DEMOGRAPHIC TRENDS, POPULATION POLICY AND THE ECONOMIC CRISIS

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ABSTRACT

The paper reviews Philippine fertility and mortality trends in relation to past socioeconomic trends and to the impact of public policies and programs. Moreover, the paper examines the prospects for fertility and mortality change in the light of the current economic crisis.

Regression analysis based on time series data indicates significant negative correlation between infant mortality and per capita personal consumption, employment rate and per capita public health expenditures. The real price of food, on the other hand, is positively correlated with infant mortality. Given the worsening in employment rate, real wage, consumption per person and food price, the immediate probable effect of the current economic crisis is to decelerate mortality declines if not increase mortality levels outright. However, the mortality effect of the current economic crisis can be attenuated by increased real public health expenditures per capita.

Regression analysis reveals that GNP per capita and real price of food are negatively correlated with marital general fertility, while real wage rate and infant mortality rate are positively correlated. With the current economic crisis, we would expect that the decline in real per capita GNP will tend to arrest the rapid fertility decline observed in the early 1970's. However, if drastic changes in expectations resulting from the crisis occur, then these could shift the entire set of macro-relationships towards reduced demand for children. The implication is that the population program must be ready more than ever to effectively respond to such increased demand in the short term even as it continues to lay the groundwork for its longer term strategy of sustaining fertility reductions in the future.

Introduction

The Philippine population grew from 7.6 million in 1903 to 48.1 million in 1980, a sixfold increase in close to eight decades. Between 1903 and 1948, the population grew at an average annual rate of 2.0 percent so that by 1948 the population stood at 19.2 million. However, during the 1948-1970 period, the average annual growth rate rose to an unprecedented 3.0 percent, so that by 1970 the total population reached 36.7 million, nearly double that of the 1948 population. While population growth decelerated moderately to 2.7 percent annually during the 1970-1980 period, still 11.4 million persons were added to the population, so that the total population stood at 48.1 million in 1980.

Projections made by the National Census and Statistics Office would place the population by year 2000 at between 71 million to 78 million under different fertility assumptions, given moderate mortality decline. By 2030, given the same set of assumptions, the population will be between 97 and 120 million. A World Bank projection based on data up to 1982 suggests that if replacement fertility is reached by year 2010, the population will reach zero growth rate at around 2075 with a population of 127 million (World Bank, 1984).*

The prospects of continued population growth well into the twenty first century irrespective of fertility trends than can realistically be expected is clear. What is not clear is the long run capacity of the Philippine economy and society not merely in accommodating the additions to the population at current standards of living, but more importantly, in significant raising such levels and improving the quality of life of the total population. The recent economic crisis casts further doubt on such capacity.

In this time of economic crisis and political uncertainty social concerns tend to be focused, quite understandably, on immediate solutions to the nation's economic and political problems. This environment is very conducive to the neglect of problems that are remotely related to political economy issues. Among such problems might be those related to population change, since such problems are often long-term in character. One of the conclusions of this paper is that population concerns have critical short-term dimensions as well, more so in this time of economic difficulties.

In this paper we review Philippine mortality and fertility trends in relation to socioeconomic trends and the impact of public policies and programs. We then examine the prospects for mortality and fertility change in the light of the recent economic crisis and discuss their implications for welfare and population policy on the short term. Finally, we briefly discuss some medium- to long-term implications of population change and suggest that the needed short term policy response to immediate mortality and fertility concerns can in fact provide an excellent opportunity for laying the ground work for the long term policy of modifying population trends consistent with the imperatives of national development and individual welfare.

Demographic Trends and their Determinants

Mortality Trends

Data on mortality levels are difficult to come by especially for the more recent period. This is also true for fertility as we shall see later. Table 1 presents selected estimates of mortality as measured by the crude death rate, infant mortality

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*Replacement fertility is the fertility rate at which childbearing women, on the average, bear only enough daughters to replace themselves in the population.

probability (q_0), and life expectancy at birth, (e_0). Hard data are available only up to 1975. The figures for 1983 are based on projections used in the Updated Philippine Development Plan, 1984-1987. The projections in turn are based on past trends with the aid of demographic models. The projected estimates, while useful for planning purposes are less useful for our own analytical purposes, i.e. for the determination of actual trends in the most recent period.

Table 1. Selected mortality estimates: Philippines

Source	Year	Crude Death Rate (CDR)	Infant Mortality Probability (q_0)	Life Expectancy at Birth (e_0°)
Aromin (1961)[a]	1904-1905	26.8	–	...
	1904-1930	–	–	37.5
	1936-1941	23.3	–	...
	1931-1941	–	–	40.0
Madigan (1965)[a]	1948-1950	21.6	–	42.5
Lorimer (1966)[a]	1948-1952	20.0	–	42.5
Lorimer (1966)[a]	1953-1958	16.7	..	47.5
Lorimer (1966)[a]	1959-1960	13.4	–	52.5
Flieger, et al. (1981)[a]	1960	12.8	113.0	52.8
Zablan (1975)[a]	1960	13.7	105.5	52.8
Flieger, et al. (1981)[a]	1970	10.8	93.0	55.8
Engracia (1974)[a]	1970	10.4	80.0	58.0
Flieger, et al. (1981)[a]	1975	8.7	76.0	59.4
Gonzaga (1979)[b]	1977	--	64.6	61.2
NEDA (1984)[c]	1983	8.2	--	62.5

Sources:
[a]Cited in Flieger, W. et al. (1981; Table 10, p. 24).
[b]Gonzaga (1979) based on the Trussell technique.
[c]NEDA (1984).

A cursory look at Table 1 suggests a general pattern of slow mortality decline from the turn of the century to around 1950, a period of rapid mortality decline between 1950 and 1960, a sharp deceleration of mortality decline in the 1960s, and a period of rapid mortality decline during the 1970-1975 period but less rapid as in the 1950s. To highlight this changing pattern of mortality decline we present the selected rates which appear to be the most reasonable estimates, together with data on economic and health development.

From this narrower set of rates, we can describe mortality patterns more specifically as follows. Crude death rates declined by 0.80 deaths per 1,000 population annually between 1948-50 to 1960. In the 1960s, the average annual change was down to only 0.20. In the 1970-75 period, however, the average annual change accelerated to 0.42 per 1,000. This pattern is duplicated by the pattern of change in life expectancy at birth which is a better measure of mortality conditions than the crude death rate since it is not distorted by the effects of changes in the age

structure. The most rapid increase occurred between 1948-50 to 1960, where the average annual increment was 0.93 year. The average annual increment dropped sharply to only 0.30 year during the 1960's, but this climbed to 0.72 year during 1970-75 period.

Year	Mortality Estimates			Average Annual Change			Real per Capita Growth Rate		Average Annual Increments in Real Health Expenditures per Capita
	CDR	q_0	$e_0{}^\circ$	CDR	q_0	$e_0{}^\circ$	PCE[a]	GNP[a]	
1948-50	21.6	–	42.5	–	–	–	–	–	–
1960	12.8	113	52.8	0.80	–	0.93	3.9[b]	3.4[b]	6.86[c]
1970	10.8	93	55.8	0.20	2.0	0.30	1.5	2.1	4.84
1975	8.7	76	59.4	0.42	3.4	0.72	1.6	3.6	6.65

[a]PCE = Personal Consumption Expenditures.
 GNP = Gross National Product.
[b]1948-1960.
[c]1956-1960.

The observed mortality pattern is broadly consistent with economic trends. For example, real per capita consumption expenditures (PCE) grew at an annual rate of 3.9 percent during 1948-60, dropped sharply to only 1.5 percent in the 1960s, but rose, albeit slightly, to 1.6 percent from 1970 to 1975. The corresponding average annual growth rate of per capita GNP for the corresponding periods are 3.4, 2.1 and 3.6 percent, respectively. On the other hand, the average annual increments in real government health expenditures per capita declined in the 1960s relative to that of the 1950s, and this decline coincided with the deceleration in mortality improvements in the 1960s.

Recently, it has been possible to examine more rigorously the macro determinants of mortality using time series data on infant mortality measured the life table infant mortality probability, q_0. (See Paqueo, Herrin and Associates, 1984). The time series data on infant mortality probabilities (q_0) was constructed by taking the infant mortality rate (IMR) estimates derived from vital registration and census data as reported by the Disease Intelligence Center of the Ministry of Health, (DIC) and correcting these for underenumeration and definitional difference (IMR vs. q_0) using Flieger's, et al. (1981) estimates of q_0 for 1960, 1970, and 1975.

The correction factor which is the ratio of Flieger's q_0 estimate for 1960, 1970 and 1975 and the corresponding DIC's IMR estimates, i.e. $(\frac{q_0}{IMR})$, implicitly takes into account both underenumeration of infant deaths, (IMR*/IMR), and the definitional difference between q_0 and IMR since

$$(1) \quad \frac{q_0}{IMR} = \frac{IMR^*}{IMR} \quad \frac{q_0}{IMR^*}$$

where   IMR   =   estimate of infant mortality from DIC
         IMR*   =   unknown true level of infant mortality
         q_0 =   the probability of dying from birth to age one as estimated by
                    Flieger, *et al.* (1981).

The correction factor for 1950 was arbitrarily set at slightly above that for 1960, since there was no comparable estimate of q_0 for 1950. Finally, correction factors for each year in the intervals 1950-60, 1960-70 and 1970-75 were derived by linear interpolation between two benchmark years. The raw data as well as the resulting estimates of infant mortality probabilities are shown in Table 2.

By regressing the constructed time series data of infant mortality probabilities with selected macro variables, we get the following equation:

$$(2)\ \ln \text{INFANTM}_t = 2.4035 - 1.0475 \ln \frac{\text{LABI}_t}{\text{LABS}_t} + 0.0169\ \text{PRFOOD}_t$$
$$\underset{(-2.02)}{} \qquad \underset{(4.51)}{}$$

$$- 1.1028 \ln \frac{\text{CEXP}_{t-1}}{\text{POP}_{t-1}} - 0.1941 \ln \frac{\text{HCAP}_t}{\text{POP}_t}$$
$$\underset{(-2.78)}{} \qquad \underset{(-3.41)}{}$$

$$R^2 = 0.92 \qquad\qquad D.W. = 1.51 \qquad\qquad N = 21\ (1957\text{-}77)$$

where INFANTM   =   infant mortality rate for both sexes defined as the proba-
                    bility of dying from birth to age one (q_0) (x 1,000)
       LABI   =   total number of employed persons in full-time equivalent in
                    thousands (standard is 40 hours a week)
       LABS   =   total labor force (in thousand persons)
       PRFOOD   =   real food price defined as the food price index relative to
                    the consumer price index (x 100)
       CEXP   =   private consumption expenditures (in millions at 1972
                    prices)
       POP   =   total population (in thousands)
       HCAP   =   cumulated government health expenditures (in million
                    pesos at 1972 prices)
       t   =   time subscript

The equation suggests that INFANTM_t is positively associated with real food price, PRFOOD_t. On the other hand, it is negatively associated with the employment rate, $\text{LABI}_t/\text{LABS}_t$, the lagged consumption per capita, $\text{CEXP}_{t-1}/\text{POP}_{t-1}$, and the cumulated government health expenditures per person, $\text{HCAP}_t/\text{POP}_t$. The reason for cumulating the government health expenditures over time is that a substantial portion of such expenditures is usually accounted for by capital expenditures which tend to have long term effects on the health of the population. Such expenditures include expenditures for immunization and control of communicable diseases, the latter through environmental sanitation and health educa-

Table 2. Estimation of infant mortality probabilities. (q_0) Philippines. 1950-1977

Year	Unadjusted IMR[a]	Assumed Correct q_0	Correction Factor	Estimated q_0
1950	101.6	160.0[b]	1.57480	160.0
1951	105.6	–	1.57190	166.0
1952	101.6	–	1.56901	159.4
1953	105.3	–	1.56611	164.9
1954	94.2	–	1.56321	147.3
1955	84.3	–	1.56031	131.5
1956	83.9	–	1.55742	130.7
1957	93.0	–	1.55452	144.6
1958	80.0	–	1.55162	124.1
1959	72.4	–	1.54873	112.1
1960	73.1	113.0[c]	1.54583	113.0
1961	72.4	–	1.54807	112.1
1962	67.7	–	1.55031	104.9
1963	66.6	–	1.55256	103.4
1964	61.5	–	1.55481	95.6
1965	68.5	–	1.55706	106.7
1966	65.8	–	1.55931	102.6
1967	65.2	–	1.56155	101.8
1968	65.5	–	1.56380	102.4
1969	64.1	–	1.56604	100.4
1970	59.3	93.0[c]	1.56829	93.0
1971	62.0	–	1.53981	95.5
1972	67.9	–	1.51133	102.6
1973	64.7	–	1.48285	95.9
1974	58.7	–	1.45437	85.4
1975	53.3	76.0[c]	1.42589	76.0
1976	56.9	–	1.39741	79.5
1977	56.8	–	1.36893	77.8

[a]IMR estimated from vital registration and census data as reported in *Philippine Health Statistics, 1977*, Disease Intelligence Center, Ministry of Health, Manila, 1981.
[b]Arbitrarily set at this level representing a level slightly higher than that implied by the difference between unadjusted and "correct" values for 1960.
[c]Estimates of q_0 from Flieger, *et al.* (1981).

tion programs. The above regression results suggest that the uneven progress towards mortality reduction from the early postwar period up to 1975 is directly related to the uneven performance of the Philippine economy as well as to the uneven capacity of the public health sector in maintaining health standards.

But what can we say about mortality trends after 1975, the critical period based on our interest in analyzing the implications of current economic performance on demographic trends? The NEDA (1984) estimates for 1983 are not useful because they are based on *assumed* trends, the very trends we wish to deter-

mine with reasonable accuracy in the first place.* To determine recent trends in the absence of hard data, we tried to examine the data on infant mortality rate (IMR) reported by the Disease Intelligence Center of the Ministry of Trade. Unfortunately, the latest data available do not go much beyond 1975.

Another piece of information regarding more recent mortality trends comes from the study on the covariates of child mortality in the Philippines based on the 1978 Republic of the Philippines Fertility Survey (RPFS) conducted by Martin, *et al.* (1983). The results of the analysis based on the application of proportional hazards model suggests that the risk of childhood mortality has failed to decline significantly during the period 1970-1978 relative to that of the earlier period 1950-1969. This result, however, runs counter to our earlier information that as far as 1970-1975 period is concerned, the infant mortality probability actually declined at a faster rate than during the 1960s.

To obtain another indication of mortality trends in the 1970s, we examined the test run projection from the economic-demographic model constructed by Paqueo, Herrin and Associates, (1984). In this projection both fertility and infant mortality were endogenously determined by the macroeconomic variables as observed during the period 1960 to 1980, using 1960 as the base year. The resulting projections for INFANTM are as follows:

Year	Projected INFANTM	Actual INFANTM
1960	--	113.0
1961	109.2	--
1970	95.2	93.0
1975	82.9	76.0
1977	78.2	--
1980	59.2	--

The results show a drop in projected infant mortality averaging 1.56 deaths per 1,000 annually between 1961 and 1970, 2.46 deaths per 1,000 annually between 1970 and 1975, and 4.74 deaths per 1,000 annually between 1975 and 1980. It would appear that the accelerating mortality decline during the 1970-1975 period was more than sustained during the latter half of the decade. The sharpest decline occurred after 1977: from 78.2 in 1977 to 59.2 in 1980. If the improvements in infant mortality achieved in 1975-80 were indeed larger than in 1970-75,′ then these improvements should be reflected in a corresponding faster increase in life expectancy in 1975-80 than in 1970-75, unless mortality improvements in childhood and older ages have not kept pace. The more rapid decline in projected INFANTM

*The NEDA's estimate of life expectancy for 1983 appears to be based on the NCSO's projection (moderate series) which simply assumed that the trend observed in 1970-75 will continue up to 2010, and will moderate thereafter up to 2030 (NCSO, 1983). The NCSO, however, used a slightly lower estimate of life expectancy for females in 1975 so that the combined life expectancy for both sexes for 1975 is one year lower than Flieger, *et al.*'s (1981) estimate shown in Table 1.

during the 1975-1980 period can be explained by the faster growth of per capita real personal consumption expenditures and of per capita real health expenditures during that period. During the 1975-1980 period, the average annual growth of real per capita personal consumption expenditures rose to 2.3 percent, up from 1.6 percent in the 1970-1975 period, while the average annual increments in real health expenditures rose by 9.95 pesos per capita during the 1975-1979 period, up from 6.65 pesos per capita during the preceding period. The average annual increments in LABI/LABS, however, remained practically the same in 1970-1979 period as in the 1970-1975 period, the change being 0.010 and 0.014, respectively.

While mortality declines accelerated in the 1970s, at least in the first half of the decade, we expect that such declines would have decelerated in the early 1980s if the relationships shown in Eq. (2) still holds, in view of the declining growth in real per capita consumption expenditures, increasing unemployment and under-employment, increasing real price of food, and declining increments in real per capita public health expenditures in this period. To what extent mortality decline actually decelerated cannot be determined accurately at present in view of the absence of recent mortality data. Mortality data obtained from the 1983 NDS should shed light on this when they become available.

In summary, the pattern of mortality decline in the postwar period correlated closely with the pattern of economic performance and public investments in health. While hard data on mortality in the more recent period is not available, it is probable that in the early 1980's the rate of mortality decline has decelerated relative to that of the 1970s in view of the deteriorating trends in the macro variables during this period.

Fertility Trends

While fertility data have normally been more available than mortality data, we likewise found it difficult to get up-to-date fertility data that might shed light as to trends during the most recent period. The latest source of information, the 1983 National Demographic Survey, has yet to produce firm estimates of total fertility rates, for example. With this limitation in mind, we present below the trends in fertility and their determinants.

Table 3 presents selected fertility estimates from various sources. The most reasonable estimates from 1960 on are reproduced together with average annual changes.

Year	Levels			Average Annual Change per 1,000			Average Annual Real per Capita GNP Growth (%)
	CBR	TFR	TMFR	CBR	TFR	TMFR	
1960	46.0	6.5	9.6	–	–	–	–
1970	39.2	6.3	9.6	0.68	0.02	0.0	2.1
1975	34.8	5.2	8.8	0.88	0.22	0.16	3.6
1982	33.6		7.8	0.15		0.14	2.6

Table 3 Selected fertility estimates: Philippines

Source	Year	Crude Birth Rate (CBR)	Total Fertility Rate (TFR)	Total Marital Fertility Rate (TMFR)
Smith[a]	1905	50 or over		
Madigan-Avancena[a]	1948-60	49.1		
Lorimer[a]	1948-49	48.0		
Chavez-Nazaret[a]	1950-55	48.6		
	1955-60	46.5		
UPP[a]	1960	46.0[b]	6.5[c]	9.6[c]
UPP[a]	1965	44.5[b]	6.3[c]	9.6[c]
UPP[a]	1970	39.2[b]	6.3[c]	9.6[c]
UPP[a]	1975	34.8[b]	5.2[c]	8.8[c]
NEDA[d]	1982	33.6		
NEDA[e]	1982		4.2	
UPP[a]	1983			7.8[f]

Sources:
[a]See Cabigon, J. (1980) for sources and methods.
[b]Conception, M.B. (1964)
[c]Cabigon, J. in Concepcion, M.B. (1983).
[d]NEDA (1984)
[e]NEDA (1983)
[f]UPPI (1984).

Long term trends in the crude birth rates reveal a pattern of slow decline from the turn of the century to 1960, a moderate drop the period 1960-1970 averaging 0.68 births per 1,000 annually, and a slightly faster decline during the 1970-1975 period averaging 0.88 births per 1,000 annually. In the most recent period 1975-1982, the decline in crude birth rates appeared to have decelerated sharply to only 0.15 births per 1,000 annually.

With respect to the other fertility measures, the total fertility rate (TFR) and total marital fertility rate (TMFR), remained practically at the same level from 1960 to 1970. Both fertility measures declined in the 1970-1975 period. Unfortunately, no hard data on these measures are available for the more recent period. The 1982 TFR figure from NEDA (1984) was estimated based on assumed trends, while the TMFR for the same year was estimated from a 25 percent subsample of the 1983 National Demographic Survey (NDS) and is a single-year estimate not directly comparable to estimates for previous years. The estimates for previous years are based on five-year averages centered on the year of reference. If, however, the 1983 NDS estimate of TMFR is close to the true value, then it would appear that marital fertility decline has not accelerated between 1975 and 1982. In fact, it may have decelerated somewhat, or at best it merely maintained the rate of decline observed during the 1970-1975 period.

What might be the factors affecting the fertility trends since 1970? Among the proximate determinants of fertility, the most important are changes in marriage patterns and changes in marital fertility, the latter mainly due to contraception. Singulate mean age at marriage have reached 22.8 years in 1970 and 23.2 years in 1975 which are relatively high by Asian standards. Given the relatively high age at marriage already achieved by 1970, it would appear that the relative contribution of nuptiality change to the overall fertility decline in the subsequent periods will become less and less important. A decomposition analysis of changes in crude birth rates from 1960 to 1975 conducted by Concepcion (1980) revealed that nuptiality patterns no longer contributed to crude birth rate decline in the 1970-1975 period as it did in the 1960s. In view of this we expect that subsequent fertility declines would be mainly due to the changes in marital fertility. The relatively rapid decline in fertility from 1970-1975, therefore, must have come almost exclusively from marital fertility change due to increased use of contraception. By extension, the slowing down of fertility decline since 1975, in terms of the crude birth rate, may be attributed mainly to the slowing down of marital fertility decline.

More recently, it has been possible to examine the macro determinants of marital fertility based on constructed time series data. Previously, quantitative studies on the determinants of fertility were either cross-section studies of international data at the macro level or cross-section analysis of survey data at the micro level. In a recent work, Paqueo, Herrin and Associates (1984) constructed time series fertility measure using vital registration and census data. The fertility measure used is the marital general fertility rate, MGFR, defined as the number of births per 1,000 currently married women. This measure was estimated for each year for the period 1948 to 1977 through the following relation:*

$$(3) \quad MGFR_t = 1000 \left[CBR_t \left(\frac{CBR_t^*}{CBR_t} \right) P_t \right] \div \left[\left(\frac{CMW}{P_t} \right) P_t \right] = 1000 \left(\frac{B_t}{CMW_t} \right)$$

where CBR_t = crude birth rate per person estimated from vital registration and census data.

$\left(\dfrac{CBR_t^*}{CBR_t} \right)$ = correction factor for underregistration, where CBR_t^* is an estimate of the true crude birth rate from independent sources.

P_t = estimated population

$\left(\dfrac{CMW_t}{P_t} \right)$ = estimated ratio of currently married women age 15-49 years.

B_t = total number of births.

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*More recent estimates of CBR such as those shown in Table 3 were not yet available when this series was being constructed. The resulting MGFR series, therefore, tends to overstate fertility declines during the 1970s.

The raw data and resulting estimates of MGFR are shown in Table 4.

Given the time series data on MGFR, we then regressed these against selected macro socioeconomic variables. The resulting equation is as follows:

$$(4) \quad \ell n\ MGFR_t = 6.476 + 0.9285\ WAGE_t - 0.0121\ WAGE_t * EDUCP_t$$
$$ (2.69) (-2.67)$$

$$- 2.5680\ \frac{GNP_t}{POP_t} + 0.0266\ \frac{GNP_t}{POP_t} * EDUCP_t$$
$$(-2.64) \phantom{\frac{GNP_t}{POP_t}}$$

$$+ 0.001\ FINFANTM_t * EDUCP_t - 0.0126\ PRFOOD_t - 0.0550\ TDUM$$
$$(2.00) (-2.83) (-1.33)$$

$$\overline{R}^2 = 0.938 \qquad D.W. = 2.03 \qquad N = 21\ (1957\text{-}1977)$$

where MGFR   = marital general fertility rate (number of live births per thousand currently married women)

WAGE   = real wage (in pesos at 1972 prices)

EDUCP   = percent of adult population age 25 years and over with less than high school educational attainment

GNP   = gross national product (in million pesos at 1972 prices)

FINFANTM = five-year moving average of infant mortality rate (q_0) per 1,000 births

TDUM   = dummy variable: 1 for observations after 1969; zero otherwise

PRFOOD   = real price of food as defined earlier

POP   = total population in thousands

Table 4. Estimation of Marital General Fertility Rate (MGFR): Philippines, 1948-1977

Year	Unadjusted Crude Birth Rate[a]	Assumed Correct Crude Birth Rate[b]	Correction Factor[c]	Adjusted Crude Birth Rate	Estimated Population (x 1000)	Estimated Proportion of Currently Married Women	Estimated MGFR[f]
1948	31.3	48.0	1.53355	48.0	19234[d]	.13950[e]	344.1
1949	31.2	–	1.53846	48.0	19889	.13961	343.8
1950	32.3		1.57284	50.8	20543	.13972	363.6
1951	31.4	–	1.60722	50.5	21198	.13983	361.2
1952	31.4		1.64161	51.5	21852	.13994	368.0
1953	22.3		1.67599	37.4(48.6)[g]	22506	.14005	347.0
1954	30.7	–	1.71037	52.5	23160	.14016	374.6
1955	31.2		1.74475	54.4	23815	.14027	387.8
1956	22.3		1.77914	39.7(45.0)[h]	24470	.14038	320.6
1957	26.5		1.81352	37.2(46.0)[i]	25124	.14048	327.4
1958	18.9	–	1.84790	34.9(46.5)[g]	25770	.14069	330.7

Table 4 (Continued)

Year	Unadjusted Crude Birth Rate[a]	Assumed Correct Crude Birth Rate[b]	Correction Factor[c]	Adjusted Crude Birth Rate	Estimated Population (x 1000)	Estimated Proportion of Currently Married Women	Estimated MGFR[f]
1959	23.2	–	1.88229	43.7	26433	.14071	310.6
1960	24.0	46.0	1.91667	46.0	27088[d]	.14083[e]	326.6
1961	23.0	–	1.87652	43.2	28047	.13988	308.8
1962	26.7	–	1.83637	49.0	29007	.13893	352.7
1963	26.3	–	1.79622	47.2	29967	.13798	342.1
1964	26.0	–	1.75607	45.7	30926	.13703	333.5
1965	25.0	–	1.71591	42.9	31886	.13608	315.2
1966	25.2	–	1.67576	42.2	32846	.13513	312.2
1967	24.9	–	1.63561	40.7	33805	.13418	303.3
1968	25.9	–	1.59546	41.3	34765	.13323	310.0
1969	26.5	–	1.55531	41.2	35725	.13228	311.4
1970	26.4	39.2	1.48484	39.2	36684[d]	.13138[e]	298.4
1971	25.5	–	1.42705	36.4	37762	.13202	275.6
1972	25.9	–	1.36925	35.5	38839	.13267	267.3
1973	26.3	–	1.31146	34.5	39916	.13332	258.7
1974	26.3	–	1.25367	33.0	40993	.13397	246.1
1975	29.1	34.8	1.19588	34.8	42071[d]	.13461[e]	258.5
1976	30.4	–	1.13808	34.6	43276	.13526	255.8
1977	29.9	–	1.08029	32.3	44482	.13590	237.7

[a]NEDA and NCSO, *Philippine Yearbook*, 1979.

[b]Rates for 1948 and 1960 are based on Lorimer (1966) while rates for 1970 and 1977 are from Concepcion (1980).

[c]Correction factors for intermediate years were obtained by linear interpolation of two benchmark years.

[d]Actual census population; intermediate values were obtained by applying average intercensal growth rates.

[e]Actual proportion in census years; intermediate values were obtained by linear interpolation of two benchmark years.

$$^f MGFR = \frac{\text{Adjusted Crude Birth Rate x Estimated Population}}{\text{Estimated Population x Estimated Proportion Currently Married}}$$

[g]Based on Nazaret-Chaves (1963) estimates for 1950-55 and 1955-60, respectively, cited in Cabigon (1980).

[h]Based on estimate by Morison (1957), cited in Cabigon (1980).

[i]Assumed rate consistent with adjacent rates.

The regression analysis shows that on the whole, i.e. taking interaction terms into account, the marginal effect on marital fertility of GNP/POP is negative, consistent with the usual demographic transition hypothesis, while that of WAGE is positive, consistent with Encarnación's (1975) threshold hypothesis. The marginal effect of real food price, PRFOOD, is negative, while that of infant mortality is positive but small and declining with increasing education. Both effects are as expected.

The fertility trends since 1970 can be understood in terms of the above relationships. The more rapid increase in real per capita GNP in the 1970-1975 period is expected to reduce fertility in this period much more significantly than the relatively slower increase in real per capita GNP in the subsequent period 1975-1982. The effect of the decline in real wage and the increase in real food price over both periods would have reinforcing effects on fertility decline. If the decline in real wage rates and the increase in real food prices were larger in the more recent period than in the 1970-1975, as is more likely, then their dampening effect on marital fertility will tend to be felt more in the recent period than in the former. They would, therefore, have the effect of partially offsetting the weakened downward effect of per capita GNP on marital fertility. The net effect, however, may still be a slower rate of fertility decline in view of the stronger effect of GNP/POP on MGFR.

The apparent failure to sustain fertility declines in the more recent period is not only due to the effect of broad macroeconomic trends, but perhaps also by the failure of direct interventions to have significant independent impact on fertility change. This conjecture is supported by the regression results above if we take the dummy variable to represent other factors including the effects of family planning activities. The effect of TDUM while negative is not statistically significant at the usual levels of significance. What this implies is that, not only were the macroeconomic factors unable to sustain and accelerate fertility declines since 1975, family planning activities, in addition, apparently did not succeed in countervailing or offsetting the unfavorable macroeconomic effects on fertility declines. The result then is slower fertility decline since 1975. Data on contraceptive prevalence provide further light on the potential effect of the family planning program.

Data on contraceptive prevalence rates shown in Table 5 do indicate that while substantial increases were observed from 1968 to 1973 and from 1973 to 1978, contraceptive prevalence rates appeared to have declined during the 1978-1983 period.* There are, of course, serious difficulties in comparing contraceptive prevalence data. For one there are possible response errors with respect to the less effective methods of contraception which could vary from survey to survey. Furthermore, survey data are subject to the usual sampling errors. In order to cor-

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*As defined in Table 4, the contraceptive prevalence rate is the percentage of currently married women age 15-44 years who are practicing any method of contraception of interview case.

rectly determine trends in contraceptive prevalence, we reexamined the data in
Table 5 by methods as follows, disregarding sampling errors for the moment:

	Rates			Change	
	1973	1978	1983	1973-78	1978-83
All Modern Program Methods Only	10.4	12.5	17.5	2.1	5.0
All Program Methods Only	18.4	25.3	28.3	6.9	3.0
All Methods (Assuming use of Non-Program Methods in 1978 is around 5.6)	24.4	30.8	33.4	6.4	2.6

If we assume that response errors with respect to modern methods are rela-
tively small, then one can see that progress has been made towards accelerating
their use in the most recent period, 1978-83. If the prevalence rates for condom
and rhythm are included, we see an increase in contraceptive prevalence over the
1978-1983 period; however, the rate of increase is much less than in the previous

Table 5. Estimates of contraceptive prevalence rates: Philippines, 1968-1983

Method	1968[a]	1973[a]	1978[b]	1983[b]
All Methods	15.5	24.4	37.1	33.4
Modern Program Methods	2.2	10.4	12.5	17.5
Pill	1.3	6.9	4.8	5.5
IUD	0.9	2.6	2.4	2.6
Litigation	*	0.9	4.7	8.9
Vasectomy	*		0.6	0.6
Other Program Methods	5.5	8.0	12.7	10.8
Rhythm	5.5	7.0	8.9	8.3
Condom	*	1.0	3.8	2.5
Non-Program Methods	7.8	6.0	11.8	5.1
Withdrawal	6.2	4.0	9.5	3.9
Abstinence		—	1.8	0.8
Others	1.6	2.0	0.5	0.4

Sources:
[a]See Herrin, A.N. and T. Pullum (1981).
[b]U.P. Population Institute (1984).

    *Cannot be determined from available data; less than 1 percent.
    **Users of two methods in combination were classified as users of one of the methods;
condoms took precedence over rhythm, which took precedence over withdrawal.

period: 3.0 vs. 6.9 percent. The trend for "All Methods" also shows an increase over the two periods, but the increase in the 1978-1983 period is again less than that observed for the previous period: 2.6 vs. 6.4 percent. Because the prevalence rate for non-program methods in 1978 is unusually high, suggesting serious response errors, we assume in the above comparison that the true rate would be in between the rates observed for 1973 and 1983, which would be around 5.6 percent.

On the basis of the above sets of comparisons in descending order of probable data reliability, it would appear that contraceptive prevalence rates have not declined from 1978 to 1983 as the data in Table 5 would suggest at first glance. Some gains appear to have been made especially for modern program methods. Overall, however, the gains over the last period, 1978-1983, are somewhat less than the gains in the previous period 1973-1978. Moreover, if the gains in the most recent period can be explained solely by sampling errors, then the best that could be said is that contraceptive prevalence rates had remained constant since 1973-1978. This is obviously a disturbing development, and this lack of progress in increasing prevalence rates is undoubtedly the major proximate factor for the lack of acceleraion in fertility declines in the most recent period.

This observation leads to the question regarding the impact of the nation's family planning program in increasing contraceptive use. Since 1976, the core activity of the program is the Outreach Project designed to expand family planning motivation activities and services to couples beyond the usual coverage of stationary clinics. In 1978 and 1980, Community Outreach Surveys (COS) were undertaken for the purpose of evaluating the Outreach Project. The findings from these surveys indicate that the Outreach Project has been functioning well in many ways. While important weakness were noted, they were thought to be those that could be dealt with through improvement of management and support services, Laing (1981). Moreover, based on a multivariate analysis of the 1980 COS data, Laing has shown that after controlling for socioeconomic characteristics and clinic-based activities, contraceptive prevalence rates are significantly higher in barangays where Outreach efforts have been more intensive. In another study, using 1978 and 1980 COS data, Herrin and Pullum (1981) found evidence of a substantial decline in the areas covered by the Outreach Project in family size preferences, measured by the percentage of currently-married, non-pregnant, fecund women who want no more children, and particularly women with three or more children. Moreover, they found that among women who want to stop childbearing, there was a dramatic increase in the use of more effective contraception.

These findings from the COS strongly suggest that the Outreach Project must have had an impact on contraceptive prevalence, at least in the covered areas. Such impact, however, is *not* reflected in overall contraceptive prevalence rates for 1978 and 1980 based on the COS data. The overall rate for 1978 was 48.1 percent, while for 1980, it was 45.5 percent. This decline may not be real as this might be due to possible response errors with respect to less effective methods; hence, a generous conclusion is that overall contraceptive prevalence rates have not change signi-

ficantly. The data examined by Herrin and Pullum (1981) likewise show no significant difference in overall prevalence rates between 1978 and 1980 COS among the sub-set of women studied. The rates were 68.6 percent in 1978 and 68.0 percent in 1980. What these imply, therefore, is that the impact of the Outreach Project has been mainly in facilitating the shift from the use among couples of less effective to more effective methods of contraception. This shift is revealed in the COS data on contraceptive prevalence rates summarized below.

	All Currently Married Women Age 15-44 Years*		Fecund, Non-Pregnant, Currently Married Women Age 15-49 Years Who Wanted No More Children**	
	1978	1980	1978	1980
Modern Program Methods	11.4	14.1	10.1	22.5
Others	36.7	31.4	58.5	45.5
All Methods	48.1	45.5	68.6	68.0

*Laing (1981).
**Herrin and Pullum (1981).

This shift from less effective to more effective methods of contraception is also reflected in the 1978 RPFS and 1983 NDS data after allowing for adjustment in the data for withdrawal and abstinence described earlier, as follows:

	1978 RPFS	1983 NDS
Modern Program Methods	12.5	17.5
Others	18.3	15.9
All Methods	30.8	33.4

Note that the rates obtained from the 1978 RPFS and 1983 NDS are based on surveys of the entire population while those from the COS are based on surveys of COS areas only.*

While the shift from less effective to more effective methods is indeed a welcome development from the standpoint of family planning program performance, the fact still remains that for fertility decline to accelerate, overall contraceptive prevalence must increase significantly, preferably the increase being due to modern methods. Shifting methods at still low levels of overall contraceptive prevalence rates, while this increases the overall use-effectiveness of methods, will obviously not be sufficient to accelerate fertility declines.

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*It might be pointed out that the COS data show higher rates of use of non-modern program methods compared to the RPFS or NDS data. It is not clear as yet whether use of non-modern program methods are really higher in COS areas compared to the nation as a whole, or that certain aspects of the COS surveys tend to produce responses that overstate the reported prevalence of non-modern program methods.

In summary, fertility trends during the postwar period has been seen to be closely associated with broad socioeconomic development, and since the 1970's, to the effects of public interventions to increase contraceptive prevalence rates and reduce fertility. The slowing down of fertility decline since 1975 may be attributed to the slowing down of socioeconomic change that tends to exert downward pressure in fertility as well as to the failure of public programs to have large and independent impact on fertility change.

Demographic Prospects and Economic Crisis: Short Run Perspective

In analyzing the demographic implications of the recent economic crisis, we begin with the following accepted facts: widespread unemployment/underemployment, drastic decline in GNP per capita (and, hence, consumption), substantial reduction in real wage in the face of extremely high inflation rates, soaring prices of food, drugs, and transportation, and shortage in medical supplies. Economic recovery is far from sight.

What are the probable immediate demographic effects of the difficulties and uncertainties that people are confronted with today? We examine the question first with reference to mortality and then to fertility decisions.

Mortality

The regression analysis described earlier indicates significant negative correlation between infant mortality and personal consumption per person, employment rate (in full-time equivalent units) and public health expenditures per capita. The real price of food, on the other hand, appears to be positively correlated with infant mortality. These results support the Malthusian view that during hard times one would expect mortality to rise. Hence, given the worsening in employment rate, real wage, consumption per person and the food price, the immediate probable effect of the economic crisis is to decelerate mortality declines if not increase mortality levels outright.

The regression analysis also suggests however, that the mortality effect of the current economic crisis can be attenuated by increased real public health expenditures per capita. Ironically, however, government is in an extremely difficult position to substantially raise its health expenditures per capita for various reasons, including the need to support distressed government or semi-government corporations and financial institutions as well as the heavy debt service burden. More importantly, real gross national product has drastically fallen.

The analysis above suggests the following: (a) there is an urgent need to strengthen the population program to soften the impact of the economic crisis on mortality, particularly among infants; (b) clearly, by the nature of the problem at hand, it should be carried out in conjunction with its maternal/child care program; (c) in order to dissipate whatever gains are accomplished through (a) and (b) above,

untimely pregnancies need to be prevented (voluntarily, of course) by providing family planning services in connection with the above measures.

The success of (c) above would obviously depend on couple's inclination to practice family planning. As we shall indicate below there is probably such an inclination as a result of the present crisis.

Fertility

The regression analysis of marital general fertility described earlier suggested the role of specific macroeconomic variables on fertility trends. With the current economic crisis, we would expect that the decline in real per capita GNP growth will tend to arrest the rapid fertility decline observed in the early 1970s. However, the combined effects of the declines in real wage rates and the increase in the real price of food, which work in the opposite direction, would tend to hasten such decline. On balance, however, the net effect of macroeconomic variables will probably tend to slow down fertility declines rather than to accelerate it.

The above analysis, however, does not take into account the role of drastic changes in expectations resulting from the economic crisis which could effectively shift the entire set of relationship towards reduced demand for children. In view of the lack of empirical information regarding the role of economic stress on fertility, our discussion below will be mainly speculative.

At the micro level, there are several possible reactions to the economic crisis among a large group of couples. First, one group of couples may view the current crisis as temporary. Their long term expectations of the future remains as before the crisis, and therefore, their long term fertility goals would likewise remain essentially the same. In the short term, however, their likely reaction from economic stress would be to postpone additional births in order to stretch out their limited resources to maintain current consumption standards. The implication of this scenario is that couples will increase their demand for effective contraceptive methods in the short run. The role of the family planning program in the short run, therefore, must be to help meet such prospective demand through the provision of better information and wider access to contraceptive supplies and services. However, because fertility may be expected to increase in the future once the economic crisis is over as couples begin to implement their long term fertility goals, there is a need to consider a long run strategy of motivating these couples to revise their expectations of the future that would lead to a decline in their long term demand for children. Such motivational efforts might involve provision of better information as to the likely medium and long term economic prospects.

Second, some couples may indeed respond to the economic crisis by revising entirely their long term expectation of economic security and, correspondingly, their long term fertility goals. For these couples, limitation of additional children will be both a short run and long run strategy. As a result, the need for sustained efforts to provide wider access to family planning information and services is imperative on the part of the population program.

Third, there may be a group of couples whose economic expectations and fertility goals would not be affected by the current economic crisis. This group may be further subdivided into two sub-groups. The first are the very poor who might feel that the recent crisis and eventual economic recovery will not substantially affect their current and future economic status, and therefore, they will pursue their usual long term strategy of having a large number of children to cope with their poverty situation. The second are the relatively well-off who can survive the crisis without limiting their family size in the short run. This second group, however, are most likely to have small family size norms anyway and, therefore, there is little need to worry about this group. It is the first group that is worrisome, because their strategy of continued high fertility in the context of declining household resources could lead to the unintended consequence of high infant/child mortality. For this group, a different motivational tact might be used to encourage fertility control in the short term to minimize mortality risks, and to encourage control in the long term as part of a new strategy based on revised expectations about the future.

In sum, the economic crisis is bound to affect couples in different ways, the majority of them most likely in terms of increased demand for fertility limitation. The implication is that the population program must be ready more than ever to effectively respond to such increased demand in the short term even as it continues to lay the groundwork for its longer term strategy of sustaining fertility reductions in the future.

Summary and Discussion

This paper reviewed Philippine fertility and mortality trends in relation to macroeconomic and social development and to the impact of public programs. Moreover, the paper examined the prospects for fertility and mortality change in the light of the recent economic crisis and suggested the needed short term policy response to such prospects.

Regression analysis based on constructed time series data indicates significant negative correlation between infant mortality and per capita consumption expenditures, employment rate, and per capita public health expenditures. The real price of food, on the other hand, is positively correlated with infant mortality. Given the worsening in employment rate, real wage, consumption per person and food price, the immediate probable effect of the current economic crisis is to decelerate long term mortality declines, if not increase mortality levels outright. In view of this potentiality, there is an urgent need to strengthen the population and health programs to soften the impact of the economic crisis on mortality, especially among infants.

In addition, regression analysis based on constructed time series data reveals that GNP per capita and real price of food are negatively correlated with marital general fertility rate, while real wage rate and infant mortality rate are positively

correlated. In view of the economic crisis, we may expect that the combined effect of all these macro variables will be to slow down the rapid fertility decline observed in the early 1970s. However, it is possible that drastic changes in household expectation of future economic security can arise from the crisis, leading to a greater desire by couples to postpone or altogether limit fertility at present. In such an eventuality, there is need to strengthen the capacity of the family planning programs in providing the necessary information and services to enable couples to effectively implement their fertility plans.

The need for short term policy responses to mitigate the adverse consequences of the economic crisis on mortality on the one hand, and to effectively meet the probable increase in household demand for fertility limitation on the other, is clear from the standpoint of short term welfare considerations of the households concerned. But what about the need for long term policy to modify demographic trends as part of overall efforts to achieve the nation's development goals? Because good health and long life are valued in themselves, there is clear cut commitment to policies and programs to improve health and reduce mortality. This is not often the case for fertility reduction. In the past few years, we detect a certain ambivalence among policy makers and planners regarding the need for population planning in general, and fertility reduction in particular. This ambivalence is inferred from the fact the last three Development Plans did not explicitly include a strategy for achieving fertility goals. Conspicuously absent from these Plans is a chapter detailing the objectives and strategies of the nation's family planning program, a chapter that has been so prominent in previous plans. Yet pronouncements by individual policy makers and program managers are not lacking in their emphasis of the need to support a population program that includes fertility reduction as an intermediate goal, and family planning as a major instrument.

Needless to say a renewal and strengthening of commitment to population planning in general, and fertility reduction in particular, depends upon a greater understanding by policy makers and others concerned of critical population and development interrelationships. It is beyond the scope of this paper to examine all these interrelationships here. However, it may be useful to review more recent information on this matter. In a recent study, Herrin and Paqueo (1985) examined in detail the dynamic interplay between economic and demographic factors related to the problem of providing productive employment to the growing labor force. They noted that the inability of the economy to sustain employment expansion at rising real wage rates can be traced to rapid population growth, deterioration in total factor productivity (i.e. growing inefficiency of the economy), unnecessarily high capital intensity of production, and external shocks. Especially significant is the growing inefficiency of the economy resulting from public economic policies especially in the more recent period. There is so much economic growth that could have been achieved from the same amount of resources had the economy been more efficient, and such extra growth from efficiency alone could have significantly raised the economy's labor absorptive capacity with rising real wage rates. In view

of the past performance what are the prospects for the future? The study suggested that in the best cases scenario where a change in the structure of incentives and penalty in both the economic and political spheres can be effected in the short term to arrest and later reverse the growing inefficiency that characterized the Philippine economy especially in the recent past, the impact of this change on full employment with rising incomes is most likely to be felt only in the medium or long run. This is so in view of the accumulated unemployed and underemployed, and of the continued growth of population and labor supply. This time frame may not be acceptable in view of society's desire to raise levels of living and improve the quality of life as quickly as possible. In the light of this, reducing the growth of labor supply through fertility reduction is obviously a crucial part of any solution to the employment problem in the context of contemporary Philippine situation. The urgency of such an effort can not be overemphasized in view of the time lag in which fertility reduction eventually translates itself into reduced growth of labor supply. Moreover, the role of moderating labor supply becomes more critical if economic performance can not be significantly improved quickly.

The study also described more concretely the impact of economic trends on household incomes and the need for fertility control. They did this by simulating the growth of the economy and population up to the year 2000 using the quantitative economic-demographic model of the Philippines constructed by Paqueo, Herrin and Associates (1984). Their preliminary analysis suggested that even in the best of macroeconomic circumstances, the prospect for the next 15-20 years is one wherein household incomes can not be expected to increase substantially. Under this situation, it is argued that it would be to the advantages of families to have fewer children in view of the difficulties and uncertainties that lie ahead. Having fewer children should give them some elbow room to meet possible stagnation in family incomes as well as future shocks arising from unwise economic policies and external circumstances such as those that led to the recent economic crisis. Under this situation, efforts to motivate couples to modify their long term fertility goals is necessary. Such efforts, however, should be made in conjunction with the broader socioeconomic efforts and self-reliance programs that assist households to increase their capacity to effectively cope with their current and possible future adverse income situation. In this broader context, fertility limitation must be seen as part of the short run survival strategy and a long run imperative.

In sum, the review of demographic trends in the light of the recent economic crisis has led us to reflect on the following, which policy makers and planners might do well to consider:

(1)   The capacity of the economy to effectively accommodate a growing population at higher standards of living can be severely reduced by the effects of poorly conceived and badly implemented economic policies as well as by various unforeseen external shocks; as a consequence, any long run strategy to improve and maintain such capacity given the current and prospective Philippine situation must now necessarily

include the moderation of population growth through fertility reduction. The economy's capacity to respond and recover from economic shocks may be greater if population pressure is lighter than if population pressure is heavier. In the former case, the policy maker can have greater flexibility in trying out alternative policies and strategies, a feature not easily obtained under intense population pressure.

(2) Public programs to encourage fertility control in the short run to help couples cope with hard times can lay the groundwork for sustaining fertility decline in the long term by encouraging couples now to adapt their fertility decisions to a revised set of expectations regarding economic conditions in the future.

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Corazon M. Raymundo, Discussant

Dr. Herrin addressed a very timely although sensitive issues with comprehensiveness, depth, scientific rigor and candidness. The economic crisis will remain to be a great challenge to the course of development in this country long after its initial effects are felt. The short- and long-term effects are expected to be significant and to touch every aspect of the so-called total development that remains to be the ultimate goal of development planning in the country.

As a response to the challenges posed by the recent crisis, the whole government machinery was set to motion and allowed to re-think its priorities, strategies and targets in the light of the setbacks brought about by the crisis and series of natural calamities. The present paper is along the same line of thinking and does its share in suggesting possible ways of adjusting/modifying present strategies/programs to meet the new challenges.

One difficulty in the recent re-planning is the paucity of data to show the nature and extent of the effects of the crisis. Herrin addressed this in his paper by giving the probable responses of different segments of the population to fertility regulation and therefore the implications to present strategies of the program.

Although Herrin's paper is more advanced than what was available during the updating of the Development Plan in the state of information on trends, it is not completely spared from this difficulty. The exercise on the future course of fertility in this country has largely remained conjectural in the present exposition because of the absence of more definitive figures for the recent past. Our more recent exploration of the 1983 NDS data gives us a good number of indications that fertility may not only have decelerated in its rate of decline but might have experienced an upturn between 1978-1982. This is not all surprising in view of the evidences presented by Herrin himself. In addition, census figures as early as 1975 have been providing some warning signals in the form of declining proportion remaining single even at older ages and the most recent evidence of a declining age at marriage provided by the 1980 figure. Likewise, in spite of our modest gain in the acceptance of modern methods, it remains that the overall contraceptive prevalence rate is on the decline. The behavior of the population on the more proximate determinants of fertility together with the adverse influences of macroeconomic factors like GNP per capita, food prices, etc. have worked hand in hand against the attainment of the goals of our national population program.

These should be regarded as signals for the forthcoming preparation for the integration plan for population, health and nutritional development of this country. Our consolation in the face of difficulty is the advancements being made by the scientific community in the knowledge critically required in the planning process.