us that in the long run, Policy CS can be expected to lead to replacement fertility rates in the nation under study. In other words, for countries experiencing rapid population growth, Policy CS is desirable in two ways: This policy overtly accounts for the desire for male progeny and the proposed policy will result in replacement fertility rates in the long run.<sup>8</sup>

As discussed in the first section, the "missing girls" problem is a key contemporary problem stemming in part from the cultural insensitivity of extant population control policies in nations such as China. In China, and in some other countries as well, female children are routinely abandoned and even killed. As a result, although the ratio of women to men is typically around 1.05 or 1.06 in North America and Europe, this ratio has been as low as 0.94 in China (Sen 1990, 2001).<sup>9</sup> The third reason for adopting Policy CS is that because this policy overtly accounts for the cultural desire to have male progeny, it is likely to be politically effective in dealing with the "missing girls" problem. The fourth cultural and political reason for adopting Policy CS is that this policy does *not* lead to a skewed sex ratio. In fact, as we have just shown, Policy CS leads to an equal proportion of females and males in the overall population.

Note that the "equal proportion of females and males in the overall population" result follows, in part, from the equal likelihood of female and male children assumption. This, in our opinion, is a reasonable assumption (also see Jacobsen et al 1999 and footnote 7). In addition, observe that this equal proportion result is robust because its validity does *not* depend on any distributional assumption about the random variable  $N$  delineating the number of children in any family. To the best of our knowledge, Policy CS has neither been proposed and nor has it been

8. At the level of principle, it is possible to think about creating a "market" for male birth rights. The idea here is to recognize that even in countries such as China and India, for some married couples, the desire to keep the size of the family relatively small may dominate the desire to have a male child. In this situation, a married couple with, say, two female children could sell its notional "right to a male child" for a price. If there are enough such "small family size" minded couples, then a viable market for male birth rights may emerge. Even if we set aside any pertinent moral issues, there are three potential problems with the creation of a market in male birth rights. First, it is unlikely that there will be enough married couples who are willing to "sell" such a right and hence we are likely to have a thin market problem. Second, the "price" of a right in a thin market is unlikely to be competitive and hence the resulting allocation of the male birth rights will almost certainly be inefficient. Third, because of this potential inefficiency, governmental intervention will typically be required to make the "market determined" allocation of male birth rights efficient. In this regard, it is not clear whether this sort of governmental intervention will pass a benefit-cost test.

9. See Banister (1987) for additional details on this important point. Readers wishing to obtain empirical information on the "missing girls" problem should consult the UNDP's Human Development Reports, census data for countries such as China, India, and Pakistan, and the many references in Sen (1990, 2001).

implemented by practitioners working in the realm of population control policy. Therefore, for the reasons given in the previous two paragraphs, we propose that this policy be used to battle excessive population growth related problems.

As discussed in the preceding three paragraphs, Policy CS has several desirable features. Therefore, with one exception (on which more below), we do not foresee any obvious barriers to its adoption. However, within a country, it is possible that there will be regional (provincial or state level) variability in the application of a policy such as Policy CS. To see why, consider the case of two states—Uttar Pradesh and Kerala—in India. Relative to southern Kerala, the desire for male children is greater in northern Uttar Pradesh. Therefore, even though Policy CS calls for a married couple to stop having children after their first boy, it is possible that a married couple in Uttar Pradesh will successfully bribe a Policy CS enforcement official so that this official reports that the couple under consideration has not yet had a boy. If this graft is either not detected or not acted upon, then the couple under consideration can have more than one male child.

In addition to the points we have made in this section, Policy CS is desirable because it is straightforward to implement and enforce. Even so, the reader will note that in arguing for the implementation of Policy CS, we invoked the elementary renewal theorem (see equation (1)). This theorem is a *long run* result and hence in practice it may take a while before (i) the population of the country under study stabilizes (the sex ratio in this population is unity) and (ii) replacement fertility rates are reached. This is, in a sense, a "price" we pay for working with an easy to implement and easy to enforce population control policy. Because it may take a while for the population of the country under study to reach the desired long run attributes, it is possible that the aggregate size of the national population that is sought to be controlled will be quite large when Policy CS is used. This suggests that population policy makers face the following *tradeoff*: If a fully culturally sensitive policy is implemented, then there is little control over the aggregate size of the germane national population. On the other hand, if an exclusively aggregate population size oriented policy—such as the Chinese one child policy—is put in place, then there is little control over culturally sensitive factors such as the desire to have male progeny.

How might we address this tradeoff? In a recent paper, Batabyal and Beladi (2004) have demonstrated one possible way. As these researchers have pointed out, the basic idea is to work with a *modified* culturally sensitive policy (hereafter Policy MCS). Policy MCS accounts for the male child bias and, at the same time, this policy caps the number of children that individual families may have. In other words, Policy MCS is a compromise policy. It is culturally sensitive, but not to the extent of Policy CS. In addition, Policy MCS is somewhat sensitive—not extreme like the Chinese one child policy in terms of its focus on the aggregate population size—to the need to control the total size of the national population. Batabyal and Beladi (2004) show that when Policy MCS is used, two desirable outcomes emerge. First, the number of children that a typical family may have is capped at three; however, the likelihood that the typical family will have either one or two children is 75%. Second, the probability that the typical family will have a boy is 88%.



## Conclusions

In this note we first observed that prominent population control policies such as the Chinese one child policy have achieved incomplete success because they are insensitive to a key cultural factor, namely, the desire to have male progeny. Therefore, we proposed an unconventional population control policy (Policy CS) and we showed that Policy CS is desirable because it can be expected to substantially ameliorate, if not altogether eliminate, the "missing girls" problem. In addition, Policy CS is beneficial because its use leads to an equal proportion of females and males in the overall population and because its adoption will eventually result in replacement fertility rates in the country under study.

The analysis of this note can be extended in a number of directions. In what follows, we suggest two possible extensions. First, it would be useful to study the properties of Policy CS when one explicitly allows for the possibility of unacceptable behavior such as the abandonment of one or more infants by individual families. Second, it would be useful to theoretically compare and contrast the absolute size of the overall population with Policy CS and with alternate population control policies such as Policy MCS. An examination of these aspects of the problem will allow richer analyses of the connections between cultural factors, alternate population control policies, and the problems stemming from unbridled population growth.

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