The paper indicates how such a simulation exercise can be used to forecast TRF and other variables of interest. It concludes by pointing out some implications for the EAG states.

Population Change, Development and Women's Status for India[1] (Lessons for EAG states)[2]

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INTRODUCTION

India's population has already crossed the billion mark and,in the next forty years or so, with current trend it is expected to outstrip the population of China, presently the most populous country in the world. A main reason attributed to continuing high growth of India's population is the adverse economic and demographic parameters of EAG states where a sizeable proportion of population lives. Table 1 provides the necessary details. First looking at the demographic parameters, we observe high fertility rates in these states. For instance, compared to India's total fertility rate (TFR) of almost 3.2, EAG states with the exception of Uttaranchal indicate a much higher TFR (between 3.9-4.3). According to a recent estimate[3], the mean TFR for EAG states is around 4.2 compared to 3.2 for India. It is also shown that while India would take nearly 16 years to achieve a TFR of 2.1, the EAG states would need almost 27 years to reach this target. These estimates are based on the

[1] This paper is based on a study led and coordinated by the author for the ESCAP/UNFPA. EAG states are some of the most backward states identified by Empowered Action Group of the Government of India for special attention.

[2] EAG states are some of the most backward states identified by Empowered Action Group of the Government of India for special attention.

assumption of "Business as Usual". Table 2 provides some further interesting details about current levels of various indicators in respect of the EAG states, and the number of years it would take for each of these interventions (keeping others untouched) to assist in achieving a target of 2.1 for TFR (see last column of the table).

If we look at other demographic indicators, namely birth and death rates, infant mortality rates, maternal and neo-natal mortality rates (Table 1), an equally depressing picture is indicated. Almost all these indicators for EAG states have lower values when compared to the all India average.

These states are also known to be lowly placed in terms of economic and social development. For instance, EAG states have a lower per capita domestic product and a higher proportion of population below the poverty line when compared to the average for the country as a whole. The other indicators of social development, including those relating to women's status for EAG states are equally inferior compared to those for non-EAG states. For instance the levels of female labour force participation rates, female literacy rates and urbanisation rates for EAG states are again adverse when compared to those for the non-EAG states (table 1).

The preceding description suggests the existence of some kind of relationship between economic, social and demographic parameters. In this paper, using the results of an earlier simulation exercise conducted by the author for ESCAP, an attempt is made in this paper to explore the impact of select economic and social parameters on population and draw some lessons for the EAG states, particularly for Madhya Pradesh, Rajasthan, Bihar and Uttar Pradesh.

The underlying rationale for exploring these relationships arise from the recognition that the high population growth rates that continue to characterise a country such as India cannot be attributed simply to poverty or to a poor family planning programme alone. There is no guarantee that economic development, as traditionally pursued, will necessarily lead to an automatic drop in birth rates unless there is a simultaneous change in several other aspects of the quality of life that traditional measures of growth fail to capture. Similarly, an

[3] Taken from Mari Bhat's presentation at a National Consultation on RCH-II held in Delhi during October 19-20, 2002 (Appendix Table 1)

aggressive family planning programme can go only thus far. While this programme is certainly useful and necessary as a means of satisfying a growing demand for fewer children, it cannot really generate such a demand beyond a point. The actual desire for fewer children, which a true demographic transition must achieve, is a function of several factors which may or may not accompany conventional economic growth. Amongst the many factors, which are gaining increasing recognition mention may be made of socio-cultural factors, particularly of the position of the women in the society. Unless economic development also leads to an improvement in women's position, it is now increasingly realised that population growth rates will take much longer to reach manageable levels. Conversely, even if economic growth is somewhat slow, if it is of the kind that changes the options and freedom available to women, fertility and mortality declines will also be faster.

It was within such a framework that the simulation study was attempted to analyse the interrelationships between three sets of variables - economic development, women's role and status, and demographic change. As the simulation exercise was carried out for the country as a whole we provide some basic features of the Indian economy and trends in population and measures of women's status at the time that the simulation exercise was undertaken. The use of results of the simulation exercise for drawing lessons for the EAG states may not be entirely misplaced as this exercise was carried out with data for period up to early nineties when all India parameters were not very different from current parameters for EAG states.

After a consideration of the many positive and negative ways in which economic development can and does affect women's role and status**,** the effects of education and employment on birth and death rates were examined by tracing the connection between the women's status variables and the proximate determinants of fertility and mortality. While some of the proximate determinants were found to be influenced in the direction of increased mortality or fertility, the balance seemed to be in the direction of lower fertility and child mortality with improvement in women's status.

Before presenting the main results of the simulation exercise, we discuss briefly the broad features of Indian economy, as well as the trends in population and measures of

women's status. The paper concludes with some policy implications of the study for the EAG states are discussed.

ECONOMIC-DEMOGRAPHIC PROFILE AND WOMEN'S POSITION[4]

In this section we trace and provide basic features of Indian economy as well as trends in population and measures of women's status upto about the mid 1990s when the model was estimated.

Structure of Indian Economy: India embarked on a path of planned industrialization from the 1950s (especially from 1956) and achieved in the initial three five year plans, a rapid industrial growth. It decelerated subsequently, and picked up again from the mid-1970s when a process of slow economic liberalization began. Looking at growth of gross domestic product (GDP) over the last 25 years, one finds that the economy has moved over time to a higher growth path. GDP growth rate rose significantly around the middle of the 1970s from a 3.2 per cent between 1962/1963 - 1974/1975 to 4.4 per cent per year between 1974/1975-1986/1987. During the 1980s, GDP grew at more than five per cent per annum. The increase in GDP is largely attributed to substantial increase in industrial growth (for 3.8 per cent per annum to 5.5 per cent per annum) and services. Agricultural growth averaged around 2.4 per cent per annum during 1962/1963-1986/1987. The GDP growth showed a sudden decline in 1991-1992, 1.2 per cent, and picked up again to 4.3 per cent each during 1992 / 1993 and 1993 /1994 and 5.3 per cent during 1994/1995. The GDP growth during the period 1995/96 and 1999/2000 has hovered around 6% plus. The estimates for the GDP growth rates in the last couple of years suggest a fall in these rates close to 5 per cent. The share of the primary sector went down from over 50 per cent in 1951/1961 to 34 per cent in 1981/1991 while that of industry and services increased from 17.5 per cent and 31.9 per cent to 27.8 per cent and 38.3 per cent respectively. The share of agriculture is now close to 30 per cent. The saving rates (gross)

[4] The trends refer to the period upto about early nineties, and the description of these trends and grammer of it should be interpreted in this context.

in Indian economy showed considerable increases from 21.2 per cent in 1980/1981 to 24.3 per cent in 1991/1992. During 1993/1994, it fell to 20.2 per cent. It is now close to 22 per cent. Most of the savings continue to originate in the household sector (around 80 per cent). In India, unlike other countries, domestic savings have financed nearly 90 per cent of investment. Whether these trends would continue in the context of fiscal developments it is difficult to predict, although in short run the scenario is not very encouraging.

Private final consumption expenditure has around 64 per cent of the GDP at market prices declining from around 83 per cent in 1960/1961. The final consumption expenditure of the Government showed a rise, from 6.6 per cent of GDP in 1960/1961 to 11.4 per cent at present.

So far as government saving was concerned, it had shown a downward trend, and the Government had resorted to borrowing not only for investment but also to cover current expenditure. Savings of the State Governments have also fallen. Recently some decline in Central Government deficits have been observed. The decline in Central savings and worsening trend in its deficit reflects a persistent tendency for expenditure, particularly current expenditure, to grow faster than buoyant tax revenues.

The inflation level in India has remained mostly at a single digit whereas the balance of payments has started improving from mid 1991. This has been possible through a combination of macro-economic stabilization policies and structural reforms in industrial and trade.

The recent trade and exchange rate policy regime is characterized by major progress in eliminating unnecessary administrative and discretionary controls over foreign trade, which are generally considered responsible for making Indian economy uncompetitive. Export performance has shown some improvements, and at the same time one is witnessing revival of imports to more normal levels. Also, composition of exports and imports as well as the direction of foreign trade have witnessed significant changes in recent years.

The public sector grew rapidly since independence, largely by investment in heavy industry and irrigation and also by nationalisation, especially of financial institutions. The public sector has basically dominated the organised sector, but its stature is relatively

modest when stood up against the economy as a whole. The performance of public sector enterprises has been somewhat uneven. Recently the Government has taken measures to undertake disinvestment in public sector undertakings and provide them greater autonomy,

So far as fiscal policy is concerned, India's fiscal policy has been conducted within the framework of resource mobilization for a high level of public investment. This was done on the assumption that public investment would be adequately supported by public savings, a presumption not realised. This is largely on account of the nature of political economy. In India price stabilisation took precedence, and in turn the fiscal policy tended to destabilise industrial output. Price stabilisation would have been better achieved by building higher resources of foreign exchange and food stocks when the harvest failed. This would have obviated the need to counter inflation by cutting investment. The highly expansionary fiscal policy in the initial stages contributed to an enhanced rate of growth of output but this effect could not be sustained since it required an excessive rate of growth of public debt.

India's monetary policy until recently has been very conservative; and was quick to impose monetary restriction wherever inflation threatened to go out of hand. Similar remarks are true for fiscal policy. Recent policies in regard to financial liberalization and lending rate are likely to prove beneficial to the Indian economy.

On foreign exchange, India's current situation is rather good with very substantial foreign exchange reserves. There is however the question of properly managing these funds.

DEMOGRAPHIC TRENDS: According to the most recent population census, India's current population as on March 1, 1991 was 846.3 million showing an annual growth rate of 2.14 per cent during the decade 1981-91. India's population as per 2001 Census was 1027.015 million indicating a decadal growth of 21.34 per cent during 1990-2001 compared to 23.86 per cent during 1981-91. In the previous decade (1971-81), the annual growth rate was 2.22 per cent indicating a decline in the decadal growth rate for the first time since independence. During 1981-91, Kerala and Tamil Nadu showed low annual growth rates of 1.34 per cent and 1.43 per cent respectively when compared to Rajasthan

(2.50 per cent), Uttar Pradesh (2.27 per cent), Madhya Pradesh (2.38 per cent) and Bihar (2.11 per cent)[5].

These latter states constitute about 40 per cent of country's population, and the future growth pattern of India's population will be largely determined by their performance in arresting future growth of India's population. The crude birth rate (CBR) has fallen from 37 in 1971 to 34 in 1981 and to 29 in 1992. In turn if one look's at more recent figures on the total fertility rate (TFR), it has declined from 5.2 in1972 to 4.5 in 1981 and 3.6 in 1991. The trend in the death rate has also been encouraging especially in the recent past. Crude Death Rate (CDR) fell from 15in, 1971 to 12.5 in 1981 and to 10 in 1991, with corresponding figures for the Infant Mortality Rate (IMR) being 129, 110, and 80 respectively. The 1991Census has shown that, on the average, there were 1079 males for every 1000females. This was 1057 in 1951, 1063 in 1961, 1075 in 1971 and 1071 in 1981.

This is a finding of great relevance to the women's status question. Not only does this continued disadvantage of women suggest a continued female disadvantage in other aspects of life such as education and employment, in turn it may also be an important explanation for the relatively slow pace of the demographic transition.

From the economic planning point of view, one needs to look also at the trends in dependency ratio. In 1991 nearly 37 per cent of India's population was in the age group 0-14 years[6] This proportion in the number of children under 15 years of age was however 42 per cent in 1971. Also the proportion of population above 60 years in 1971 was 6.0 per cent and grew to 6.5 per cent in 1981. It is currently estimated to be 6.8 per cent. This trend

[5] The decadal growth rates (1991-2001) for Kerala and Tamil Nadu are respectively 9.42% and 11.19% compared to 28.33% for rajasthan, 25/80% for Uttar Pradesh, 28.43 for Bihar and 24.34 for Madhya Pradesh. These four states, even after carving out new states constitute 35.60% of India's population.

[6] With the decline in fertility and cohorts that benefited from decline of mortality in the 1950s started entering the labour force, the population aged 15-64 began to grow faster than the total population. The demographic bonus that resulted from this would cause some growth in per capita income even if output per worker remained stationery. A time would arrive where this bonus would peak. According to a recent study by Mari Bhat "A Demographic Bonus for India: On the First Consequence of Population Ageing (mimeo, November 2001), the peak would arrive during the decade 2001-11 when the excess growth rate at 15-64 would be o.6 percent. The growth rate in this age group according to Bhat would continue to exceed the total growth rate of population until the decade 2021-31. After this period, India's population would truly be greying and the demographic bonus would be negative. As far as EAG states are concerned, they would continue to have significant demographic bonus even during the decade 2021-31, and beyond (Appendix Table 2)

is expected to accelerate in the next decade. As far as the growth of the urban population is concerned, it has also been consistently above the population growth rate, being 2.34 per cent in 1951-61, 3.21 per cent in 1961-71, 3.83 per cent in 1971-81 and 3.09 per cent in 1981-91.

TRENDS IN WOMEN'S STATUS

Education: At the 1991 census, the number of illiterate females continued to exceed the number of literate females (200 million versus 130 million). At the same time, sex differentials in literacy narrowed for the first time in the 1981-91decade and the sex ratio of literates (females per 1000 males) also increased from 491 in 1981 to 564 in 1991. But almost all this narrowing was accounted for by the trend in urban areas; the sex ratio of literates in rural areas continued relatively unchanged.

But once again, there were tremendous variations of these average figures. For example, the gap between the states with the lowest and highest literacy rates (Rajasthan and Kerala) increased between 1981 and 1991 from 62 per cent to 66 per cent. Secondly, the lowest sex ratios among the literates are found in the northern states of Rajasthan (338), Bihar (392), Uttar Pradesh (394) and Madhya Pradesh (457) compared to Kerala (965) and Punjab (678). Further disaggregation will have to await census data on age specific literacy rates, before the composition of these trends can be identified.

We also do not have data yet on trends in educational attainment as opposed to simple literacy. From all accounts the relatively high dropout rate for girls continues to be a major problem even when initial enrolment rates are high.

Employment: While it is difficult to draw too many conclusions about trends in female employment because of measurement problems and difficulties in comparing data over time, the census information can however be used to make a few broad generalisations. First, while the 1991 Census has recorded a net increase in the proportion of female main workers between 1981 and 1991, some parts of the country have actually registered a

decrease in female work participation rates. In Punjab for example the female participation rate has declined by 1.7 per cent from an already very low level of 6.2 per cent in 1981.

Coming to changes in the kinds of work done by women, the proportion of women working as both cultivators and agricultural labourers has registered a clear increase. This rise was particularly marked in the southern states of Andhra Pradesh, Tamil Nadu and Karnataka and the northern states of Uttar Pradesh and Rajasthan. The employment of women in household industry has also increased over time, but it is not clear how much of this increase is real and how much of it is a reflection of better counting in the 1991 Census. Finally, looking at employment in the three sectors of the economy, the proportion of female workers in the primary sector has increased everywhere but in Kerala, Tamil Nadu, Maharashtra and West Bengal; the proportion in the secondary sector has declined everywhere but in Kerala and West Bengal, and the proportion in the tertiary sector has increased everywhere but in Rajasthan and West Bengal.

The overall trend everywhere seems to be an increase in the proportion of women in paid employment, though how much of this is a result of modernisation and how much due to poverty related factors is not clear. The latter is particularly suggested by the clear gender differential in wage rates.

An Economic -Demographic Model for India

We have so far provided a brief review of the salient features of the economic and demographic trends including those relating to the role and status of the women. Using the framework of an economic-demographic model, an attempt was made to analyse the interactions among the variables relating to population change, women's role and status and economic development. To build up the model, equations were specified and estimated econometrically using time series data for the 1970s and 1980s (up to 1991 in some cases) and cross-section data by state for certain years in this period. To validate the model, counter-factual simulations were undertaken for the years 1982 to 1991. The model was then used to carry out short term simulations up to 2006.

The basic premise underlying the model is that economic and demographic variables are simultaneously determined in the course of development, and these variables influence and get influenced by women's role and status. The model has been cast in terms of real variables, and the determination of prices and related economic relationships (e.g. money supply) has not been incorporated into the model. The only set of price variable included in the model was the real wage rates. This was considered necessary for modelling the labour market (determining female participation).

The model has been formulated at a high level of aggregation. In regard to demographic and women's role and status variables, a rural-urban dichotomy is maintained in many cases. Similarly, while modelling the production side, agriculture and non-agriculture are taken as two broad sectors. The basic data sources for the model are (i) *National Accounts Statistics, (ii)* Census, (iii) National Sample Survey data and (iv) Sample Registration System data. The estimation of the equations has been done by the Ordinary Least Squares (OLS) method or methods of similar nature. In the course of developing the submodels for demographic behaviour and women's role and status, inadequate data availability often posed serious problems The specifications of the functional forms for these submodels are therefore dictated in many cases by the availability of data.

Before providing the description of the model and results of the simulation, a brief overview of the attempts made (in the period prior to mid 90's) at model building in India is provided.

Review of earlier models

While, in India, the history of model building for the economic sector has been a long one, dating back to 1960, there has hardly been any serious and systematic attempt at formulating an economic-demographic model, and such modelling which includes a women's role and status submodel is, to our knowledge, non-existent. It must, however, be mentioned that there have been some attempts to explain demographic variables, for example, explaining fertility in terms of certain economic and social variables. Similarly,

very recently, there have been some attempts to relate women's role and status with some demographic variables. These estimates generally relate to small date sets covering very small geographical areas and are not of much use for carrying and simulation exercise are based on data for specific district (s) and they are therefore hardly useful in carrying out any meaningful simulation exercise for the country. It is in this context that the present exercise may be considered as pioneering so far as India is concerned.

As already mentioned, while there have been numerous attempts at building macroeconomic models for the Indian economy, there are only one or two scattered pieces relating to postulating relationships aimed at incorporating either a demographic model or a women's role and status model. There has been no attempt to establish linkages between them. Also, the objectives and purposes of these modelling exercises have been entirely different from the objective of the present exercise and therefore their usefulness (in the present context of analysing the causes and effects of changing women's role and status is limited.

Directing attention to the efforts at constructing macroeconometric models for India, there are fairly exhaustive surveys on the subject, the prominent ones being: Desai (1973), Pani (1977), Bhaduri (1982), Krishnamurty and Pandit (1984), Jadav (1990), Krishna et al (1991) and Marwah (1963), and for this reason these need not be described here. Suffice it to say that over the last 35 years or so, nearly 40 econometric models have been constructed for India which can be broadly classified into three generations (Krishnamurty, 1992).

The first or earliest generation models are mostly doctoral dissertations prepared under the guidance of Professor L.R. Klein. These were, in most cases, constrained by data availability and time. They were therefore small and close to textbook macroeconomic theory. However, these models set the trend for future work. The issues investigated by these models included price behaviour (Marwah, 1963; Chakrabarty, 1977), investment behaviour and endogenous population growth (Krishnamurty, 1964), the role of foodgrain output in growth and price stability (Pandit, 1973), interaction between monetary and real variables in the monetized component of the economy (Bliattacharya, 1975), the structure

of monetary and financial markets (Gupta, 1973; Mammen 1973), external trade (Choudhary, 1963; Dutta, 1964) and growth in the dualistic economy.

The second generation models focused on policy analysis, and the features of each of the second generation models followed their respective objectives. These models were more disaggregated and larger, and recognized explicitly the mixed nature and other institutional characteristics of the Indian economy. Moreover, unlike the first generation models, these models allowed for lagged and somewhat more complex adjustment processes. Builders of these models have had the clear advantage of the earlier work, apart from the availability of a considerably improved database.

The third generation models distinguish themselves from the earlier models in their explicit treatment of the problems of macroeconornic adjustment, at the same time attempting to address themselves to issues not until recently discussed in formal quantitative terms. Broad features of the third generation models and special focus in them are shown in table below. It may be mentioned that some of these models are intended to be maintained, updated and revised from time to time.

Despite India's preoccupation with macromodelling for so long, other developing countries have advanced a great deal in developing, maintaining and using these models for policy analysis and forecasting. The rather tardy progress in research in this area may partly be attributed to difficulties in dealing with institutional and structural changes in the economy. Also, the policy concern has been largely with long-run problems, which are handled within the framework of input-output models. The short-run problems are considered less important and generally dealt through certain rules of thumb. Besides, the behavioural part of the model is taken care of by means of simple and isolated relationships. Further, the lack of interaction between model builders and users of these models has also been responsible for the absence of better appreciation and use of macrocconometric models,

Before we close the discussion on earlier models, a word or two may be added about the model work relating to population, development and women's role and status in India's context. One example of this type of model is Krishnamurty's work (1966) on economic development and population growth with illustrations for India. He attempted to

estimate the impact of economic development, as reflected in per capita real income and other related variables, on birth and death rates for the period 1922-1960. First, he relates birth rate with per capita real income and a time trend.

Table 3: Broad features of third generation models

	Period	**Special Focus**
Ghose, Lahiri, Madhur and Roy (1986)	1960-78	General purpose model covering agriculture, industry, government, money and trade with high level of disaggregations
Pani (1984)	1969-1973 - 1981/82	Output, demand and prices, and their interaction
Bhattacharya (1984)	1951/52 – 1975/76	Public expenditures, inflation and growth
Krishnamurty (1984)	1961/62 - 1979/80	Inflation and growth; supply side, infrastructure, money and prices, public investment and its interrelationship with private investment and fiscal operations, and growth - inflation trade-off
Pandit (1984)	1950/51 - 1977/78	Medium term analysis of output and prices
Pandit (1985a)	1950/51 - 1974/75	Macro-economic structure, stabilisation policies and growth
Pandit (1985b)	1955-1980	Supply, demand and monetary policy
Pandit (1986a)	1951-1980	Growth performance and relative roles of supply and demand - model estimated for two periods 1951-65 and 1966-80 to test for structural break
Pandit (1986b)	1953/54 - 1980/81 varying period for different equations	External trade in detail and price formation - used in the LINK model
Pandit (1989)	1953/54 - 1980/81	Deals in depth on theoretical issues

	varying period for different equations	relating to macro modelling for India, illustrations from his model (1985)
Bhattacharya and Rao (1986)	1966/67 -1983/84	Agriculture-industry interrelationship and public investment
Pandit and Bhattacharya (1987)	1960/61 - 1979/80	Resource mobilization, growth and inflation
Bhattacharya (1987)	1950/51 – 1984/85	Effectiveness of monetary policy and inflation
Madhur(1987)	1951/52 - 1984/85	Macro impacts of monetary and fiscal policy changes; *exante* forests
Chakrabarty (1987)	1962/63 - 1983/84	Linkages among sectors: real (domestic and foreign), fiscal and monetary sectors
Krishnamurty, Pandit and Sharma (1988)	1961/62 - 1982/83	Parameters of growth, productivity, infrastructure, imports, exports, public investment and its interrelationship with private investment, and relative prices
Kanan (1988)	1968-1985	Monetary approach to balance of payments: includes trade, invisible and capital account
Panchmukhi and Mehta (1991)	1970-1984	Emphasis on trade flows
Mehta and Sinha (1991)	1951/52 - 1984/85	External trade and public sector
Rastogi (1991)	1951-1987	Two sector rational expectations model with government budget, external trade and debt, and labour market
Bhattacharya and Guha (l992)	1969/70 - 1988/89	Public sector resource gap, external trade and public debt domestic and external

Source: K. Krishnamurty, 1992, *States of Macroeconomic Modelling in India* (Delhi, Institute of Economic Growth).

$$\log b_t = a_0 + a_1 \log Y_t + a_2 \log t + u_t^b$$

where b_t = birth rate at t; y_t = per capita real income at time t:; t = time trend, and u^b_t is a random term. Then, the decline in mortality is postulated to be related to improvements in general standards of living and those associated with health programmes, etc. Hence, in the equation for death rate (d_t), government expenditure on welfare at constant prices (G^w_t) *is* added as an explanatory variable.

$$\log d_t = b_o + b_1 \log Y_t + b_2 G_t^w + b_3 \log t + u_t^d$$

Krishnamurty uses the following identity to close the model:

$$N_t = N_{t-1}(1 + b_t - d_t) + E_t$$

where N_t = population at time t, E_t is net migration at time t which is treated as exogenous.

In regard to women's role and status, hardly any analytical work has been done to relate these to economic and demographic variables. Most empirical of research in this area in India is confined to the study of only some aspects of women's status such as caste, education, occupation of husband and their influence on fertility. Some studies have also attempted to explore other issues in the context of women's status such as autonomy in decision-making, the role of the female in society, interaction with media, and property ownership by females and their influence on poverty (Jejeebhoy, 1986; Mahadevan, 1979, 1987; Murthy, 1986; Rao, Kulkarni: and Rayappa, 1986). However, these studies are mostly descriptive and do not attempt any empirical estimation.

Description of Sub Models

We now proceed to provide a description of the various sub-models, and the key interactive process amongst these sub-model. Inter alia, the procedure adopted and the methodological details in the estimation of sub-models are outlined.

ECONOMIC SUBMODEL: The economic submodel determines various macro-economic variables such as production, consumption and investment, government revenue and expenditure, capital stock, labour demand and wage rate, and exports. Almost all equations have been estimated from time-series data. The economic submodel is disaggregated into two sectors: agriculture and allied, and non-agricultural sectors. Such disaggregation is made in equations for production, investment, capital stock, labour supply-demand and wage rate.

A production function is used for supply side determination. From the supply side, output is determined by capital input, labour input (incorporating labour quality improvement arising from education) and a time trend to capture technological progress.

Fixed capital stock is determined by an identity consisting of fixed capital stock of previous year and fixed investment of current year using the perpetual inventory method.

Labour supply is determined in the demographic submodel. Growth of real wage rate is determined by the gap between labour supply and labour demand. Labour demand is determined by the level of production and real wage rate.

Other relations in the submodel are as follows. Population growth affects both private consumption and government revenue expenditure. Private consumption is further affected by changes in population structure represented by the dependency ratio. The rate of fixed investment is influenced by the previous year's investment rate and by the level of demand for domestic products. The composition of fixed investment in terms of the shares of agriculture and non-agriculture sectors is determined by gross domestic product per capita reflecting the influence of increases in income levels on the pattern of expenditure. Inventory investment is determined by changes in gross domestic product. Government revenue is influenced by gross domestic product, and it influences government expenditure. Export is determined by gross national product of developed countries and effective exchange rate. The model is closed by making imports (and statistical discrepancy) as residual of the expenditure identity.

DEMOGRAPHIC SUBMODEL: This submodel determines the size and age-sex composition of the rural and urban population as well as certain other demographic

characteristics such as literacy rate, urbanization rate and labour force participation rate. Most of the equations in this submodel have been estimated from cross-sectional data for different Indian states pooled for two or three points of time (say 1981 and 1991).

As mentioned earlier, a rural-urban dichotomy is maintained for several demographic variables. Thus, estimates are provided for demographic variables separately for rural and urban areas. This has not been done by estimating equations separately for rural and urban areas. Rather, econometric equations have been specified and estimated to explain the demographic variables at the All India level, i.e. taking rural and urban areas together, and then, from such general estimates, separate estimates for rural and urban areas are derived.

To model fertility behaviour, an equation has been estimated to explain total fertility rate (TFR**).** While growth of income and industrial development are expected to have a major influence on fertility behaviour, the coefficients obtained for these variables were statistically insignificant. Thus, in the final equation chosen for TFR, these variables were not included and it has been taken as a function of female literacy rate, female workforce participation rate, female mean age at marriage, and per capita government expenditure on health and family welfare.

In the model, age-specific fertility rates (ASFRs) are derived from TFR as some earlier studies have done. We assume ASFRs to follow a truncated Pearson Curve Type III pattern. For our calculations, four parameters are specified: (1) total fertility rate, (2) mean age at child bearing (MACB), (3) relative fertility rate of women in the age group 20-24 years to those in the age group 15-19 years, and (4) relative fertility rate of women in age group 35-39 years to 40-44 years. Age-specific fertility rates are calculated for rural and urban areas separately and for all ages in the fertility period.

Female mean age at marriage (FMAM) is estimated as a function of two WRS variables, namely female literacy rate and relative female-male wage rate in agriculture. FMAM influences ASFRs in two ways: through its influence on TFR and through its influence on MACB (for which a relationship is estimated).

For mortality estimation we have used life expectancy at birth. An equation for life expectancy at birth for female has been estimated by cross-sectional regression. As in the

case of TFR, urbanization and industrialization factors turned out to be insignificant in explaining life expectancy. In the final equation chosen to explain female life expectancy at birth, female literacy rate and government expenditure on health per capita were taken as an explanatory variables. Based on our study of past trends in life expectancy, we have taken male life expectancy at birth to be equal to that for females.

Besides life expectancy at birth, we make use of infant mortality rate in our calculations. It is used for calculating infant survival rate for 0-1 year age group in population projection. It has been taken as a function of female literacy rate and per capita government expenditure on health and family welfare.

Once life expectancy at birth for male and female in rural and urban areas are obtained, South Asian Model Life Table and Brass Logit System are used to estimate the survival ratios, age-sex wise for rural and urban areas separately. The single year survival ratios and age specific fertility rates are utilised to project age-sex specific population for both rural and urban areas in the next period.

To provide estimates of migration, the model estimates first the level of urbanisation (taken as being determined by per capita income and proportion of domestic product originating in agricultural to non-agricultural sector) and then it calculates net rural-urban migration as the difference between population size in urban areas consistent with rate of urbanisation and natural population size obtained from previous year's natural growth of urban population.

The labour force participation rates for males are taken as exogenously determined and constant (0.864 and 0.802 for rural and urban areas respectively). Female labour force participation in rural and urban areas are treated as variables and equations for them have been estimated as a part of women's role and status submodel. Labour supply is calculated as the product of working age population, generated from population projection, and labour force participation rates.

Male literacy rate is estimated as a function of per capita income and government expenditure on education per capita. Urbanisation and industrialization factors were tried as possible explanatory variables but the results were poor. The male secondary education rate has been taken as a function of government expenditure on education and the rate of

urbanisation. Similar specifications have been used for female education rates as discussed later.

WOMEN'S ROLE AND STATUS SUBMODEL: Women's role and status in the sense of their control over material and social resources, their position in family and society and opportunities and alternatives available to them is difficult to incorporate in quantitative model estimation. Other aspects like physical seclusion and social invisibility in the context of women's status are even more difficult to quantify. Therefore, in this study, we have included only a few measurable variables. As in the case of the demographic submodel, equations for this submodel are estimated from cross-section data. The submodel determines female literacy, female participation rates and relative wage rate.'

Female literacy rate (FLR) has been postulated as being determined by per capita income, government expenditure on education per capita and urbanisation rate. In the equation for female secondary education rate, per capita government expenditure on education and urbanisation rate have been taken as the explanatory variables.

Female labour force participation rate in rural areas has been postulated as being determined by fertility rate, wage rate of male (as a proxy for household income) and female wage rate (as a motivating factor for female participation). A somewhat different specification has been for urban female labour force participation rate; the explanatory variables chosen are per capita income reflecting the level of development, female literacy in urban areas, and mean age at marriage. Female workforce participation rate has been taken as dependent on female labour force participation rate and the general rate of unemployment.

Wage differential between female and male is an indicator of the status of women. Higher wage differential reflects lower status of women. Due to data limitations, this could be studied only for rural areas. The ratio of agricultural wages of females to males has been taken as being determined by differences in abilities (educational differential used as proxy) and female participation rates in rural areas.

SOME METHODOLOGICAL POINTS

The equations in the demographic and women's role and status **(WRS)** submodels were mostly estimated with cross-section (or pooled time-series and cross-section) data across different states of India. The model, on the other hand, provides forecast for various variables over time at the all-India level. Some adjustment of the coefficients therefore becomes necessary. In most cases, we have adjusted only the constant term of the estimated equations as this adjustment yielded a good forecast of the time-series scenario. However, in a few cases, this procedure did not yield good forecasts. In these cases, we feel, the parameter estimates obtained from cross-sectional regression significantly overstate the effect that some of the explanatory variables would have in time--series context. It became necessary therefore to reduce slightly the coefficients of those variables so that the equation so modified would fit the time series data well. Another change we have made is to use cumulative government expenditure (over ten years) in place of the current government expenditure in the equations and adjust the coefficient of the variable suitably. It was felt that this change would make it possible to capture more satisfactorily the fact that the effect of government expenditure on female literacy, total fertility rate, infant mortality rate, etc. occur with a lag and that a level of expenditure has to be sustained over time for the effect to come about.

For solving the system of equations constituting the model, the RATS (Regression Analysis of Time Series) package was used. To facilitate computation, we have divided the computational procedure into the following four components:

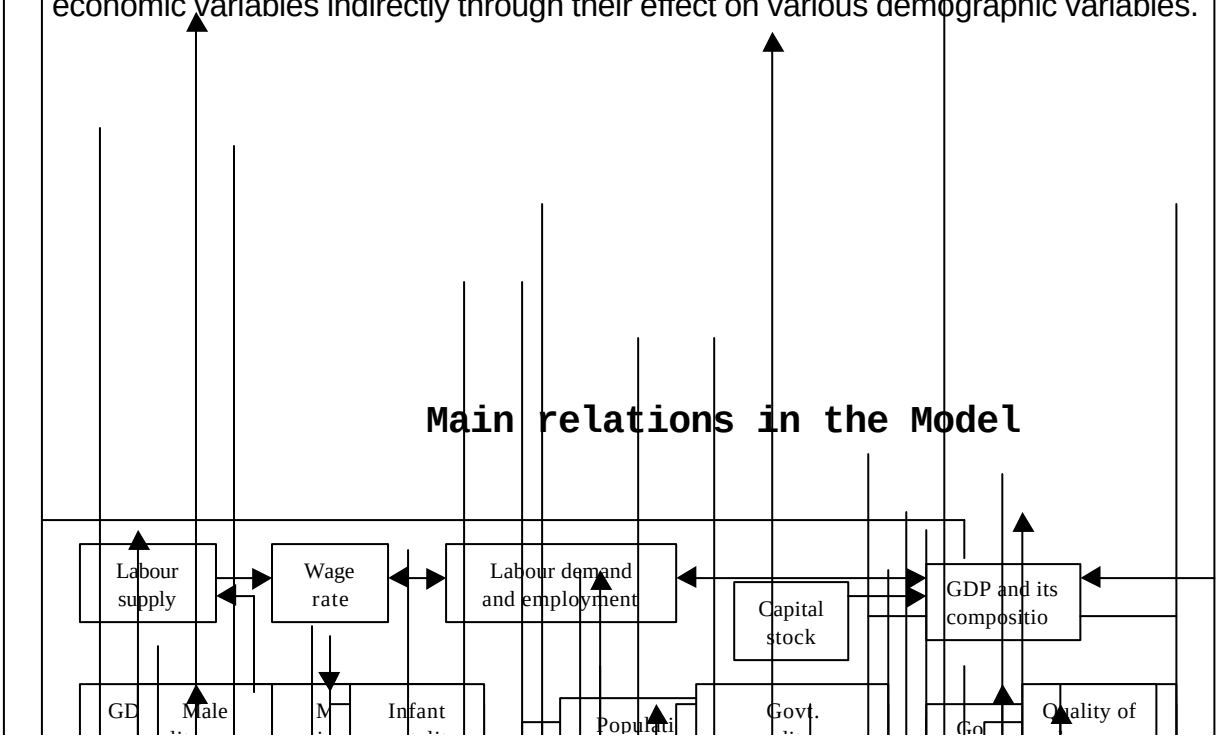
(A) Economic submodel,
(B) Demographic (excluding components C and D) and women's role and status (WRS) submodels,
(C) Estimation of ASFRs from TFR, and
(D) Population projection

The RATS package was used to solve the components A and B. All these equations are put together and solved simultaneously. Components C and D are computed by using a FORTRAN computer programme. To explain the process of computation further,

let 1981 be the starting year of solving the system. Using TFR and various other parameter such as life expectancy, the components C and D are solved to yield population projections for 1982. Using the values of exogenous variables, including size and composition of population for 1982 and lagged values of some endogenous variables, the components A and B are then solved for 1982. The solution provides estimated total fertility rate, life expectancy and infant mortality rate. Various other parameters needed for components C and D are also provided. Given these parameters, the components C and D are solved to provide the size and structure of population for 1983. This enables us to solve the components A and B for 1983. This process was repeated to generate solution of the model for subsequent years.

Turning to the interrelationship between demographic and WRS variables, female mean age at marriage, total fertility rate, urbanization rate and literacy differentials by sex are factors which affect WRS variables. Female literacy rate is the most important variable in the "S model influencing several demographic variables like female mean age at marriage, fertility, infant mortality and life expectancy. Female labour participation variables influences labour supply in demographic submodel. Further, female mean age at marriage is determined by female literacy rate and wage differential by sex.

As regards the interaction between economic variables and WRS variables, it is seen that gross domestic product, government expenditure on education and wage rate variables are affecting WRS variables. On the other hand, WRS variables affect the economic variables indirectly through their effect on various demographic variables.



Counter-factual simulation

The base year of the model is 1981. Using counter-factual simulation the complete model has been validated for the years 1982 to 1991. The estimated figures for a large number of variables have been compared with the actual values. For most variables, the estimated figures are quite close to the observed data. In particular, the average percentage difference (absolute) between the actual and estimated values in respect of certain key variables are shown in the table below. In addition, it may be noted that, as compared to the actual growth rate of population of 2.133 per cent per annum between 1981 and 1991, the growth indicated in the counter-factual simulation is 2.131 per annum. Similarly, the growth rates in actual and estimated real GDP are 5. 100 and 5.119 per cent per annum respectively.

Table 4: Difference between actual and estimated values of key variables.

	Difference (per cent)
Gross Domestic product	1.8
Gross domestic product in agriculture	3.4
Gross domestic product in non-agriculture	1.5
Population	0.1
Urbanisation ratio	1.1
Government expenditure	4.6
Private consumption expenditure	2.2
Infant mortality rate	2.5
Life expectancy	3.5
Total fertility rate	1.4
Female mean age at marriage	0.7
Female literacy rate	0.1
Male literacy rate	0.1

The validated model has been used for providing simulations of the future scenario of the economic, demographic and women's role and status variables for the period 1991 to 2006. For the reference run, the following assumptions were made:

- Beyond 1993, the real effective exchange rate will remain fixed at the 1993 level
- The GNP of developed countries grew at the rate of 1.2 per cent between 1990 and 1993 and will grow at the rate of 2.7 per cent per annum beyond 1993. This is based on the forecast made by a study of the World Bank.
- The share of government expenditure on education, health and family welfare will remain fixed at the average proportions observed during the 1980s.
- The variables and parameters for which trend equations were estimated will continue to follow the trend indicated in then estimated equations.
- The rate of "technological progress" in the agricultural sector will remain fixed at 1.57 and 2.48 per cent per annum, as has been the experience during the period 1971 to 1991.

It should be pointed out that the reference run is not a prediction of the future. It depicts the most likely scenario when there is no deviation from the past policies. However, the results of the reference run provide a basis for comparison with policy simulation runs.

The highlights of the baseline scenario are as follows:

- Real GDP will grow at the rate of 5.6 per cent per annum between 1991 and 2006. The growth rate of GDP per capita will be 3.95 per cent per annum.
- Population will grow at the rate of 1.62 per cent per annum between 1991 and 2006 to reach the figure of 107.6 crore by 2006.
- Total fertility rate will decline from 3.6 in 1991 to 2.39 in 2006.
- Between 1991 and 2006, life expectancy will go up from 59.5 years to 66.3 years and infant mortality will go down from 80 to 43.8.
- Between 1991 and 2006, the male literacy rate will increase from 64.2 to 78.7, the female literacy rate will increase from 39.2 to 5 8. 1, the male secondary education

rate will increase from 9.68to 18.04 and the female secondary education rate will increase from 3.87 to 9.69.

- The share of the non-agriculture sector in GDP will increase from 69.4 per cent in 1991 to 78.7 per cent in 2006. During this period the urbanisation rate will go up from 25.7 to 32.7 per cent.
- There will be a marked increase in the real wage rates in both agriculture and non-agriculture.
- In agriculture, the increase will be by 107 per cent between 1991 and 2006, while in the non-agriculture sector the increase will be by 62 per cent in the same period. The ratio of female to male wage rate in agriculture is expected to improve from 0.844 in 1991 to 0.875 in 2006.

Policy simulation exercises

Five policy simulation exercises were carried out. Two of them (higher female literacy, higher female participation) show the effect of policy changes in regard to women's role and status variables, two others (higher age at marriage, faster decline in fertility) relate to demographic variables, while one (higher rate of investment) relates to economic development).

Impact of raising female literacy

Female literacy is one of the most important variables representing female role and status. During the 1980s, the female literacy rate (FLR) increased from about 30 to about 40 per cent. The results of the reference run predict that this rate will rise further to 58.11 per cent by 2006. It is important to find out how various key variables of the model will be affected by raising the level of FLR. To implement this policy simulation, the constant term of the equation for the FLR equation was increased by 3.87 (1992 onwards) to raise the all-India level of FLR to half of the level of the state of Kerala, which has the highest FLR in the country.

The impact of this change in FLR may be seen from table which summarizes the results of simulation. The population for 2006 is lower by 1.6 per cent, per capita GDP goes up by about 2 per cent, and the total fertility rate declines by over 10 per cent and reaches the level of 2.14. The female participation rate in rural areas goes up by about 7 per cent and that in urban areas by about 2.6 per cent. The female mean age at marriage rises by 1.9 per cent. On the other hand, there is little effect on the female-male wage ratio in rural areas.

Impact of increasing female labour force participation

The female labour force participation rate is another important variable reflecting women's role and status. During the 1980s, the female participation rate in rural areas increased from about 380 to about 390 per thousand. In urban areas, there was a fall in the female participation rate from about 195 to 190. To study the effects of raising female participation rates, one simulation exercise was carried out. The constant terms of the equations determining female participation rates were raised (1992 onwards) to implement this simulation. The increase was by 69 in the case of the equation for rural areas and by 6 in the case of the equation for urban areas. This raised the all-India level of the participation rates to 75 per cent of the level of the states having highest female participation rates.

The impact of raising female participation rates can be seen from table. Population is lower by 0.3 per cent compared to the base scenario. Per capita GDP goes up by about 1 per cent. Total fertility declines by about 7 per cent to reach the level of 2.23. One major effect is on the female-male wage ratio, which goes down by about 6 per cent. This basically reflects the adverse effect on greater women participation in the labour force on the wage rate of women. Another interesting result is that, while higher female literacy causes life expectancy to go up, greater female participation does not have much impact. Also, while higher female literacy leads to higher age at marriage, greater female participation in the labour force tends to push down the age at marriage.

Impact of higher female age at marriage

In our study, mean age at marriage has been considered as a demographic variable, though it can also be taken as women's role and status variable. The female mean age at marriage has been increasing in India at a very slow pace. During the 1980s, it increased from 18.3 years to 19.3 years. In 1991, it reached the level of 19.6 years. It would be useful to examine the impact of raising the mean age at marriage. To implement this policy simulation, the constant term in the equation for mean age at marriage has been raised (1992 onwards) by 3.12, so that the mean age at marriage at the all-India level reaches the level of Kerala, which is the highest in the country.

The effect of the increase in the mean age at marriage can be seen from table 5. It causes a significant fall in the population size for 2006. Compared

increase of about 4 per cent. This has a major effect on the total fertility rate and makes it go down by as much as about 17 per cent compared with the base scenario. The female literacy rate increases by 2.77 per cent, while the female secondary education rate increases by 3.1 per cent. Another important result is the sharp increase in the female participation rate as a result of the increase in the age at marriage. The participation rate increases by 14.55 per cent. As in the case of the previous simulation, in which the female participation rate was raised, in this case also the female-male wage ratio is adversely affected by the increase in the mean age at marriage. This is perhaps due to the effect of a higher mean age at marriage on female participation which, in turn, influences the female-male wage ratio.

Impact of higher investment rate

Since a major objective of the present modelling exercise is to bring out the interactions among the economic, demographic and women's role and status variables, it would be useful to carry out some simulations of the economic variables and study their impact on the variables of the other two submodels. With this objective, a policy simulation has been carried out in which it is assumed that the rate of investment will be 10 per cent more than what the investment function gives. It may be mentioned here that, with the economic policy

liberalization initiated since 1991, it is likely that the rate of investment in the country will go up in response to the new economic policy (a significant inflow of foreign capital is expected). Thus, this simulation of increased investment rate might show the possible effect of economic policy liberalization on the demographic and women's role and status variables.

It is seen from table 5 that the higher investment rate causes a faster growth in GDP and, as a result, the GDP rises by 9.5 per cent compared with the base run estimate. The increase in per capita GDP is higher at over 10 per cent as the higher investment rate causes a slower growth of the population. In this scenario, significant effects are found in most variables considered in table 5. Thus, the female literacy rate goes up by 6.75 per cent, the female secondary education rate by 6.3 per cent, the urbanization rate by 4.89 per cent, and the male literacy rate by 3.68 per cent. It is interesting to note that, while the female participation rate in rural areas goes up (by about 3 per cent) as a result of higher rates of investment, that in the urban areas goes down (by about 2 per cent).

Impact of a faster decline in the fertility rate

To study how demographic variables influence economic and women's role and status variables, we have carried out one policy simulation in which we assume a faster decline in the total fertility rate compared with the base run estimates, but take other things as the same. To implement this simulation, the constant term of the equation for the total fertility rate has been made to decline by 0.01 every year (1992 onwards). Such a decline may come about by an enhanced government effort to reduce fertility. The effect of this change is found to be small. Thus, GDP is affected only by 0.03 per cent. Also, the population for 2006 is lower by only 0.9 per cent. It is only in the case of the female participation rate in rural areas that there is some effect of a faster decline in the total fertility rate. The participation rate is about 3 per cent higher.

An illustration for EAG States:

For the purpose of demonstrating how this model can be used to determine the impact of a faster decline in fertility rates on the TRF of select EAG states, the all India estimates obtained above have been used. This is done by comparing the base estimates of TRF arrived at on the assumption of "Business as Usual" with those obtained when there is a "faster decline in the fertility rate" (as has been done for the all India case for 2006). The simulation results are contained in the following table

Simulation Exercise for Select EAG States (2006)

States	Base run "Business as Usual"	Faster decline in fertility rate	TRF level as projected by 10th Plan in 2007
Bihar	3.9	3.57	2.8
Madhya Pradesh	3.5	3.20	2.6
Rajasthan	3.9	3.57	2.7
Uttar Pradesh	4.2	3.85	2.7

It may be noted that the Tenth Plan TRF projection are arrived at by assuming that all the key interventions' will be successfully implemented

Table 5: Simultation Results, 2006						
	Base run	**Higher female literacy**	**Higher female participation**	**Higher age at marriage**	**Higher investment rate**	**Faster decline infertility rate**
Gross domestic product (million R) (% deviation from base)	485 958	487 357 0.29	489 524 0.73	485 781 -0.04	532 309 9.54	486 111 0.03
Population (million) (% deviation from base)	1076.4	1058.9 -1.63	1073.1 -0.31	1034.7 -3.87	1070.7 -0.53	1066.9 -0.88
Per capita GDP (Ruppee) (% deviation from base)	4514.66	4602.48 1.95	4561.77 1.04	4694.90 3.99	4971.60 10.12	4556.29 0.92
Total fertility rate (% deviation from base)	2.39	2.14 -10.46	2.23 -6.69	1.99 -16.74	2.17 -9.21	2.19 -8.37
Life Expectancy (% deviation from base)	66.3	67.5 1.81	66.4 0.15	66.8 0.75	67.5 1.81	66.4 0.15
Female literacy rate (% deviation from base)	58.11	62.76 8.00	58.53 0.72	59.72 2.77	62.03 6.75	58.5 0.67
Female secondary education rate (% deviation from base)	9.69	9.83 1.44	9.76 0.72	9.99 3.10	10.3 6.30	9.8 1.14
Female participatrion rate-rural (% deviation from base)	307.9	328.2 6.59	440.6 43.10	352.7 14.55	317.8 3.22	316.9 2.92
Female participation rate-urban (% deviation from base)	197.5	202.6 2.58	202.9 2.73	197.7 0.10	193.4 -2.08	197.2 -0.15
Female mean age at marriage (% deviation from base)	21.2	21.6 1.89	20.9 -1.42	24.4 15.09	21.6 1.89	21.2 0.00
Female-male wage ratio (% deviation from base)	0.875	0.872 -0.34	0.822 -6.06	0.858 -1.94	0.873 -0.23	0.872 -0.34
Urbanisation rate (% deviation from base)	32.7	33 0.92	32.9 0.61	33.3 1.83	34.3 4.89	32.8 0.31
Male literacy rate (% deviation from base)	78.7	79.2 0.64	79 0.38	79.9 1.52	81.6 3.68	79 0.38

Note: Gross domestic product is in Rs. crore (at constant 1980/81 prices), gross domestic product per capita is in rupees (at constant 1980/81), population is in crore, all rates are in percentages, except female participation rates in rural and urban areas which are per thousand.

IMPLICATIONS FOR EAG STATES

The results of the simulation exercises indicate the relative importance of various interventions. For instance, when fertility is the target variable, the raising of age at marriage and female literacy followed by investment are most effective interventions in reducing fertility rate. For instance, enhanced government efforts towards reducing fertility has little impact on containing population and raising state domestic product. Faster economic development through increased investments does retard population growth, helps in raising female literacy as well as in increasing the urbanisation rate. Curiously however while the female participation rate in rural areas goes up as a result of higher investment rates, the urban female participation rate indicates a decline.

A revealing feature of simulation exercises is that a particular policy intervention can have both good and adverse effects on different parameters, as for instance higher female participation was found to result in a fall in the female-male wage ratio and at the same time causing a fall in the total fertility rate. This suggests the need to adopt a more pervasive approach by taking anticipatory policy measures in sectors which are likely to be so adversely affected by particular policy changes.

In short it would be prudent to make an all out effort to raise the female literacy. As far as raising age at marriage is concerned, it is a long term measure and an aggressive media campaign is needed. Also economic development, if pursued with some seriousness may give some good results through its alround impact on various parameters.

Before we conclude it may be useful to cite the results of a recent National Consultation on Population Stabilisation held in October 2002 in connection with the preparation of RCH Project, according to which the key stakeholders ranked the following five policy interventions as the most favoured and the five least favoured.

Most Favoured Recommendations

- Improve quality of care

- Reduce unmet need for contraception
- Increase female literacy
- Reduce infant mortality rate
- Strengthen IEC activities

Least Favoured Recommendations

- Provide disincentive for high fertility
- Improving inter-sectoral linkages
- Reorientation of CNA
- Reintroduce Family Planning Targets
- Introduce hormonal methods

Of course these are only broad interventions, and specific interventions under each major intervention will need to be worked for each.

In conclusion it may be fair to assert that reduction in fertility per se may not significantly help in curtailing population growth or raising domestic product. The investment variable however shows its importance in that, apart from significantly raising the values of economic variables like domestic product etc, it is very effective in increasing life expectancy, urbanisation rate and all education related variables such as female literacy rate, the female secondary education rate and the male literacy rate. Also the results of simulation exercise underline the need to raise the women's status as a means to make a dent in both economic and demographic variables.

Appendix: Estimates

Demographic

LIFEXPF = 38.199 + 0.252 FLR + 3.623 ln (COVEXPLI/POP)
(7.083) (7.218) (1.977)

Random Effects Model (with year dummy) $R^2 = 0.782$

Ln (LIFEXPFUR/LIFEXPFRU -1)

=-1.460 -0.031t

(156.694) (-36.706)

Period 1973 to 1988 R^2 -0.988

IMR = 234.880 - 1.279 FLR -30.526 ln (GOVEXPHFIPOP)
(5.296) (4.033) (-2.025)

Random effects model (with state dummy) R^2 0.633

Ln (RAIMR) = -0.064 - 0.016 T
(-0.811) (-3.085)

$R^2 = 0.405$ DW = 1.551

Period 1976 to 1991

TFR = 7.671 - 0.037 FLR - 0.023 FWFPR
(6.010) (-3.656) (-2.101)

- 0.059 GOVEXPHF/P0P - 0.079 FMAM
(1.495) (-1.040)

Random Effects Model (with state dummy) R^2 0.842

TFRRU/TFRUR = $e^{-0.344 + 0.172\ TFR}$

[Assuming as TFR approaches 2, TFRRU/TFRUR approaches 11

UR = 0.005 GDPIPOP - 0. 185 GDPAG/GDPNAG
(5.208) (-7.863)

Fixed Effects Model (with year dummy) R^2 0.808

LPRMRU 0.864 (constant)

LPRMRU 0.802 (constant)

GAMMA 1 (yl) = 2.209 - 0.005T

(34.138) (-0.978)

Period 1970 to 1989 R^2 0.080

GAMMA (y) = 2.495 + 0.023 T
(43.894) (4.934)

Period 1970 to 1989 R^2 0.582

MACB/(MACB-FMAM) = 2.479 + 0.051 t
(147.592) (17.145)

Period 1970 to 1989 R^2 0.977

FMAM = 11.269 + 0.090 FLR + 5.649 WFAG/WMAG
(7.536) (9.724) (3.326)

Random effects model (with state dummy)

MLR = 0.0057 GDP/POP + 8.680 In (GOVEXPED/POP)
(4.617) (5.852)

Fixed effects model (with state dummy) R^2 0.995

Ln (FLRRU/MLRRU) = 0.041 + 1.352 In (FLR/MLR)
(1.191) (25.768)

Fixed effects model (with year dummy) R^2 0.964

MECEDR = 12.621 + 4.5 88 In GOVEXPED/POP + 0.197 UR
(-1.357) (1.758) (1.784)

Cross-section regression 1980-81 R^2 0.504

Women's Role and Status

FLR = 0.0061 GDP/POP + 8.220 ln (GOVEXPED/POP) + 0.627 UR
(3.585) (4.321) (2.063)

Fixed effects model (with state dummy) R^2 0.997

Ln (FLRUR) = 2.453 + 0.420 ln FLR
(22.760) (13.792)

Random effects model (with state dummy) R^2 0.884

FSECEDR = 3.993 + 0.069 GOVEXPED/POP + 0.189 UR
(-2.675) (4.141) (4.170)

Cross-section regression 1980-81 $R^2$0.704

LPRFRU = 1125.9 - 72.606 TFRRU - 186.215 WMAG
(6.819) (-2.794) (-3.994)

-193.641 DUMMY 1 + 169.422 DUMMY 2
(-2.957) (2.455)

Cross-section regression (1990-91) $R^2$0.837
[These dummies are for different states falling in different agro-climatic regions]

LPRFUR = -3.757 + 3.257 FLRUR - 0.022 G13P/P0P
(-0.049) (2.335) (-1.356)

+ 0.568 finam
(1.490)

Cross-section regression (1990-91) R^2 0.342

WFAG/WMAF = 0.938 + 0.081 17FLRRU/MLRRU - 0.0004 LPRFRU
(16.2530) (1.041) (-5.017)

Cross-section regression (1990-91) $R^2$0.734

Ln (FWFPR/LPRF) = 1.126 - 1.901 ln (LAB/LSU)
(-146.429) (-52.874)

R^2 = 0.999 DW 2.342

Period 1981 to 1991

Economic

Ln GDPAG - 0.23 ln (LABAG*E) - (1.0-0.23) ln KSTDAG(-1)
= 0.381 + 0.0157T
(2.729) (2.158)

$R^2$0.597

M.L. AR(8) Period 1973 to 1990

Ln GDPNAG - 0.515 ln (LABNAG*E) - (1.0-0.515) ln KSTDNAG (-1)
= 1.655 + 0.0248T
(15.641) (3.895)

R^2 0.970 DW =1.789

C.O.: AR (I) Period 1972 to 1990

PRCON = -41250.7 + 0.846 GDP - 1.136 TAXREV
(-3.569) (10.931) (-3.790)

+ 19.367 PORDEPRTO
(3.276)

R^2 0.998 DW 1.999

C.O.: AR (I) Period 1971 to 1990

Ln GOVCON = 2.7676 + 0.671 ln GOVEXP
(5.511) (13.780)

R^2= 0.991 DW = 1.684

C.O.: AR(I) Period 1970 to 1991

INV = -399.49 + 0.0297 (GOVEXP + PRCON+ EX) + 0.590 INV (-1)
(-0.436) (1.817) (2.547)
$R^2$0.951 DW 2.220

Period 1971 to 1989

INVAG/INVNAG = -14.032 + 0.011 GDP/P0P
(-2.837) (4.520)

R^2 0.840 DW = 1.858

C.O.: AR (I) Period 1970 to 1990

GOVEXP/P0P = -47.475 + 0.945 TAXREV/POP
(-0.403) (1.668)

+ 9.829 T - 452.385 DUMMY + 26.595 T.DUMMY

(1.627) (-2.042) (2.250)

R^2 0.977 DW 1.897

Period 1970 to 1991

GOVEXPHF = CUGOVEXP * 0. 1325

GOVEXPH = CUGOVEXP * 0.0610

GOVEXPED = CUGOVEXP * 0.0839

TAXREV = -5327.2 + 0.168 GDP + 0.268 TAXREV (-1)
(4.984) (5.104) (1.703)

R^2 = 0.995 DW = 2.353

Period 1971 to 1991

Ln INDTAX = 0. 118 + 0.954 Ln TAXREV
(0.139) (11.407)

R^2 0.981 DW = 2.031

C.O.: AR (I) Period 1970 to 1991

WTSTD = -4776.0 + 0.265 GDP + 0.460 IVTSTD (-1)
(-1,053) (2.940) (2.658)

$R^2$0.990 DW 2.003

Period 1981 to 1992

Ln LABAG = -1.061 - 0.20 In WRAG + 0.75 In GDPAG

Ln LABAG = 3.017 - 0.7 In WRNAG + 0.31 In GDPNAG
+ 0.55 In LABNAG (-1)

GRWR = 4.105 - 1.458 DUMMY - 0.0047 (LSU-LAB)/LSU
(4.821) (-2.938) (-0.211)

$R^2$0.237 DW2.947

[This dummy is for the non-agriculture sector]

cross-section combined regression of GRWRAG and GRWRNAG

LABUA = LABNAG * 0.9859

CONCAP = -6021.4 + 0.063 KSTD(-1)
(-8.087) (40.349)

R^2 = (.999 DW = 2.406

C.O.: AR (1) Period 1971 to 1991

Ln (EXIGNP13Q = 6.065 - 0.560 ln REER + 0.390 ln (WPIGNPDC)
(8.183) (-2.438) (1.103)

R^2 0.633 DW = 1.347

Period 1970-1971 to 1989-1990

Notes:
1. Figures in parentheses are t-values.
2. C.O. AR(n) - Cochrane - Orcutt iterative procedure in auto regressive scheme n
3. DW Darbin - Watson statistics.
4. Ln - Natural logarithm.
5. Log - Logarithm with base 10.
6. M.L.: AR(8) Maximum likelihood estimator in auto regressive scheme 8.