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Economic Crisis, Structural Adjustment, and Health in Africa

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Has the economic crisis of the 1980s in Sub-Saharan Africa increased mortality or at least reduced its rate of decline? Nationally, no. But the urban poor suffered more, the rural nonpoor less.

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This paper — a product of the Population, Health, and Nutrition Division, Population and Human Resources Department — is part of a larger study undertaken by PRE of African health policy. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Otilia Nadora, room S6-065, extension 31091 (73 pages).

Diop, Hill, and Sirageldin applied two types of analysis to two types of data to try to quantify any short-term effect economic crisis and adjustment might have had on child mortality in Sub-Saharan Africa.

First they analyzed aggregate data for ten countries covered by the Demographic and Health Surveys project. Then they analyzed an elaborate data set for Cote d'Ivoire collected in the mid-1980s. Both analyses used time-period dummy variables to identify the effects of crisis and adjustment. Despite very different methodologies and data sets, the two analyses produced surprisingly similar results.

They found that in the short run, neither crisis nor adjustment increased child mortality at the national level, relative to countries not undergoing adjustment (but not necessarily avoiding crisis).

Because of economic decline and adjustment policies, real income declined in urban areas. But rural incomes among producers of cash crops may not have been negatively affected, because the agricultural policy components of structural adjustment have been relatively protective of agricultural incomes.

The effect of structural adjustment on the health sector in Côte d'Ivoire is unclear. The structure of public health spending in 1985 suggests that the emphasis on curative care, based disproportionately in Abidjan hospital centers, has not shifted. And immunization coverage showed no signs of improvement between 1980 and 1984. As subsidies to urban consumers have been curtailed and real urban income has declined, child health in the urban areas has deteriorated, particularly in the postneonatal period. This deterioration has disproportionately affected families in the top 40 percent of urban income distribution — mostly civil servants.

The LSMS data suggest that families with no savings have been severely affected by these changes in child health. In the rural areas, child health has not been significantly affected by the economic crisis or adjustment policies. This finding is consistent with the notion that when families are insulated from (or marginally affected by) public services and subsidies, they will also be insulated from changes in these services and subsidies during adjustment.

It would be surprising if economic crisis and adjustment, both of which imply falling real wages for some components of society, had no effect on child mortality. But countries of Sub-Saharan Africa have not yet reached the levels of development and industrialization that now-developed countries had reached when the link between their economic and health indicators weakened.

Diop, Hill, and Sirageldin found no across-the-board increase in mortality. Rather, they found a change in relative levels among groups that favors the rural nonpoor at the expense of the urban middle-income and the urban poor, with little net effect at the national level.

Of course, child survival interventions expanded greatly in the 1980s, and would have had their greatest impact in rural, poorly served areas. How much the effect of crisis and adjustment has been cancelled out by immunizations and oral rehydration therapy it is impossible to tell.

Diop, Hill, and Sirageldin examined only short-term effects — the only ones they could expect to measure. The long-run effects of crisis and adjustment will depend on adjustment's success in boosting sustained long-term growth. Such growth should reduce child mortality and speed the reduction of fertility as well, thus reinforcing declines in child mortality.

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ECONOMIC CRISIS, STRUCTURAL ADJUSTMENT, AND HEALTH IN AFRICA

Francois Diop, Kenneth Hill, and Ismail Sirageldin

The relation between economic change and health have long been of interest to social and medical scientists. Empirical study has generally focused on mortality -- or its complement, survival, expressed as life expectancy at birth -- because of the serious problems of definitions in collecting sound morbidity data. Although a long-run general relation between economic and health conditions is evident in both longitudinal and cross-sectional analysis, debate has centered on the relative importance to mortality reduction of income gains and of improvements in public health or medical technology. In a series of cross-sectional comparisons, Preston (1975, 1985) showed that the cross-national relation between life expectancy at birth and per capita income changed substantially between the 1930s and the 1960s, and again between that period and the 1970s. Most of the gains in life expectancy for a typical country appeared to result from the upward shift in the relation (that is a higher life expectancy for a given per capita income) rather than from a higher income. The persistently strong relation between per capita income and life expectancy, and the change in the relation over time, led Preston to conclude that "income has been a trivial factor in recent mortality trends [but] is still a critical determinant of mortality levels..." The short-run effects of economic fluctuations on mortality have also attracted considerable interest. Detecting such effects requires long time series of observations, but sufficently accurate time series are available for few developing countries. However, the development of reasonably accurate time series of numbers, vital events and simple economic indicators covering several centuries up to the nineteenth century, for a number

of European countries has opened up new opportunities for detecting short-run effects. In a recent review, Lee (1990) finds similarities in demographic responses to economic fluctuations between contemporary developing countries and historical observations for developed countries. With grain prices as the index of economic fluctuation, historical, detrended European series show a positive relation between mortality and prices, with the cumulative elasticities for non-infant mortality (over a five-year period) ranging from +0.05 to +0.6, concentrated on lags from zero to two years. Galloway (1988) shows that the mortality response is generally larger in poorer, more agricultural populations, and disappears in England in the nineteenth century. Hill (1989) finds a small positive mortality response to economic reverse in Chile, both in the 1970s and 1980s and in the 1930s, though with a lag of one to two years.

The historical record clearly shows that mortality rates do respond to short-term economic fluctuations, at least in poor and largely agricultural settings, and that mortality rates are strongly associated with the level of development. It would therefore not be surprising to find that the economic crisis of the 1980s in Sub-Saharan Africa has had the effect of increasing mortality, or at least of reducing its rate of decline. It is this question that this paper addresses.

ECONOMIC CRISIS AND STRUCTURAL ADJUSTMENT

Many Sub-Saharan African countries experienced major economic crises in the late 1970s and early 1980s, brought about by rising real interest rates, a rapid deterioration in the terms of trade, the continuation of over ambitious public investment programs often supported by external borrowing and distorted incentive

patterns that lead to reduced output of tradeable commodities. In response, the World Bank and the IMF proposed and supported adjustment policies aimed at speeding the return to sustainable growth. Two elements of adjustment have been distinguished (World Bank 1988): stabilization (reducing expenditures to the level of external resources in an orderly way) and structural adjustment (changing relative prices and institutions to be more flexible and more efficient).

Adjustment packages have varied widely, with each country's program determined by the ingredients of its crisis and its political realities. But a typical package includes policies to limit the growth of money supply, reduce the fiscal deficit, improve the balance of payments through a currency devaluation, reduce export taxes, remove import subsidies, and increase public sector efficiency through cost recovery and improved institutional management. After a short-term shakeout, the economy would then make the transition to higher, stable, and sustainable growth (World Bank 1988). Quick-disbursing loans tied to policy changes ease short-term balance of payments and other constraints.

CRISIS, ADJUSTMENT, AND HEALTH

Before turning to an examination of data, it is useful to examine the effects that a typical adjustment program might be expected to have on health. A convenient framework for examining such effects is the Mosley-Chen (1984) model of child health, in which socioeconomic factors operate through four categories of proximate determinants to affect health. If the proximate determinants are fully specified, changes in health can occur only through changes in the

proximate determinants, changes that are in turn driven (though not necessarily in the same directions) by changes in socioeconomic conditions. By identifying the changes likely to occur in proximate determinants as a result of adjustment policies, we can derive hypotheses about how such policies will affect health, particularly differences in health among groups in a society.

The Mosley-Chen model identifies four categories of proximate factors that determine underlying child health status: maternal factors (age, parity, prior birth interval, subsequent birth interval); environmental contamination (waterborne, airborne, food-borne, and insect-borne infectious or parasitic agents); nutrient deficiency (intake of carbohydrates, proteins, vitamins, and trace elements); and personal injury. A fifth category of factors, personal illness controls, both preventive and curative, determine the relation between underlying health status and actual health status. Post-childhood health status is determined by all the same categories of proximate factors but maternal factors (except for maternal mortality).

We now consider the likely effects of adjustment policies on each of these categories.

(a) Maternal factors. The historical studies and limited contemporary studies available suggest that an economic deterioration has an effect over two years or so of reducing fertility, followed by a less-than-compensating increase. For population subgroups adversely affected by adjustment (those facing higher food prices as a result of reduced or eliminated food subsidies, government employees sacrificed to efficiency, and subsistence producers facing higher prices for

nonfood items), numbers of birth and numbers of infant deaths should fall. For the same groups, the proportion of high-birth-order, high-parity, and short-birth-interval births should fall (with an appropriate lag, as a result of reduced fertility). And the proportion of first births, also a high-risk group, should fall as a result of postponed entry into union. So economic adversity should be associated with lower child mortality rates through this category of factors. This effect may be offset to an undetermined extent by worsened maternal nutrition, leading to higher proportion of low-birth-weight births and possibly of premature births. In the long term, economic adversity may postpone the adoption of voluntary limits to family size (either through postponing household level changes in the costs and benefits of children, or through reduced investment in national family planning programs), thus slowing long-term decline in child mortality. But such slowing would be impossible to quantify.

(b) Environmental contamination. In the absence of other changes, reduced government spending can be expected to slow the expansion of the provision of safe drinking water (through reduced investment), and to reduce the safety of piped water (through reduced recurrent expenditure on maintenance). The first might reduce the rate of decline of child mortality in the medium term, and the second might increase child mortality in the short run. Both effects will be stronger in urban than in rural areas, where piped water is rare. Similarly, reduced government expenditure will slow the provision of affordable housing and reduce maintenance levels of existing public housing, while cost recovery will increase rental payments. All three consequences will tend to increase crowding in urban areas, and such crowding will increase transmission rates for airborne infectious agents. Though public spraying programs to reduce insect transmission

have already become scarce, reduced government expenditure and increased unit costs will cut them still further; the biggest effect is likely to be felt in rural areas, where insect transmission rates are highest. Thus adjustment policies are likely to operate through environmental contamination factors to increase child mortality, particularly in marginal urban areas, through reduced public investment, reduced recurrent expenditure, and increased import costs.

(c) Nutrient deficiency. Reducing or eliminating food subsidies will increase food prices for all, but particularly for those relying heavily on subsidized foods. Subsistence producers will be relatively insulated from such price effects, and producers of agricultural tradeables will gain at least as much as they lose. The landless rural poor, dependent on wage labor, are likely to lose unambiguously, but this group is not large in Sub-Saharan Africa. Effects on the urban poor may be substantial, though some food substitution may occur, possibly offsetting losses in quantity with gains in quality (Behrman 1988); food price effects will reinforce the income effects of stabilization on those once employed in the public sector. Thus nutritional deficiency is likely to increase, especially in urban areas, among the old and new poor.

(d) Personal injury. Personal injury is likely to be little affected by adjustment programs. Because industrial activity and road traffic are below trend, some slight reduction in (mainly urban) injury might be expected, while accidents associated with food collection (falling out of coconut palms, for instance) might increase in rural areas. The net effects are likely to be small.

(e) Personal illness control. Reduced government expenditures are likely to reduce such public measures to prevent illness as immunizations. Some may switch

to private sources, but few households affected by lower real income and rural households with limited access to private services will be able to switch. Because urban households are more likely to suffer reduced real income than are rural households, adjustment should affect measures to prevent illness more in urban areas than in rural areas. This effect is likely to be reinforced by urban areas' higher use of and access to services. (But the effects of adjustment policies may be reversed by the emphasis in the 1980s on primary health care, which has a large prevention component and enjoys support from several large international donors.)

The effects of adjustment on curative services -- on availability of medical supplies, on expansion of services, on quality of care, on higher user fees, and on costs as a result of higher import prices -- are likely to have a negative effect on health. This effect will be most marked for those who, in earlier periods, used the services most intensively. The urban population -- perhaps most of all the urban middle class -- may thus be most affected.

HEALTH INDICATORS IN SUB-SAHARAN AFRICA

Sub-Saharan Africa is perhaps the worst region of the world in which to investigate complex and subtle relations between economic and demographic measures. No country in the region (except Mauritius) has a vital registration system complete enough to provide even a time series of numbers of vital events for numerator analysis, let alone a time series of demographic rates. Nor are there subpopulations for which time series of morbidity data, anthropometric information, or data on use of health services, exist. Even basic mortality indicators, reasonable proxies for health status, are weak (Hill and Hill 1988).

Our knowledge of adult mortality levels and patterns in the region comes from intercensal survival techniques, which have worked poorly in most applications, and from parental or spousal survival methods. Whether estimates from the survival methods are valid is still uncertain and, even if valid, they provide indicators for periods of decade or so before the survey date. Thus we have no data or techniques that allow us to measure recent levels of, or detect short-run fluctuations in, adult mortality.

The situation with child mortality is somewhat more satisfactory. Much of our knowledge of child mortality levels and trends in the region is derived from census and sample survey data about the survival of children, as reported by mothers. Information from aggregate questions on child survival (numbers born and numbers dead) provides robust indicators of child mortality and of broad trends over time, typically to a point some five years before the survey date. But these indicators smooth out short-term fluctuations. Because of this, and because the data provide little usable information about recent (last five years) child mortality, their value for examining links between child mortality and economic crisis or adjustment is limited.

The Demographic and Health Surveys (DHS) program conducted 10 surveys during 1986-89 in Sub-Saharan Africa using a maternity history data collection format. With this format, information is sought about the date of birth and, if applicable, the age at death of each child borne by each woman interviewed. Such data permit the calculation of period life tables for childhood, showing both the level and the age pattern of child mortality for specific periods before the survey. Serendipitously, half the countries surveyed have been in structural adjustment, and half have not.

There are two main problems with using the DHS survey data. The countries are only a small, and not necessarily representative, sample of all the countries of the region, accounting for less than 20 percent of the region's birth in 1985. The in-country samples are also small, with the numbers of reported births in the five years before the survey varying from about 3,500 to 7,500, with smaller numbers for earlier five-year periods. The small size of the sample limits the amount of disaggregation that is feasible. Despite these drawbacks, the DHS data provide the only period-specific measures of child mortality covering a substantial proportion of the 1980s.

CHILD MORTALITY TRENDS IN SUB-SAHARAN AFRICA IN THE 1980S

Hill and Pebley (1989) have suggested that the pace of decline in child mortality in the early 1980s was roughly similar to that in the 1960s and in the 1970s, showing nc clear pattern of a slowdown during the recession of the 1980s. The DHS data for Sub-Saharan Africa (SSA), not all available to Hill and Pebley, indicate a wide variation in experience among the countries of the region. Figure 1 shows the probabilities of dying by age one (the infant mortality rate) and by age five for the 10 SSA countries covered by the DHS. It also gives comparable measures from the earlier World Fertility Survey (WFS) program around 1980 for countries that had both surveys. Several countries show a rapid decline in child mortality throughout the period, with little difference between the late 1970s and the early 1980s (Mali, Liberia, Senegal). Others show apparently increasing child mortality in the late 1970s, followed by declines in the 1980s (Zimbabwe, Uganda, Burundi). A final group shows an apparent slowing of decline in the 1980s relative to the late 1970s (Botswana, Kenya, Ghana, Togo). The

first and second groups contain one adjuster each (Senegal and Burundi, respectively), and the third group contains three adjusters (Ghana, Kenya and Togo); the different patterns are thus not tied strictly to adjustment status. Adding the WFS observations does nothing to clarify the situation: only for Senegal do the WFS and DHS series come close to linking up; for Kenya, the DHS estimates appear below the WFS ones, and for Ghana, the WFS estimates are below the DHS one. The figure gives little support to the idea that the pace of decline in child mortality has changed in the recent past. But the figure does suggest a great deal of variation among countries in both levels and trends.

The trends can be examined more formally by regressing the child mortality estimates for the periods zero to four years and five to nine years before each DHS survey on the estimate for the period 10 to 14 years before the survey and on measures indicating the number of years included in 1980-84 and 1985-89 for each survey period. The regression coefficients on each time period dummy should thus indicate the mortality decline associated with those periods. Results are shown in table 1.

Table 1. Regression-Based Estimates of Child Mortality Decline in the 1980s for 10 Sub-Saharan African Countries with Demographic and Health Surveys

Child Mortality Measure ( )	Regression coefficients for Constant ( )	Base Value	1980-84 ( )	1985-89 ( )	R^2 ( )
$_5q_0$	74.2	0.706	-12.6	-12.1	0.905
	(2.5)	(10.6)	(-1.9)	(-2.6)	
$_1q_0$	42.3	0.664	-5.5	-5.9	0.853
	(2.3)	(8.2)	(-1.4)	(-2.1)	
$_4q_0$	45.2	0.693	-9.1	-8.1	0.927
	2.8	(12.5)	(-2.3)	(-2.9)	

Note: T values in parentheses.

The regression results indicate that both 1980-84 and 1985-89 are associated with lower child mortality, according to all three measures used -- the probability of dying by age five, the probability of dying by age one, and the probability of dying between ages one and five. But the declines associated with 1980-84 are similar in size to those associated with 1985-89, relative to the omitted period 1975-79. This suggests that little additional progress occurred between the early 1980s and the late 1980s. The results also suggest larger declines in mortality for children between the ages of one and five than for those in infancy -- perhaps evidence that child survival interventions expected to have their largest effects in post-infancy have been successful.

Child mortality appears to have continued to decline in the 1980s in Sub-Saharan Africa, though progress has been erratic and has varied widely among countries.

ADJUSTMENT STATUS AND ITS EFFECTS ON CHILD MORTALITY TRENDS AND DIFFERENCES IN TRENDS AMONG GROUPS

The earlier discussion suggested that the negative welfare effects of adjustment policies would be felt most keenly by the urban poor, and least -- if at all -- by the rural nonpoor. The effects of the economic crisis before adjustment are harder to predict. All population groups are likely to have suffered to some extent from a serious crisis, but certain subgroups, particularly in urban areas, are likely to have been effectively cushioned from the effects of crises caught in their earlier stages. Examining child mortality trends (taken as the only available proxy for overall health status) for different socioeconomic groups can provide insight into how the effects of both crisis and adjustment varied

among the groups.

The DHS program again provides the necessary data in the form of life table measures of child mortality for five-year periods before each survey and the socioeconomic characteristics of the mothers at the time of the survey, as indicated by the mothers' education (none, primary, secondary and higher) and place of residence (urban, rural). The basic approach is again to model the child mortality estimate for a period zero to four or five to nine years before the survey in terms of the corresponding estimate for the period 10 to 14 years before the survey, the number of years in the calendar period, 1980-84, and the number of years in the calendar period 1985-89. Two more variables are added in an attempt to capture crisis and adjustment effects: the number of years, up to a maximum of three, that a period included prior to effective adjustment (to capture crisis effects), and the number of years, up to a maximum of three, that a period included after effective adjustment (to capture adjustment effects). For this purpose, the date of effective adjustment has been taken as the beginning of the year in which real government expenditure began a sustained reduction in trend (Gallagher and Ogbu 1989; Table II.3).

Because the sample size is small for disaggregated data, analysis has been limited to the measure of child mortality that maximizes person-years of exposure -- that is the probability of dying by aged five, ${}_5q_0$. This measure is also the best available indicator of overall mortality in childhood. It has been modelled in two ways: as the actual level per 1,000 live births with the base level for the period 10 to 14 years before the survey included as an independent variable; and as the ratio of the actual level to the base level 10 to 14 years before the

survey, including only time period dummy variables as independent variables. The first version corresponds approximately to modelling absolute declines in child mortality and the second to modelling relative declines in child mortality. Models have been estimated for all births, and for births to women living in urban areas, living in rural areas, with no education, with primary education, with secondary or higher education, living in urban areas and with no education (the urban poor), and living in rural areas and with no education (the rural poor). Results of the regression equations are shown in table 2.

Table 2. Regression Coefficients for Probability of Dying by Age Five on Time Period Dummy Variables and Socioeconomic Categories for 10 Countries of Sub-Saharan Africa

Absolute Decline Model

Socioeconomic category	Regression coefficients for						R^2
	Constant	Base value	1980-84	1985-89	Pre-Adjustment	Post-Adjustment	
Total	68.9	0.713	-9.5	-10.9	-3.8	-3.8	0.92
	(2.2)	(10.5)	(-1.3)	(-2.0)	(-0.4)	(-0.4)	
Urban	36.8	0.729	-0.5	-4.0	-10.9	9.3	0.77
	(0.9)	(6.1)	(-0.1)	(-0.6)	(-0.9)	(0.8)	
Rural	90.3	0.675	-13.2	-13.9	-5.4	-4.1	0.92
	(2.8)	(10.9)	(-1.7)	(-2.4)	(-0.5)	(-0.4)	
No education	81.2	0.669	-7.5	-12.9	-7.0	-3.0	0.88
	(2.2)	(8.2)	(-0.9)	(-2.0)	(-0.6)	(-0.3)	
Primary education	76.5	0.684	-11.0	-9.8	-6.0	1.3	0.82
	(2.1)	(6.8)	(-1.3)	(-1.5)	(-0.5)	(0.1)	
Secondary + educ	48.6	0.718	-4.9	-3.0	1.5	-1.4	0.48
	(1.4)	(3.2)	(-0.5)	(-0.4)	(0.1)	(0.1)	
Rural, no educ	100.8	0.643	-11.1	-15.5	-9.5	-2.6	0.89
	(2.7)	(8.7)	(-1.3)	(-2.3)	(-0.8)	(-0.2)	
Urban, no educ	27.0	0.727	3.3	-2.9	-2.8	4.8	0.64
	(0.5)	(4.5)	(0.3)	(-0.3)	(-0.2)	(0.3)	

Model specification: ${}_5q_0(i) = \text{constant} + {}_5q_0(\text{base}) + \text{years of period i in 1980-84} + \text{years of period i in 1985-89} + \text{years of i in 3 years before start of adjustment} + \text{years of period i in 3 years after start of adjustment.}$

Table 2. (con.t)
Relative Change Model

Socioeconomic category	Regression coefficients for: Constant	Base value	1980-84	1985-89	Pre-Adjustment	Post-Adjustment	R^2
Total	0.93	*	-0.007	-0.033	-0.024	-0.017	0.20
	(6.7)		(-0.2)	(-1.1)	(-0.4)	(-0.3)	
Urban	0.86	*	0.001	0.039	-0.069	0.055	0.04
	(3.4)		(0.5)	(0.0)	(-0.6)	(0.6)	
Rural	0.93	*	-0.011	-0.033	-0.020	-0.025	0.19
	(6.2)		(-0.2)	(-1.0)	(-0.3)	(-0.4)	
No education	0.90	*	0.022	-0.036	-0.050	-0.017	0.19
	(4.5)		(0.4)	(-0.8)	(-0.6)	(-0.2)	
Primary educ	1.02	*	-0.035	-0.028	-0.020	0.012	0.04
	(5.7)		(-0.7)	(-0.7)	(-0.3)	(0.2)	
Secondary + educ	1.50	*	-0.134	-0.050	0.241	-0.053	0.12
	(2.6)		(-0.8)	(-0.4)	(1.0)	(-0.2)	
Rural, no educ	0.91	*	0.016	-0.034	-0.051	-0.023	0.19
	(4.4)		(0.3)	(-0.7)	(-0.6)	(-0.3)	
Urban, no educ	0.77	*	0.064	-0.007	-0.029	0.032	0.08
	(2.8)		(0.7)	(-0.1)	(-0.2)	(0.3)	

Model specification: ${}_5q_0(i)/{}_5q_0(base)$ = constant + years of period i in 1980-84 + years of period i in 1985-89 + years of i in 3 years before start of adjustment + years of period i in 3 years after start of adjustment.

In the absolute decline model, the R^2's are about 0.8 or 0.9 (except the equation for secondary and higher education, for which the R^2 is only about 0.5, perhaps because of the small numbers of women and children in this group). In the total equation, both 1980-84 and 1985-89 have large negative coefficients. But the coefficient for 1985-89 is not much larger than that for 1980-84, indicating again some slowdown of the pace of decline in child mortality in the late 1980s. Both the pre-adjustment and the post-adjustment periods have negative

coefficients too, indicating somewhat faster decline in crisis-and-adjustment countries than in countries not adjusting; these coefficients are not significantly different from zero, however. For the subgroup analyses, few coefficients are significant, but the coefficients on the time period dummy variables are large and negative for the rural population, for mothers with no education or primary education, and for the rural uneducated mothers. The coefficients of time period variables are closer to zero for urban mothers and for those with secondary or higher education. And the coefficient is positive for urban uneducated mothers in 1980-84. The pre-adjustment period dummy generally has a negative coefficient, except for women with secondary education, indicating no excess child mortality in the period before adjustment; the negative effect appears largest for children of urban mothers and children of uneducated rural mothers. The post-adjustment period coefficients are generally small and negative, but are positive for children of urban mothers, uneducated urban mothers, and (marginally) mothers with primary education. Though not statistically significant, these coefficients are consistent with a positive adjustment effect on child mortality for the urban poor, but a slight negative adjustment effect for the rural poor, and a slightly larger negative effect for the rural nonpoor.

In the relative change model, the R^2 values for all the equations are small, and none of the coefficients is significantly different from zero. In the total model, all the time period dummy variables have negative signs. The coefficient for 1985-89 (-0.033) shows more rapid decline than that for 1980-84 (-0.007). Both pre- and post-adjustment periods are associated with substantially lower child mortality risks. For the subgroup models, the coefficients for the 1985-

89 dummy variable are always negative, except for the urban population. But the coefficients for 1980-84 are mixed: they are positive for children of women with no education, rural women with no education, and urban women with no education. The coefficients for the pre-adjustment period are all negative (except for a large positive coefficient for children of women with secondary or higher education, a value probably reflecting small numbers of sample cases). The coefficients for the post-adjustment period are positive for children of urban women, women with primary education, and urban women without education. Though none of the coefficients is significant, the relative change model is also consistent with a positive effect of adjustment on child mortality for the urban poor, but a negative effect for both rural mothers and rural poor mothers.

The analysis reported in table 2 leaves much to be desired. The coefficients shown are generally not significant, the amount of variance accounted for is very small in the relative change model, and there are some aberrant values, probably as the result of small numbers. Perhaps most important, an aggregate analysis of this sort can only suggest causal links because of the vast number of factors not controlled for. As a partial answer to this last concern, we now turn to an individual-level analysis with a much more clearly defined economic model underlying it; the model will be illustrated using data from the Cote d'Ivoire Living Standards Measurement Survey.

Conceptual Framework: Child Health Investment in Sub-Saharan Africa

For analytical purposes, the notion of child health is limited to a child's capacity to combat disease. Most indicators of child health used to measure

health status in a population can be reached from this limited notion. The simplication which proves useful in analyzing the impact of economic factors on child health, is used in our conceptual framework.

The basic notion underlying the economic framework of child health presented is the conceptualization of a child's capacity to combat disease as a stock of a durable good. This treatment follows a growing tradition in economics (Cropper 1977; Grossman 1972; Muurinen 1982; Muurinen and Le Grand 1985). It will be assumed that the stock of a child's health has a value in itself because it augments the welfare of the child's family. As with other commodities produced within the family, the level of child health that the family can attain is constrained by the family's financial and nonfinancial resources and its economic environment.

A child is assumed to be innately endowed with an initial stock of health determined in part by the biological make-up of his or her parents. Given the random distribution of biological characteristics in a cohort of births, it is assumed that this initial stock of child health bears little relation to the differences in child health among socioeconomic groups and to changes in relative health over time.

Parents continually increase their child's initial stock of health through activities that promote child health. But the child's exposure to diseases prevalent in his or her community reduces the child's capacity to combat disease. Activities that increase the child's health stock can be viewed as <u>gross investment</u> in the child's health, and exposure to diseases as the <u>use intensity</u>

of the child's health. This conceptualization allows investment theory to be used to analyze the effect of economic factors on child health.

Activities that promote child health include use of prenatal, perinatal, and postnatal care, immunization, use of modern and traditional medical goods and services for curative purposes, and feeding practices. Typically, a family combines market and nonmarket goods and services with its members' time in these activities to promote and maintain the health of its children. The combination of inputs used in this production process depends not only on relative prices of health-related goods and services, including family members' time, but also on the information that these members have about the efficacy of these inputs. Knowledge of health-related technologies is assumed to be acquired cumulatively through direct experiences with these technologies and exposure to health education programs. But most influential are habits that result from past behavior, or from traditional practices transmitted between generations within families or larger networks (village or ethnic group, for instance). So health-promoting activities may not respond only to current price configurations and family income. Expectations about the quality of health-related inputs based on outcomes of past behaviors may lock in patterns of health-promoting activities in a socioeconomic group for some time.

The exposure of a child to diseases typically depends on the intensity of environmental contamination in his or her community. Following Mosley and Chen (1984), this intensity can be viewed as directly related to, among other factors, the quality of water supply and environmental sanitation in the community. It will be assumed that the child's family has no control over these conditions and

that sanitation services and safe water are provided as public goods.

In summary, over a period of time, the change in a child's health status can be viewed as the outcome of two opposite effects:

Change of child health over time	=	Outcome of health-promoting activities	-	Deteriotation of child health

Changes in child health in a socioeconomic group depend on the interaction of the group's typical child-health-promoting behavior and changes in the supply of health-related goods, and the servicing of its residential area.

To illustrate how inequalities in child health develop among socioeconomic groups and how the inequalities may change during economic crises and structural adjustment, we borrow some concepts from investment theory. First, the relevant price concept in the demand for child health, as a durable good, is the user-cost of health. In any period, the user-cost of child health -- the shadow price of health -- results from the interaction of the effective costs of health-promoting activities and the deterioration of child health. Second, as long as the marginal benefits (MB) of increasing the stock of child health outweigh the effective marginal costs (MC) of increasing that stock, parents will engage in activities to promote child health. But as the costs of health-promoting activities increase (as a consequence of higher food prices, for instance) or the deterioration of child health increases, the level of child health that families can achieve falls. These notions are illustrated in figure 2.

The slope of the MB curve is based on the assumption that, as a child becomes

healthier, the marginal benefit from increasing his or her health gets smaller. The constant slope of the marginal costs curve is based on the simplifying assumption that increases in the costs of child health-promoting activities are independent of the level of the child health stock. Increases in the prices of health-related inputs, or declines in the quality of these inputs, or the worsening of the child's environment shift the MC curve upward. Changes in the opposite directions shift it downards. Increases in family wealth shift the MB curve upward, and vice versa. The relative positions of the MB and MC curves summarize the environment of the family, and H* indicates the level of child health the family can achieve in this environment.

Assume that we have two types of families, Type I and Type II, with similar characteristics, except that Type I families reside in an adequately serviced area while Type II families do not. Children of Type II families face greater exposure to environmental contamination, thus the price of child health is higher for these families than for Type I families: $PxD^{II} > PxD^{I}$ (see figure 3). Therefore, Type II families will achieve a lower level of child health than families of Type I, <u>other things being equal</u>. If these two types of families are taxed at similar rates, and environmental sanitation is publicly provided, society is implicitly subsidizing the promotion of Type I families' child health. The same results hold when families face different private prices for modern medical services. Because exposure to diseases directly causes deterioration of child health, the shifts in the MC curve are more responsive to cross-sectional or dynamic variation in environmental conditions than to changes in the prices of health-related goods. And, as a result of the synergistic effects of multiple infections on child health (Mosley and Chen 1984), higher exposure

to poor environmental conditions inflates the effective marginal costs for using modern medical services, therefore generating disproportionately larger shifts in the MC curve. Differences in population density and servicing among urban residential areas may lead to large differences in child health even where access to medical services is relatively equal.

Urban food and housing subsidies operate similarly in generating inequalities in child health. But for food subsidies, the shifts in the MC curve will typically vary from one socioeconomic group to the other depending on the share in total family spending represented by food purchased in the markets.

The effects of family wealth on child health are illustrated in figure 4. As family wealth increases, the marginal utility of wealth decreases and resources allocated to child health increase, yielding a higher level of child health. Changes in current income, as a component of wealth, shift the MB curve; but these shifts may be limited for families with substantial savings or for families facing mild borrowing constraints.

It is not clear whether parents' education shifts the MC curve downward, as the efficiency-like effects of education in the household production framework imply (Grossman 1972; Schultz 1984). In Sub-Saharan Africa, where education is among the most important determinants of family income, the empirical content of such a hypothesis is limited. Educated parents, mostly employed in the modern sector of the economy, face milder liquidity constraints than noneducated parents, who are mostly self-employed in agriculture or in the urban informal sector. Thus, educated parents probably have better access to modern medical services and

serviced residential areas. Therefore, one expects parents' education to have not only efficiency-life effects in activities that promote child health, but also positive effects on child health through its effects on income. (Education may also affect parents' tastes, and consequently the demand for child health.)

Three major reasons account for the relevance of these considerations in Sub-Saharan Africa. First, modern medical goods and services are relatively new to the region. Even though they are provided mostly as collective goods, their uneven spatial distribution implies different private costs to families. And traditional alternatives, which can be viewed as substitutes to modern inputs to child health, also pay a role. Patterns of use will be determined not only by the relative prices of traditional and modern medical goods and services but also by parents' expectations about their relative efficacy. Second, subsidizing health-related goods, other than medical services, is common policy in Africa. Staple foods, which constitute a large share of the food basket of urban families, have been subsidized for a long time. Third, infectious diseases are so prevalent in Africa that the environmental conditions of its communities are an important proximate determinant of child health. Unequal access to modern medical services, paralleled by unequal access to adequately serviced residential areas, is the general pattern in Africa.

In Sub-Saharan Africa, the patterns of public spending, reflected in unequal spatial distribution of medical facilities, environmental sanitation, and housing and food subsidies, are an important determinant of health inequalities. Family financial and nonfinancial resources also contribute to differences in child health in the region. The next section illustrates the implications of changes

in the determinants of health-promoting activities and the deterioration of child health on health inequalities in Africa.

Adjustment Policies and Child Health

Following Khan (1987), macroeconomic adjustment policies can be classified in four groups: demand management policies, structural policies, exchange rate policies, and external financing policies. Demand management policies include monetary policy and fiscal policy instruments aimed at reducing domestic absorption. Structural policies are long-term and include instruments to restructure relative prices in order to influence current and future output. Exchange rate policies aim to improve international competitiveness and to expand the sector of tradeable goods. Finally, external financial policies are designed to effect capital flows.

In the framework we present here, macroeconomic adjustment policies may affect child health through four mechanisms -- their effect on (1) family income, (2) prices, primarily of health-related goods, (3) the quantity and quality of modern medical goods and services, and (4) community environmental conditions. How these factors affect each socioeconomic group depends on its interaction with the modern economy and its access to public services before and during adjustment.

Discussing the effects of all adjustment policies on child health is impractical. So we focus on instruments aimed at restricting real income and components that

curtail public health expenditures.[1]

Policy packages aimed at restricting real income may affect child health through the first two mechanisms -- family income and prices. The size of this effect depends on the elasticity of the demand for health-related goods, which tends to vary among socioeconomic groups.

Policies to restrict real income typically include wage control and curtailing consumer subsidies to reduce domestic absorption. The effects of these policies on the capacity of a family to maintain or improve the health of its children during an adjustment period depend on the family's engagement in the market economy and on its borrowing constraints.

Wage control and curtailing food and housing subsidies eventually affect the outcome of health-promoting activities through not only the quantity but also the quality of food available to households. In a context where most families are engaged in the modern labor market and a large share of the foods they consume are purchased in the market, the health of children among poor families will be disproportionately adversely affected by such policies. But in Sub-Saharan Africa, where a large proportion of families are self-employed either

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[1]The theoretical base of the effects of monetary policy on interest rates and unemployment in developing countries is very weak (Khan 1987), and theories of private health investment still in their infancy, await empirical validation. Therefore, we will not address the effects of monetary policy components of adjustment packages on child health.

Exchange rate policies may affect child health through their effects on (1) prices of drugs and medical supplies; (2) the housing market; and (3) prices of imported consumer durables, which constitute the technological setting of family child health production. These mechanisms will not be discussed further here.

entirely or partially in subsistence agriculture, changes in wages and food prices may not affect the health of children among the poorest sectors of society -- the rural poor. In such a context, the poor and middle-income urban families are more likely to be affected by such policies. Thus, families whose consumption expenditures include a large share of subsidized health-related goods are likely to be more seriously affected than other sectors of society.

The impact of wage control, which takes the dramatic form of a wage cut, is restricted to families whose major breadwinners are employed in the modern sectors of the economy. It is not clear how wage cuts in the formal sector affect employment and incomes in the informal sector.

Policy packages that significantly reduce public health expenditures affect child health through the last two mechanisms and the quantity and quality of medical goods. Reducing central or local public health expenditures may affect both the sanitation of residential areas and the quantity and quality of modern medical goods and services. First, reduced and irregular environmental sanitation and reduced extension and maintenance of water supply systems are likely to lead to increased environmental contamination. The likely consequence is a greater incidence of childhood infectious diseases. This may occur mainly in nonstructured urban residential areas. In communities that were not serviced before the adjustment -- villages, for instance -- the intensity of environmental contamination may not change.

Second, public health expenditures are biased toward curative services. Curtailing public expenditures on health eventually delays the extension of

preventive programs. And with declining public spending on health, expenditures on drugs and supplies are likely to be affected more than wages for medical personnel, therefore impairing the quantity and quality of public medical services.

Hence, curtailing public health expenditures may lead to an increasing demand for medical services that cannot be met by a health system locked into a drug-intensive medical technology. Among socioeconomic groups whose health-promoting activities center on modern medical services, adjustment policies that cut government health outlays significantly may have dramatic effects on child health.

In summary, in a typical Sub-Saharan African country, with large social sectors still engaged in agriculture, macroeconomic adjustment policies may in the short run primarily affect the health of children in urban areas, though in the longer run they will delay improvements in child health in rural areas. But during adjustment, many rural communities that had benefited only mildly from public subsidies, adjustment policies may have no effect on child health. Significant segments of Sub-Saharan African societies live in precarious conditions, largely insulated both from government social expenditures and from changes in such expenditures during structural adjustment. Groups vulnerable to the effects of such policies are not necessarily the poor, but those that benefit disproportionately from public services and subsidies -- usually urban civil servants and other urban middle-income groups.

Data and Results

In this section, data from Cote d'Ivoire are used to examine the links between adjustment and child health suggested in the conceptual framework. Although the Ivorian economy and the structures of its government expenditures share many similarities with other Sub-Saharan African countries, adjustment policy packages vary from one country to another. Therefore, we abstain from generalization based on the Ivorian data.

Economic changes in Cote d'Ivoire: A Summary

Cote d'Ivoire experienced important economic changes during the past two decades. For the purposes of this paper, it is useful to distinguish two periods: (i) the expansionary period of the 1970s, and (ii) the economic crisis of the 1980s.

During the 1970s, the Ivorian economy grew tremendously as a result of a dynamic agricultural sector and favorable international markets and rapidly growing manufacturing and service sectors (den Tuinder 1978; Zartman and Delgado 1984). Between 1975 and 1977, increasing international prices of cocoa and coffee, the country's major export crops, gave the economy a strong boost. But the confidence in the economy's future performance that the cocoa and coffee boom generated led to an explosion in government spending and increased borrowing in international financial markets at relatively hard terms.

After the cocoa and coffee boom, public revenues collapsed, but adjustment of government expenditures lagged somewhat. This led to major fiscal imbalances,

which peaked in 1981. Between 1980 and 1986, the Ivorian economy suffered a severe economic crisis, and with the support of the World Bank and International Monetary Fund, the authorities undertook a structural adjustment program (SAP) in an effort to adjust the country's macroeconomic imbalances. During this period, gross domestic product declined 0.3 percent, general government consumption fell 4 percent, private consumption increased only 0.9 percent, and gross investment declined 22 percent. These changes reflected in part the implementation of the SAP, which at the beginning put strong emphasis on stabilization.

A few components of the Ivorian SAP merit attention for their relevance to the determination of child health, as outlined in the conceptual framework. These are the reduction in public investment, erosion of real income, and changes in urban housing policy.

Public investment suffered severe cutbacks in Cote d'Ivoire between 1980 and 1986. The extent to which such cutbacks affected the health sector, however, is unclear. At the end of the period, primary health care investment accounted for less than 5 percent of total public health investment (Grootaert and Kanbur 1990). There was no significant reallocation of public health resources during the period: hospital centers in Abidjan were still absorbing the bulk of public investment in health. And Grootaert and Kanbur (1990) report insufficient funding of drugs and materials in 1985.

In a health system locked into curative technology, such financing patterns eventually impair the quality and quantity of care health centers provide. In

Cote d'Ivoire immunization coverage is relatively low. In 1984 about 34 percent of pregnant women were immunized against tetanus, and of children under three years of age, 31 percent were fully immunized against measles, 11 percent against diphtheria/pertussis/tetanus, and 16 percent against tuberculosis (UNICEF 1987).

Civil servants in Ivory Coast experienced severe cutbacks in real income during the first half of the 1980s. It is not clear how the adjustment process affected the incomes of families engaged in the urban informal sector. In the rural areas, however, agricultural policy components of the SAP have eventually protected the incomes of families self-employed in cash crop production.

The Ivorian SAP introduced changes in urban housing policy, shifting the emphasis from the "high-standard housing" approach of the 1970s, which disproportionately benefited upper-income classes, toward site development targeted to lower-income families. Although these changes are unlikely to affect child health during the period we consider, they may influence child health during the late 1980s and the 1990s.

The economic crisis and adjustment policies seem to have affected mainly urban families. Agricultural policy components have protected the incomes of rural producers. Although new directions in urban housing have been introduced during the adjustment process, the health system has remained locked into a curative technology with insufficient drugs and materials. This situation occurred in a context where immunization coverage has stagnated at relatively low levels.

Data and Methods

Panel data are preferred for investigating the effect of economic crisis and adjustment policies on health. But this type of data is rarely available. Alternatively, retrospective data are used to reach mild inferences about the effect of economic changes on child health, and how this effect is distributed among socioeconomic groups.

Data. The analysis is based on the Living Standards Measurement Surveys (LSMS) conducted in Ivory Coast in 1985 and 1986. Grootaert (1987) presents the design of the LSMS questionnaires; Ainsworth and Munoz (1986) describe the sample design and field implementation of the surveys. It is impossible to make quantitative statements about the magnitude of nonrandom errors in the LSMS mortality data.

We use two national surveys conducted in Cote d'Ivoire to check the relative quality of the LSMS mortality data: (1) the *"Enquete Demographique a Passages Repetes"* (EPR) and (2) the Ivorian Fertility Survey (IFS). The EPR is a survey organized in 1978-79 for demographic measurement only. It was based on a national sample of 200,000 people. The survey was conducted in three rounds at six-month intervals, thus yielding two consecutive six-month periods during which demographic events, including births and deaths, were observed. The IFS, the Cote d'Ivoire country project of the World Fertility Survey, was conducted in 1981-82.

Table 3 presents infant mortality rates estimated for 1975-79 based on the different sources. The LSMS are separated into four groups: (1) data from half the sample in 1985 only; (2) the 1985 data from that half of the 1985 sample

reinterviewed in 1986; (3) the 1986 data from the half of the 1985 sample reinterviewed in 1986; and (4) the 1986 data from the households newly included in the 1986 sample. This separation highlights differences between the 1985 and 1986 data. The infant mortality rates obtained for group (2) and group (3) can be expected to be similar if no significant distortions exist in the data.

Table 3. External Checks of 1985/86 LSMS Mortality Data for Cote d'Ivoire

Survey	Period	Infant mortality rate
LSMS - 1985 data		
Interview:		
1985 only	1975-79	106
1985 and 1986	1975-79	126
LSMS - 1986 data		
Interview:		
1985 and 1986	1975-79	84
1986 only	1975-79	82
IFS[a] 1981-82 (i)	1975-79	119
EPR[b] 1978-79 (ii)	1978-79	103

[a]Ivorian Fertility Survey.
[b]*Enquete a Passages Repetes*

Sources: i. Rutstein 1984.
ii. Rep. de Cote d'Ivoire 1984b.

This comparison of the LSMS data which can be viewed as an internal check, yields two observations. The 1985 LSMS data give higher estimates of infant mortality than the 1986 data. And the comparison of infant mortality rates based on the same set of households in 1985 (group 2) and 1986 (group 3) suggests that infant deaths have been omitted disproportionately compared to live births still alive

in the 1986 survey. One plausible explanation of the second observation is that because the LSMS interview requires considerable time from the women interviewed, those reinterviewed in 1986 had learned not only the costs of an interview in time, but also how to dismiss interviewers. And one can conjecture, based on the first observation, that interview effects exist, which would explain in part differences between the 1985 and 1986 infant mortality rates.

The 1985 data show levels of infant mortality comparable to the IFS and EPR estimates. But the 1986 data clearly underestimate the 1975-79 infant mortality rates, as suggested above.

The 1985 data and the data from the subsample of households newly included in 1986 are used for the mortality analysis to provide a sufficient number of observations. There is no indication, however, of how the suspected omission of deaths in 1986 will affect inferences about the relations between household characteristics and mortality.

Infant and child mortality is still very high in Cote d'Ivoire (table 4). During 1967-86, 5 percent of live births died in the first month of life; another 5 percent died in the postneonatal period. Among children who survived to 12 months, 6 percent died before age five.

Table 4. Infant and Child Mortality Rates in Cote d' Ivoire, 1967-86
LMS 1985/86

Variables	Neonatal mortality rate per 1,000	Postnatal mortality rate per 1,000	Infant mortality rate per 1,000	Child mortality rate per 1,000
Total	55	46	102	60
Demographic Variables				
Sex				
Male	58	45	103	62
Female	52	48	100	58
Mother's age at birth				
<20	64	49	113	63
20-24	62	45	106	50
25-29	40	43	82	62
30-34	36	49	85	56
35-39	54	37	91	78
40+	84	63	146	54
Birth order				
1st	60	47	107	49
2nd	43	39	82	47
3rd	45	36	82	48
4th	42	39	81	57
5th	42	41	83	69
6th	50	58	108	86
7+	89	65	154	80
Variables for Use of Utilization of Health Services				
Place of delivery				
(last birth)				
Maternity	41	43	85	44
Other	75	51	126	82
Prenatal visits				
(last birth)				
None	84	54	138	73
1-3	48	53	100	68
4-5	45	50	94	61
6	52	33	85	48
7+	50	41	91	45

Table 4 (cont.)

Variables	Neonatal mortality rate per 1,000	Postnatal mortality rate per 1,000	Infant mortality rate per 1,000	Child mortality rate per 1,000
Community Environmental Varables				
Water supply				
High	45	37	83	35
Low	63	54	117	80
Garbage disposal				
High	31	20	51	27
Intermediate	57	52	108	44
Low	62	52	113	76
Toilet sanitation				
High	44	34	78	28
Intermediate	49	43	92	65
Low	69	57	126	76
Type of residence				
Abidjan	43	37	80	21
Other cities	43	37	80	47
Rural - Forest	58	58	112	74
Rural- Savannah	84	52	136	61
Parental Education				
Mother's education				
None	58	51	109	66
Primary	50	37	87	38
Secondary +	33	17	49	21
Household head's education				
None	60	51	111	72
Primary	60	58	118	40
Secondary+	28	20	48	25

Demographic variables reveal typical mortality differentials. In Cote d'Ivoire, there seem to be no significant differences between males and females in national infant and child mortality levels. The relation between infant mortality and mother's age at birth displays the J-type relation commonly reported in the demographic literature. The pattern is most pronounced in the neonatal component, as would be expected. Births delivered by mothers older than 40 are more likely to die in the first year of life than births to mothers in intermediate childbearing years. Beyond one year of age, however, the differences disappear. At the other extreme, babies born to mothers younger than 20 have a greater chance of dying not only at neonatal ages but also above one year of age than do babies of mothers in their intermediate childbearing years.

Similarly, the expected U-type (or J-type) relation between birth order and infant and child mortality is supported by the data. The first and high-order births (six and beyond) experience relatively high mortality. The relatively heavy mortality of first births, however, is limited to neonatal ages; conversely, higher order births show a heavy mortality rate throughout infancy and childhood.

The relation between the utilization of modern health services and infant and child mortality is as expected: child born to mothers who use modern health services are more likely to survive than their counterparts. At the modal number of prenatal visits (six visits) and beyond, the gains in survival are more recognizable beyond the neonatal ages. This pattern probably reflects the covariation between the use of maternal health services and the use of child preventive and curative care.

The association between community environmental variables and infant and child mortality is typical. Communities with a less adequate water supply experience heavier mortality than their counterparts, and as would be expected given typical weaning ages, the gap in mortality is relatively larger during childhood. The same pattern prevails for environmental and toilet sanitation. But the high covariance between community environmental variables may confound the relations between community characteristics and infant and child mortality.

Abidjan, the capital city, experienced lower mortality than the rest of the country between 1967 and 1986. Although for the entire period Abidjan and other cities had similar levels of infant mortality on average, Abidjan had levels of child mortality half those of other cities.

Rural areas experience heavier mortality than urban areas, and the mortality gap widens with age. And within the rural areas, differences in mortality between forest and savannah zones vary by age. Neonatal mortality in the savannah zone is much higher than in the forest zone. But because of epidemiological differences between the rainy south and the relatively dry north, childhood mortality levels are lower in the north. Parents' education and infant and child mortality show the now familiar association: child survival increases with parents' education. The relationship is not linear, however, and shows an age-dependent pattern. For infants below one year, the survival gains associated with parents' secondary education relative to primary education are much higher than the gains associated with primary education relative to no schooling. The pattern is reversed at childhood ages. And the relation between mortality and parents' education is more noticeable with mothers' education, as has been widely

reported in the health-related literature.

Because the LSMS surveys were conducted six years after the period used for the comparison with EPR and IFS results, we can conclude that the quality of the 1985 LSMS mortality data is relatively good. No similar statement can be made, however, for the 1986 LSMS mortality data. We have no knowledge about the relations between the omission of deaths and socioeconomic characteristics of respondents in Africa, which knowledge could serve as a base for hypothesizing a direction for potential biases on parameter estimates of interest in this paper. But if the omission of deaths is not related to family characteristics, these biases would be minimal.

The data suggest associations between infant and child mortality and proximate determinants of child health that are quite consistent with what is reported in the literature. These results add to our confidence in the LSMS mortality data.

Methods. The methodology adopted in this section rests on the assumption that a family's characteristics, such as education, type of residence, and relative position in the income scale, are fixed during the expansionary period and the economic crisis-adjustment period. In considering aggregates of families, this assumption appears very mild: the mobility of individual families is unlikely to affect significantly the relative position of aggregates of families over a limited period.

The probability of dying in the first year of life is used as an indicator of child health. The age-dependent nature of child-health-promoting activities

and the effect of environmental contamination on child health suggests a conditional analysis based on intervals shorter than the first-year range. Neonatal health is more responsive to inherited biological characteristics and the outcome of prenatal and perinatal care. But postneonatal ages are typically transitional: children are still more or less protected by maternal antibodies, and they start building up natural or artificial resistance to diseases prevalent in their environment. Their exposure to these diseases is intensified by the introduction of foods other than breastmilk and of other child-rearing practices. These differences between neonatal and postneonatal infants means that the critical amount of family resources needed to sustain a child's health typically depends on the child's age group. Consequently, our analysis presents information separately for neonatal and postneonatal ages.

Descriptive and regression analyses are used to assess the changes in child health between 1970 and 1986. The analyses focus on how these changes vary among socioeconomic groups. For the purposes of this paper, we focus on a few family characteristics.

We use family expenditure per capita as an indicator of family permanent income and to classify families by income group. Family expenditure per capita is also used to define the rural poor and the urban poor. The rural poor is defined as families who fall within the bottom 60 percent of the distribution of family income within the rural areas. The urban poor is similarly defined using the distribution of family income in the urban areas.

Family savings have been recorded in the LSMS. The ratio of the total amount of family savings over total family expenditure is used as an indicator of the

availability to the family of a buffer mechanism for mitigating the effects of changes in the family's economic environment on investment in child health .

Unlike other variables used in the analyses family expenditure and savings raise methodological problems. They vary over time and may be affected by the outcomes of child health processes. And their measurement may be subject to systematic errors. Although we have no indication of how these drawbacks may affect the empirical results, it is important to keep them in mind when drawing inferences based on the data.

Changes in Child Health: 1970-86

Infant mortality in Cote d' Ivoire started at relatively high levels in the 1970's.[2] But in the early 1980s a declining trend that started around 1978 was interrupted (figure 5). Neonatal mortality fluctuated between 50 and 55 per 1,000 during the period without any discernable trends (figure 6). Postneonatal mortality, however, increased by 10 points between 1977-81 and 1982-86 --- from 41 per 1,000 to 51 per 1,000.

The data suggest that infant mortality increased between the expansionary period of the late 1970s and the economic crisis-adjustment period of the early 1980s. But these changes were apparently limited to the postneonatal ages.
Among families above the median income (HIGH in figures 5 to 7), neonatal mortality remained fairly steady, while postneonatal mortality increased from 38 per 1,000 in 1977-81 to 68 per 1,000 in 1982-86. Among families below the

[2]The low levels in the early 1970s are probably due to distortions in the data. The levels of the middle and late 1970s, however, are consistent with IFS data mentioned earlier.

median income (LOW in figures 5 to 7), infant mortality remained at the same levels during the period.

But because higher income families reside disproportionately in the urban areas, differences in infant mortality trends between income groups may reflect differences between rural and urban trends (compared in figures 8 to 10). At the extreme, in Abidjan, neonatal mortality increased from 37 per 1,000 in 1977-81 to 47 per 1,000 in 1982-86, and postneonatal mortality from 32 per 1,000 to 64 per 1,000 between the two periods. Thus, infant mortality in Abidjan almost doubled between the expansionary period and the economic crisis-adjustment period (Diop 1990: p. 162), while in other cities and in rural areas it remained steady. Figures 11 to 13 summarize infant mortality trends among families in three different savings categories. Infant mortality indices among families with relatively high ratios of savings over expenditure are noticeably stable between 1970 and 1986. Among families with medium ratios of savings over expenditure postneonatal mortality was stable until 1982, but increased slightly afterwards. Neonatal mortality among these families declined between the mid-1970s and the beginning of the 1980s, but has been increasing since 1981. And among families with relatively low savings in 1985-86 neonatal mortality has been declining since the mid-1970s, but postneonatal mortality, after fluctuating around 40 per 1,000 during the 1970s, increased dramatically during the first half of the 1980s.

Among family characteristics we consider here parental education is obviously the more stable.[3] Figures 14 to 16 show infant mortality trends among families with educated and noneducated mothers. Among families of noneducated mothers,

[3]Most educated mothers have only a primary school education

neonatal mortality showed signs of decline during the second half of the 1970s and fluctuated between 50 and 55 per 1,000 during the HP LaserJet Series IIHPLASEII.PRSed between 30 and 40 per 1,000 during the 1970s, moving up to a higher plateau during the 1980s. Postneonatal mortality among this group of families shows more noticeable changes, more than doubling between 1977-81 and 1982-86.

Mortality trends among the rural poor and the urban poor are presented in figures 17 to 19. Among the rural poor, neonatal mortality declined during the 1970s, and during the 1980s it fluctuated around the same levels reached in 1977-81. Postneonatal mortality for the group increased somewhat between the middle of the 1970s and the early 1980s, and showed no signs of decline during the first half of the 1980s.

Among the urban poor during the 1980s, neonatal mortality remained at the levels reached in 1977-81. Postneonatal mortality declined during the second half of the 1970s, but showed some signs of increase during the 1980s.

The descriptive analysis suggests that changes in child health between the expansionary period and the economic crisis-adjustment period varied from one socioeconomic group to another. In general, infant mortality either increased or remained at the same levels between the two periods in each socioeconomic group. Postneonatal mortality underwent more important changes than neonatal mortality, increasing markedly in urban areas, particularly Abidjan, and among families with limited savings. We reach stronger statements based on the regression results, where we attempt to control for the effects of confounding variables.

Variables included in the regression analysis are presented in table 5. Maximum-likelihood methods are used to fit two logistic models -- a neonatal mortality model and a postneonatal mortality model -- to the data. As mentioned earlier, mortality is used as an indicator of child health. As suggested in the conceptual framework, the level of child health a family can attain depends on its wealth and the prices of health-related goods and their changes over time. But, price variables are rarely available, so dummy variables indicating the expansionary period and the economic crisis-adjustment period are used to capture changes in the economic environment of families between these two periods.

The analysis is controlled for the effects of demographic variables (birth order, sex, mother's age at birth) and parents' education. The inferential process focuses on the effects of the interaction of time variables (Time2 and Time3) and family socioeconomic characteristics (Urban1, Urban2, Rural1, Savings1, and Savings2) on the likelihood of neonatal death and of postneonatal death between 1970 and 1986. For a given socioeconomic group, the deterioration of its child investment environment during the economic crisis-adjustment period is expected to be reflected in the results by positive parameter estimates in the two models of the interaction of Time3 and its respective indicator variable.

The regression results are presented in table 6. Interaction terms do not add significantly to the explanatory power of the neonatal mortality model; in contrast, they improve the fit of the postneonatal mortality model.

The changes in neonatal mortality between 1970 and 1986 suggested in the descriptive analysis are not significantly supported by the regression results. Among variables of interest, only rural poor (Rural1) exhibits significant positive effects on neonatal mortality after controlling for other variables in

the model. Hence, the LSMS data do not support changes in neonatal mortality during 1970-86 either in the overall sample or in socioeconomic groups considered in this analysis.

During the period, urban nonpoor (Urban2) and families with mothers with at least a secondary education (Meduc3) experienced significantly lower postneonatal mortality than their counterparts. But the data support the finding that children of urban nonpoor families born during the economic crisis-adjustment period (Time3*Urban2) experienced significantly higher postneonatal mortality than their counterparts, other things being equal. Similarly, children born to families with virtually no savings (Time3*Savings1) experienced heavier postneonatal mortality after controlling for other variables. These last results are consistent with patterns suggested in the descriptive analysis.

The occurrence of neonatal death or postneonatal death is negatively correlated with being born among the rural poor between 1982 and 1986 (Time3*Rural1), after controlling for the effects of other variables. These results, though weak, signal improvements in child health among the rural poor during the adjustment period.

CONCLUSION

Two very different types of analysis have been applied to very different types of data to try to quantify any short-term effect of economic crisis and subsequent adjustment on child mortality in Sub-Saharan Africa. The first analysis is of aggregate data for 10 countries covered by the Demographic and Health Surveys project. The second is an individual-level analysis of a very elaborate data set for Cote d'Ivoire collected in the mid-1980s. Both analyses use time period dummy variables to identify effects of crisis and adjustment. Despite very different methodologies and data sets, the two analyses come up with surprisingly similar results.

The aggregate study, covering 10 countries that contribute some 20 percent of Sub-Saharan Africa's births in the late 1980s, achieves a respectable level of representativeness. Results suggest that neither economic crisis nor the resulting adjustment policies had the effect of increasing child mortality in the short run at the national level relative to countries not undergoing adjustment (but not necessarily avoiding crisis). The results are, however, consistent with some differential effects across socioeconomic groups, with adjustment policies associated with some increase in child mortality in urban areas, particularly among the urban poor.

The individual-level analysis examined the child mortality effects of adjustment in Cote d' Ivoire. The stabilization policies, together with the economic crisis, have led to a decline in real income in urban areas. In contrast, rural incomes among producers of cash crops may not have been negatively affected, because agricultural policy components of the SAP have been relatively protective of agricultural incomes. The effect of the SAP on the health sector is unclear.

But, the structure of public health expenditures in 1985 suggests that the emphasis on curative care, based disproportionately in Abidjan hospital centers, has not shifted. And immunization coverage showed no signs of improvement between 1980 and 1984. As subsidies to urban consumers have been curtailed, and real income in these settings has been declining, child health in the urban areas has deteriorated, particularly in the postneonatal period. This deterioration has disproportionately affected families in the top 40 percent of urban income distribution, mostly civil servants. The LSMS data suggest that families with no savings have been severely affected by these changes in child health. In the rural areas child health has not been significantly affected by the economic crisis or adjustment policies. This finding is consistent with the notion that when families are insulated from (or marginally affected by) public services and subsidies, they will be insulated also from changes in these services and subsidies during an adjustment process.

From a historical perspective, it would be surprising if economic crisis and adjustment, both of which imply falling real wages for some components of society, had no effect on child mortality in Sub-Saharan Africa. Countries of the region have not yet reached the levels of development and industrialization that now-developed countries had reached when the link between their economic and health indicators weakened. But the analysis reported here does not indicate an across the board increase in mortality. Rather, it shows a change in relative levels among groups that favors the rural nonpoor at the expense of the urban poor, with little net effect at the national level. The 1980s have of course been a period of great expansion of child survival interventions, which would be expected to have their greatest effect in rural, poorly served areas. How much the effect of crisis and adjustment has been cancelled out by immunizations and Oral Rehydration Therapy it is impossible to tell.

We have looked only at short-term effects -- the only ones we can expect to measure. Long-run effects of crisis and adjustment will depend on the success of adjustment in boosting sustained long-term growth. Such growth will tend to reduce child mortality and probably speed the reduction of fertility as well, reinforcing declines in child mortality.

Table 5 Definition and Labels of Variables Included in Logistic Models

Variable	Variable labels and values	Unit
D_o	Neonatal death -1 if death in the first month of life, 0 otherwise.	Birth
S_1	Exposed to postneonatal death	Birth
D_1	Postneonatal death -1 if death between the first and the 12th months of life, 0 otherwise.	Birth
Time2	Born between 1977 and 1981 -1 if yes, 0 otherwise.	Birth
Time 3	Born between 1982 and 1986 -1 if yes, 0 otherwise.	Birth
Ord1	First in birth order -1 if yes, 0 otherwise.	Birth
Ord2	Birth order is 7th or higher -1 if yes, 0 otherwise.	Birth
Male	Sex of child is male -1 if yes, 0 otherwise.	Birth
Mageb1	Mother's age at birth is below 20 years -1 if yes, 0 otherwise.	Birth
Mageb2	Mother's age at birth is 35 years or more -1 if yes, 0 otherwise.	Birth

Table 5 (cont.)

Variable	Variable labels and values	Unit
Urban1	Urban poor -1 if yes, 0 otherwise.	Household
Urban2	Urban nonpoor -1 if yes, 0 otherwise.	Household
Rural1	Rural poor -1 if yes, 0 otherwise.	Household
Savings1	Ratio of savings over family expenditure is less than 1 percent -1 if yes, 0 otherwise.	Household
Savings1	Ratio of savings over family expenditure is between 1 and 5 percent -1 if yes, 0 otherwise.	Household
Meduc2	Mother's education is primary -1 if yes, 0 if otherwise.	Mother
Meduc3	Mother's education is secondary or above -1 if yes, 0 otherwise.	Mother

Table 6 Logistic Regression Results for Infant Mortality Components for Birth Cohorts 1970-86 in Cote D' Ivoire (LSMS 1985/86)

	Neonatal Mortality		Postneonatal Mortality	
Variable	Coefficient	Chi-square	Coefficient	Chi-square
Intercept	-3.39226	152.27*	-2.80905	109.66*
Time2	0.15771	0.19	-0.28819	0.59
Time3	-0.10228	0.07	0.00759	0.00
Ord1	0.38778	5.68**	0.14689	0.62
Ord20	0.71340	22.04*	6.54**	
Male	0.14130	1.34	-0.06799	0.25
Mageb1	0.03004	0.04	0.17842	1.28
Mageb2	-0.09816	0.16	-0.16455	0.32
Urban1	-0.49365	2.31	-0.31418	1.12
Urban2	-0.01402	0.00	-1.13590	4.37**
Rural1	0.39930	2.76***	-0.19990	0.60
Savings1	0.20246	0.70	-0.12521	0.24
Savings2	0.19392	0.66	-0.32094	1.42
Meduc2	0.22020	0.73	-0.45176	1.61
Meduc3	-0.18936	0.21	-1.07151	3.11***
Time2*Urban1	0.07393	0.03	-0.45794	0.89
Time2*Urban2	-0.28729	0.30	0.65811	0.83
Time2*Rurel1	-0.44130	1.53	0.35481	0.84
Time3*Urban1	0.32111	0.44	-0.46590	0.96
Time3*Urban2	0.17022	0.10	1.26450	3.69***
Time3*Rural1	-0.19119	0.24	-0.47631	1.29
Time2*Savings1	0.23976	0.46	0.35849	0.88
Time2*Savings2	-0.08854	0.06	0.21924	0.30
Time3*Savings1	0.06511	0.03	0.91607	5.43**
Time3*Savings2	0.18999	0.27	0.23648	0.29
Model Chi-square	49.73*		53.02*	
Degrees of freedom	24		24	
Number of observations	5,354		4,801	

Table 6 (cont.)

Note: A Chi-square (df-1) associated with a coefficient's estimate is the square of the ratio of the estimate over its asymptotic standard error.

Significance level: *, < .01; **, [.01, .05); ***, [.05, .10).

Dependent Variable - Pr (D_o-1) <neonatal mortality model>

Dependent Variable - Pr (D_1-^{1} S_1-1) <postneonatal mortality model>

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KEY

Mauritania	MA	+++
Liberia	LI	-···-···-
Senegal	SE	+-+-+-
Uganda	UG	·--·-·--·-
Togo	TO	-++-++-
Sudan	SU	-·-·-·
Ghana	GH	-··-··-
Kenya	KE	·----·----·
Zaire	ZI	·+·+·+·+·
Botswana	BO	·····-····

FIGURE 1. TRENDS IN INFANT MORTALITY ($_1q_0$) AND CHILD MORTALITY ($_5q_0$) IN 10 DHS COUNTRIES OF SUB-SAHARAN AFRICA IN THE 1970s AND 1980s

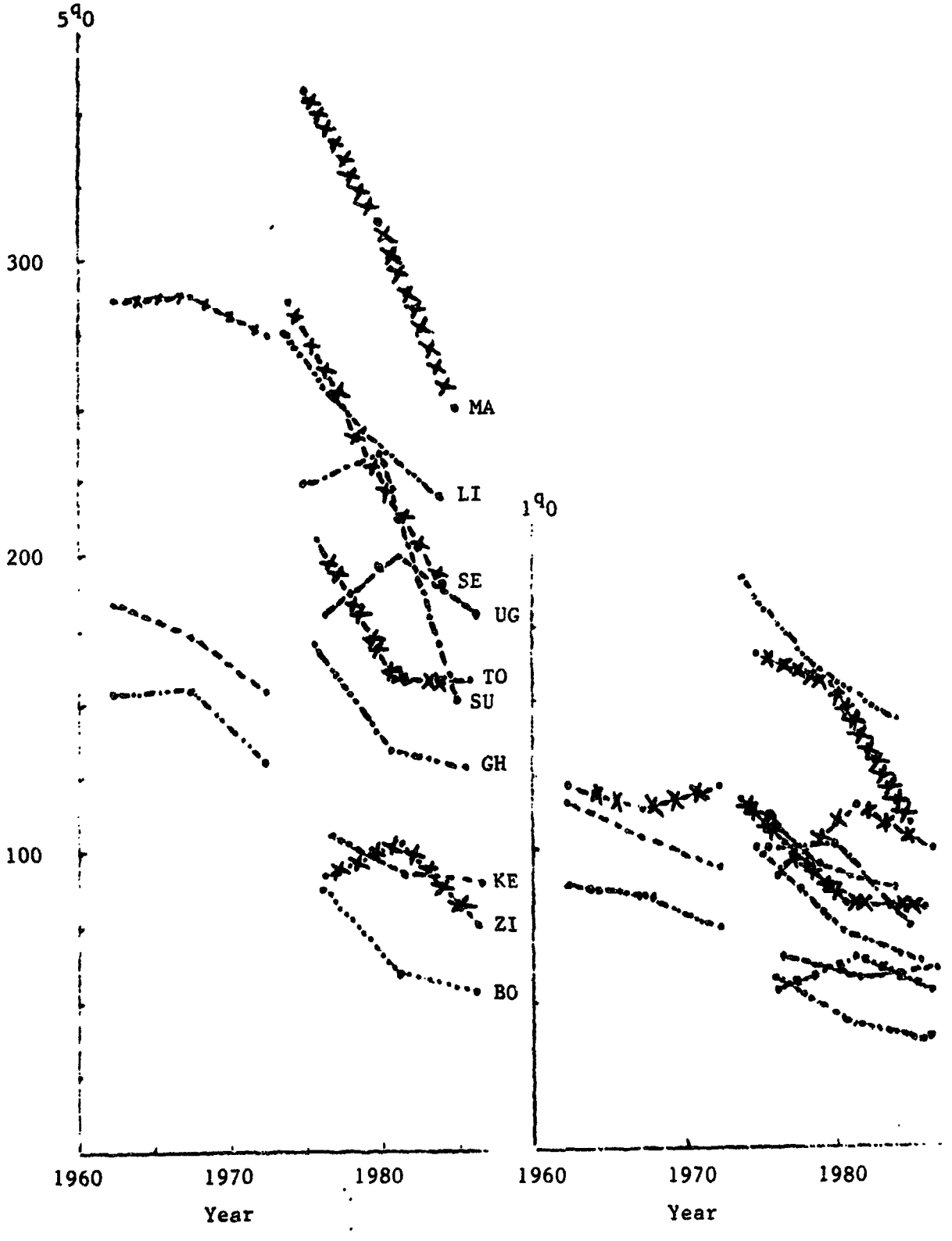


FIGURE 2. DETERMINATION OF THE LEVEL OF CHILD HEALTH ACHIEVABLE IN A GIVEN ECONOMIC ENVIRONMENT

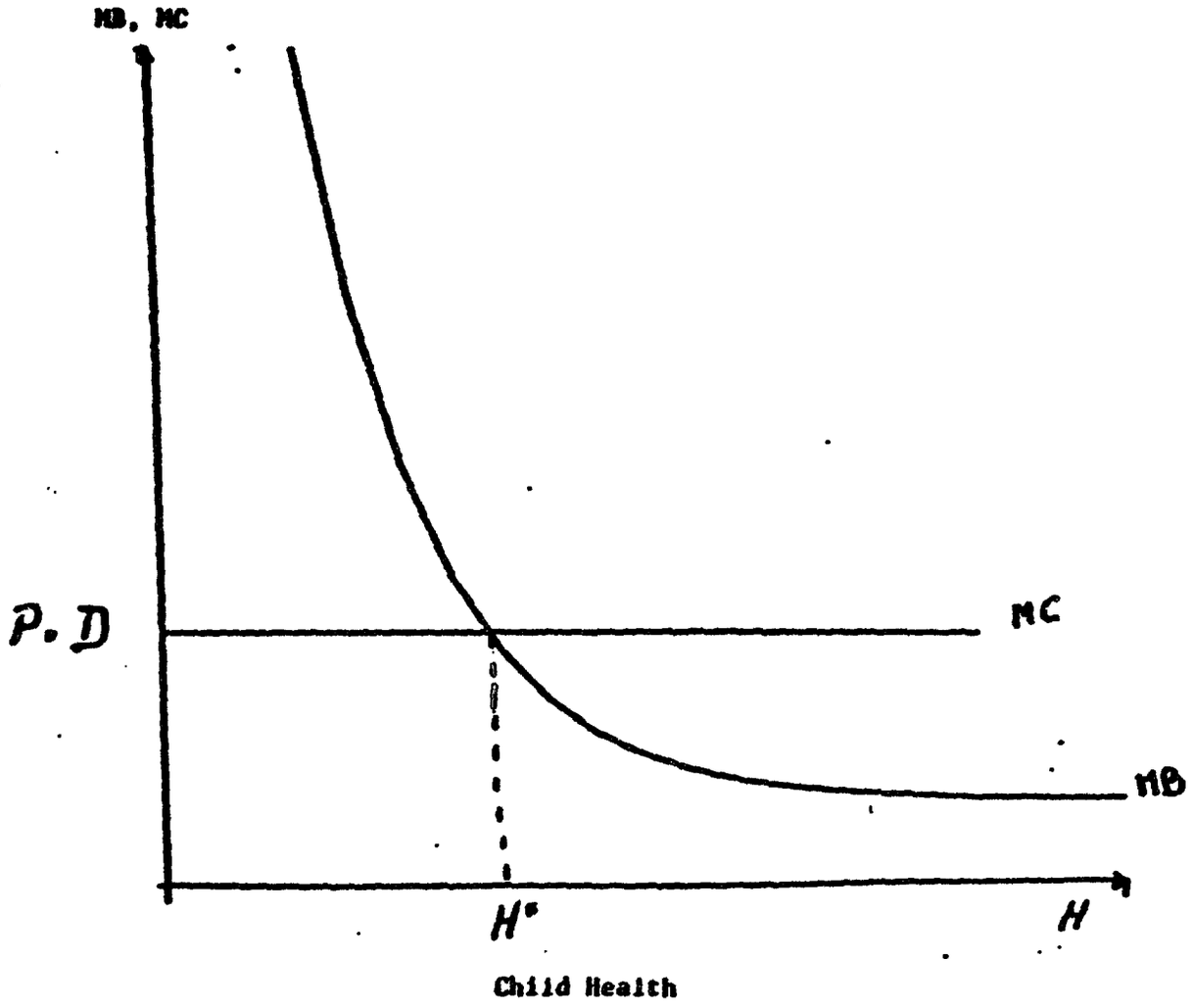
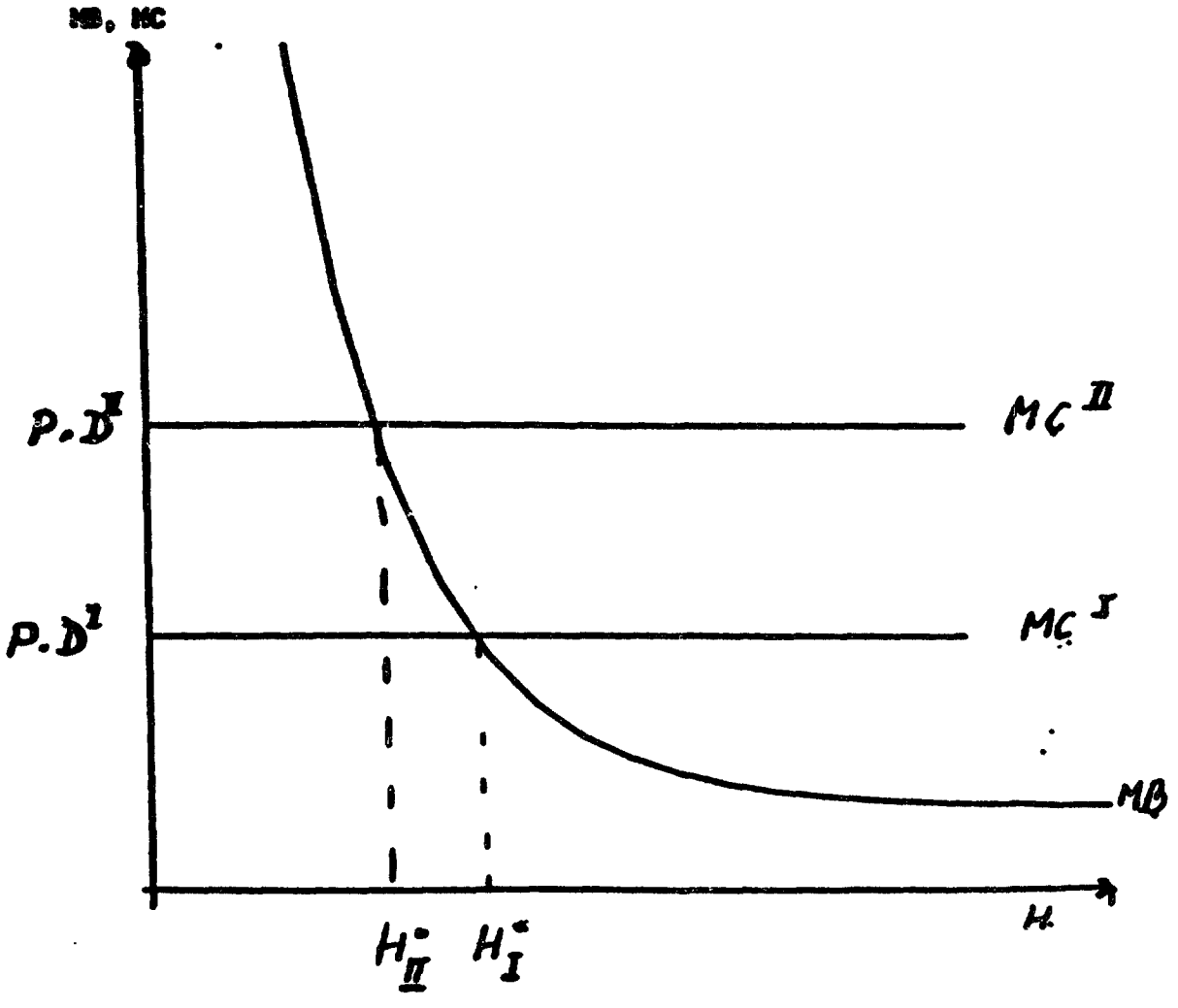


FIGURE 3. DIFFERENCES IN CHILD HEALTH BETWEEN TWO SOCIOECONOMIC GROUPS WITH DIFFERENT EXPOSURE TO DISEASE



Child Health

FIGURE 4. DIFFERENCES IN CHILD HEALTH BETWEEN TWO INCOME GROUPS FACING EQUAL PRICES OF CHILD HEALTH

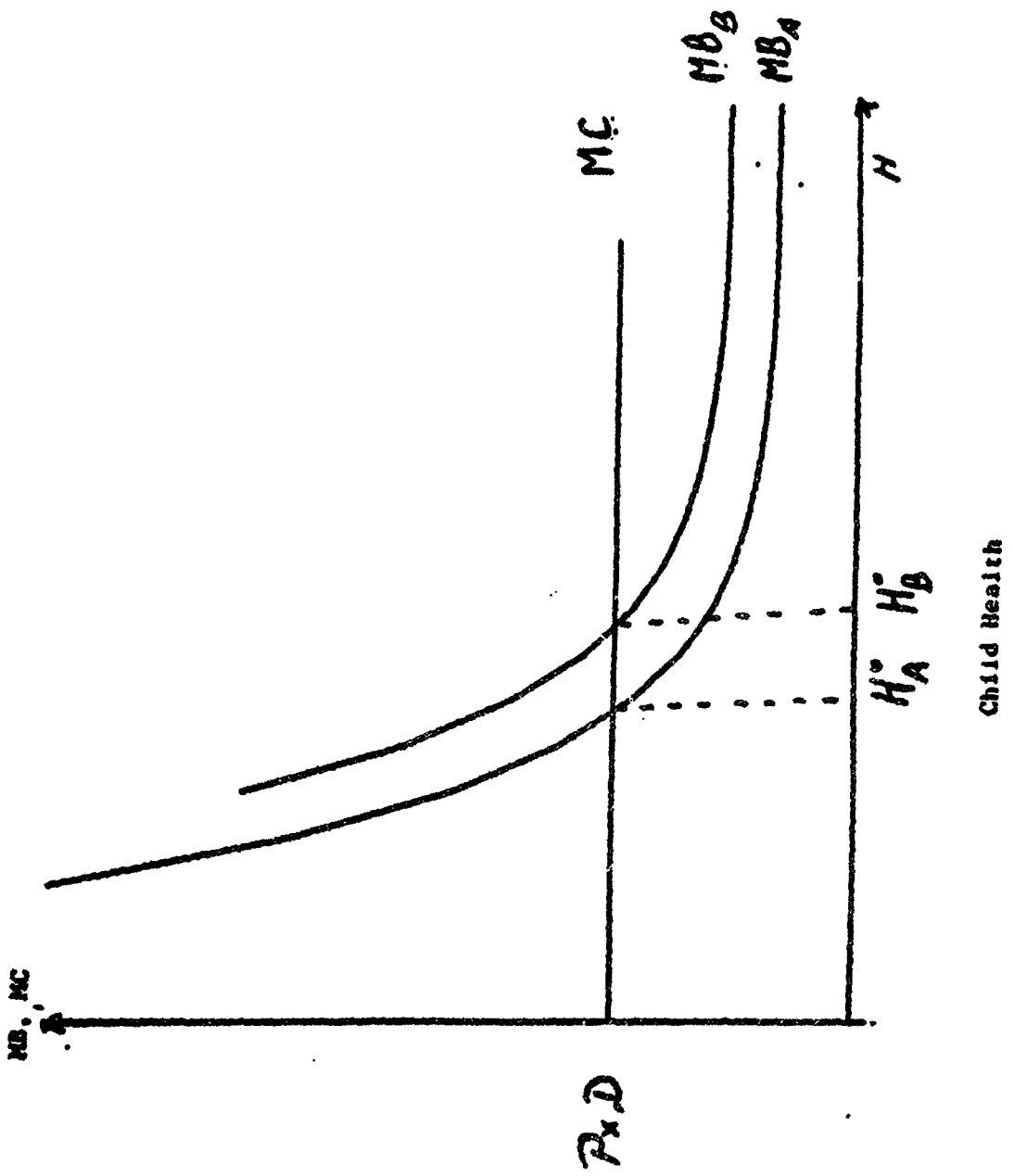
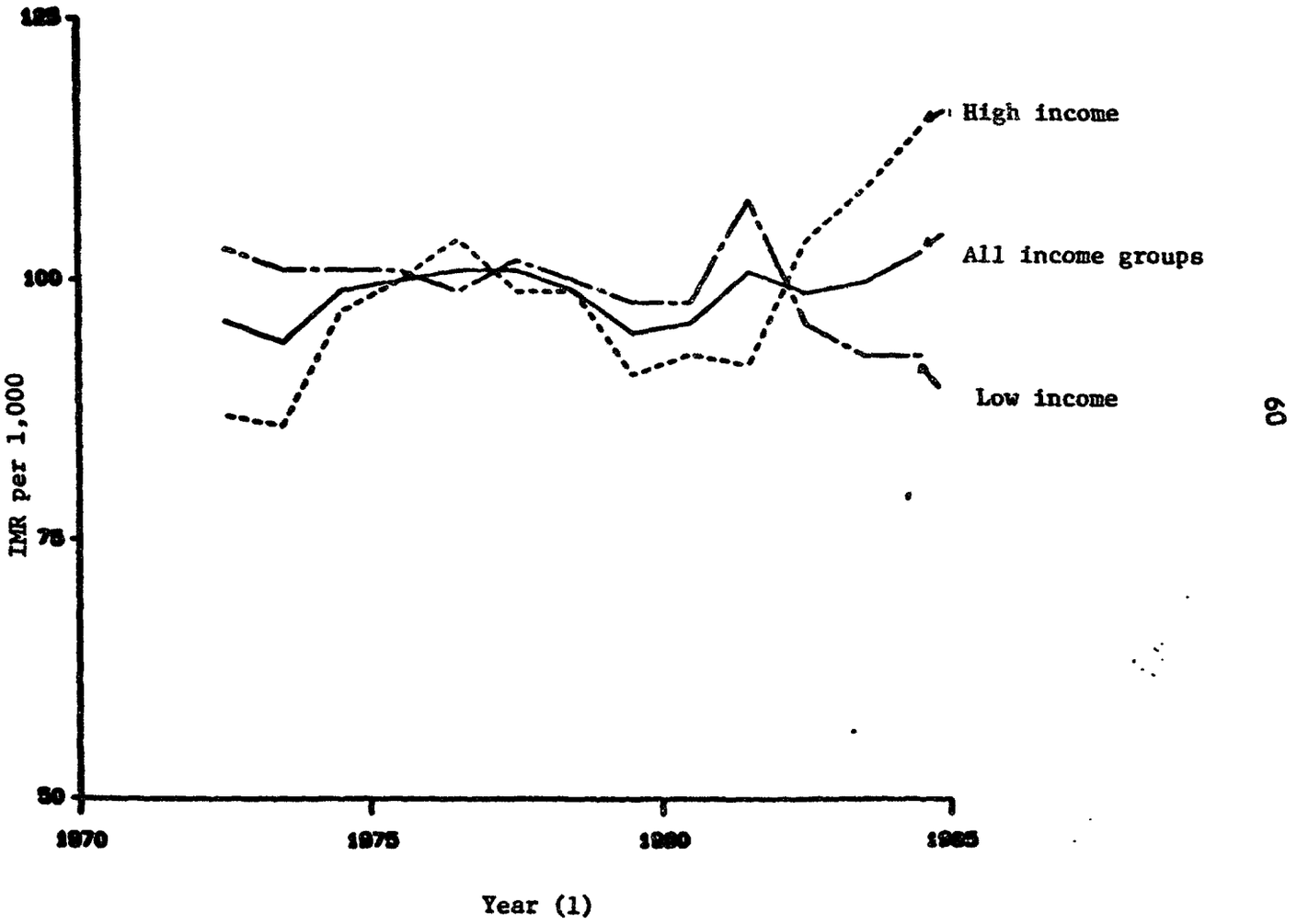
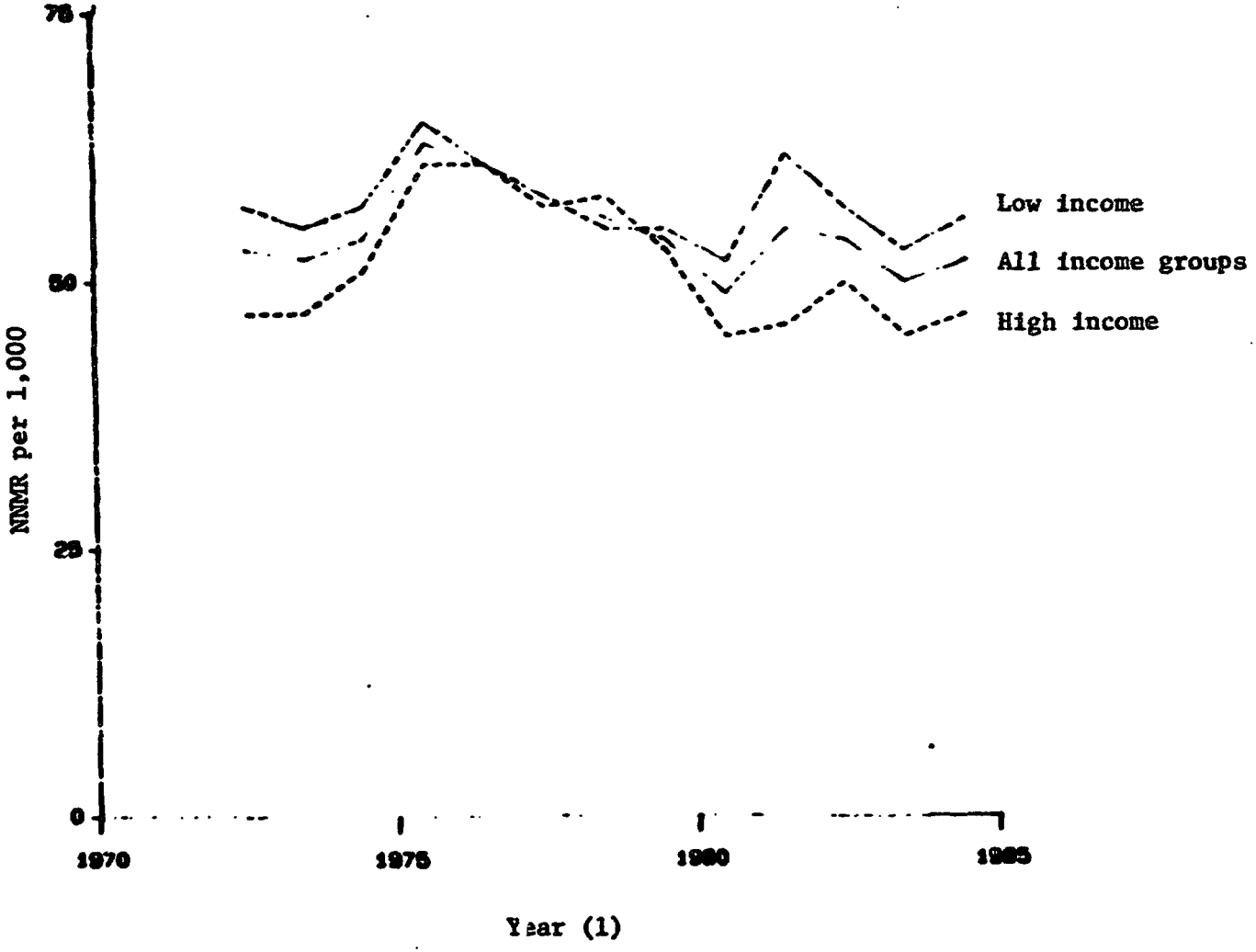


FIGURE 5. INFANT MORTALITY TRENDS BY INCOME GROUP
IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)



PRG: PLOTSM2
NOTE (1): IMR 5 - YEAR MOVING AVERAGE

FIGURE 6. NEONATAL MORTALITY TRENDS BY INCOME GROUP IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)

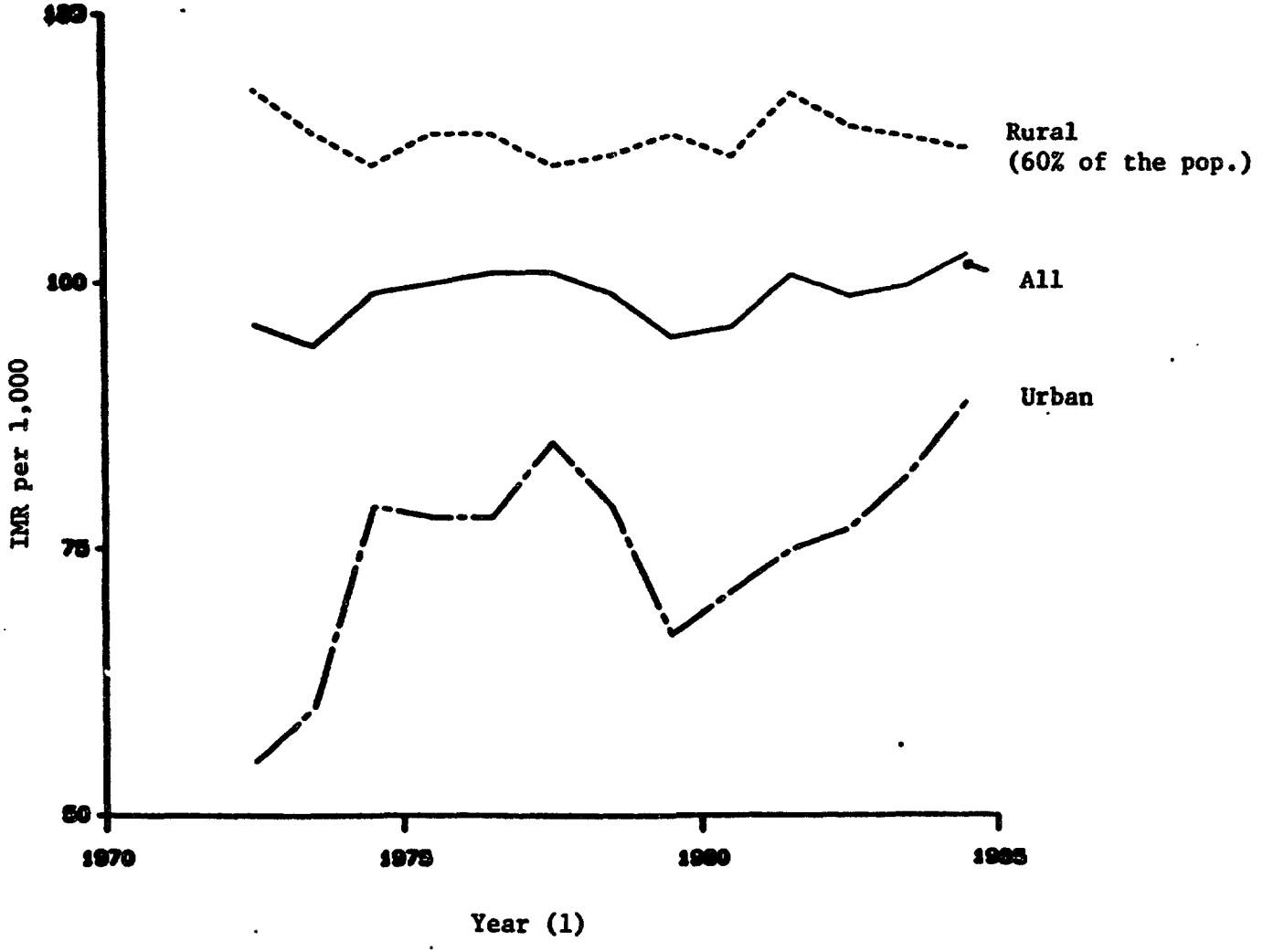


NOTE: (1) NNMR 5 - YEAR MOVING AVERAGE

FIGURE 7. POSTNEONATAL MORTALITY TRENDS BY INCOME GROUP IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)

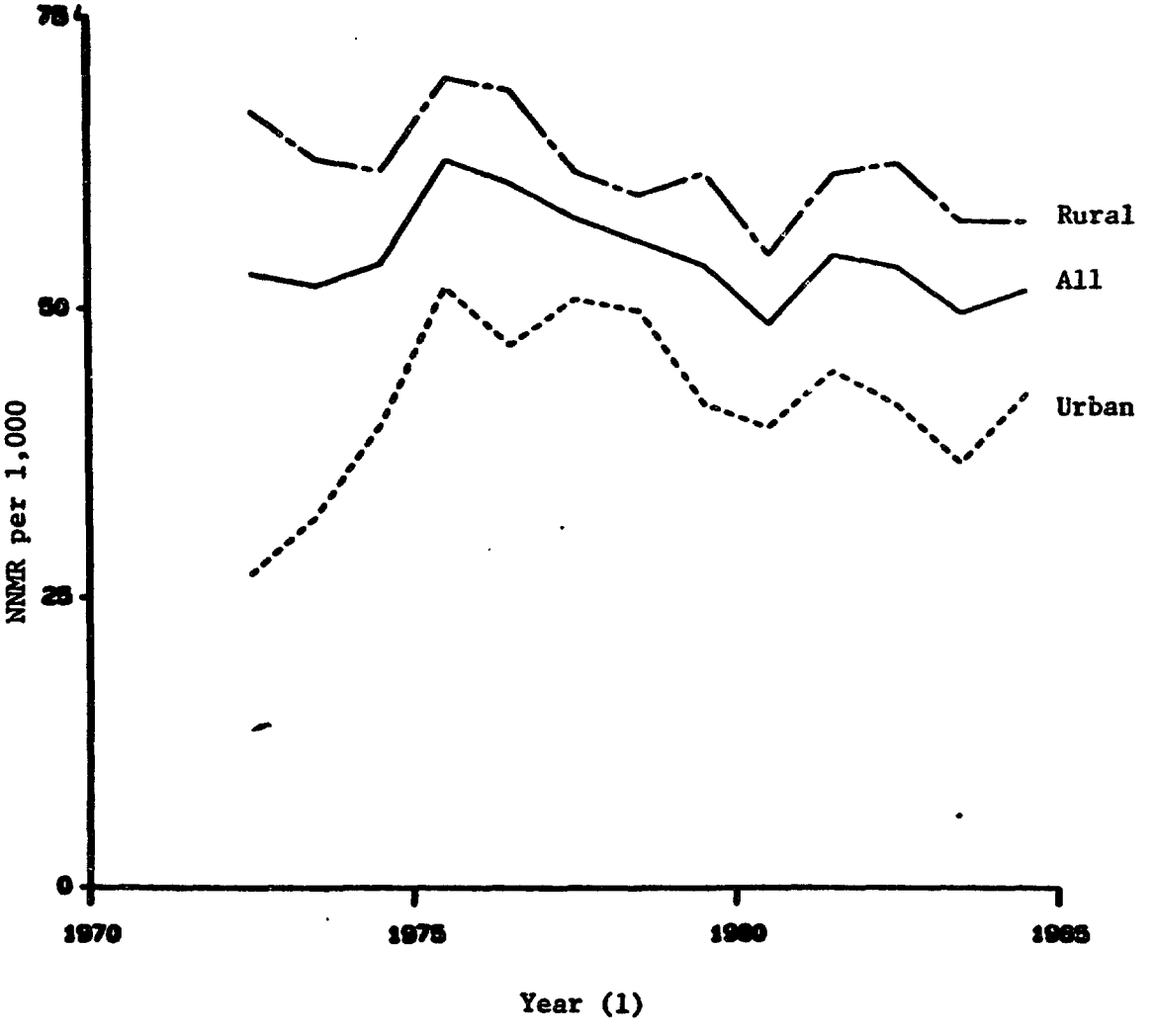
NOTE: (1) PNMR 5 - YEAR MOVING AVERAGE

FIGURE 8. URBAN AND RURAL INFANT MORTALITY TRENDS
IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)



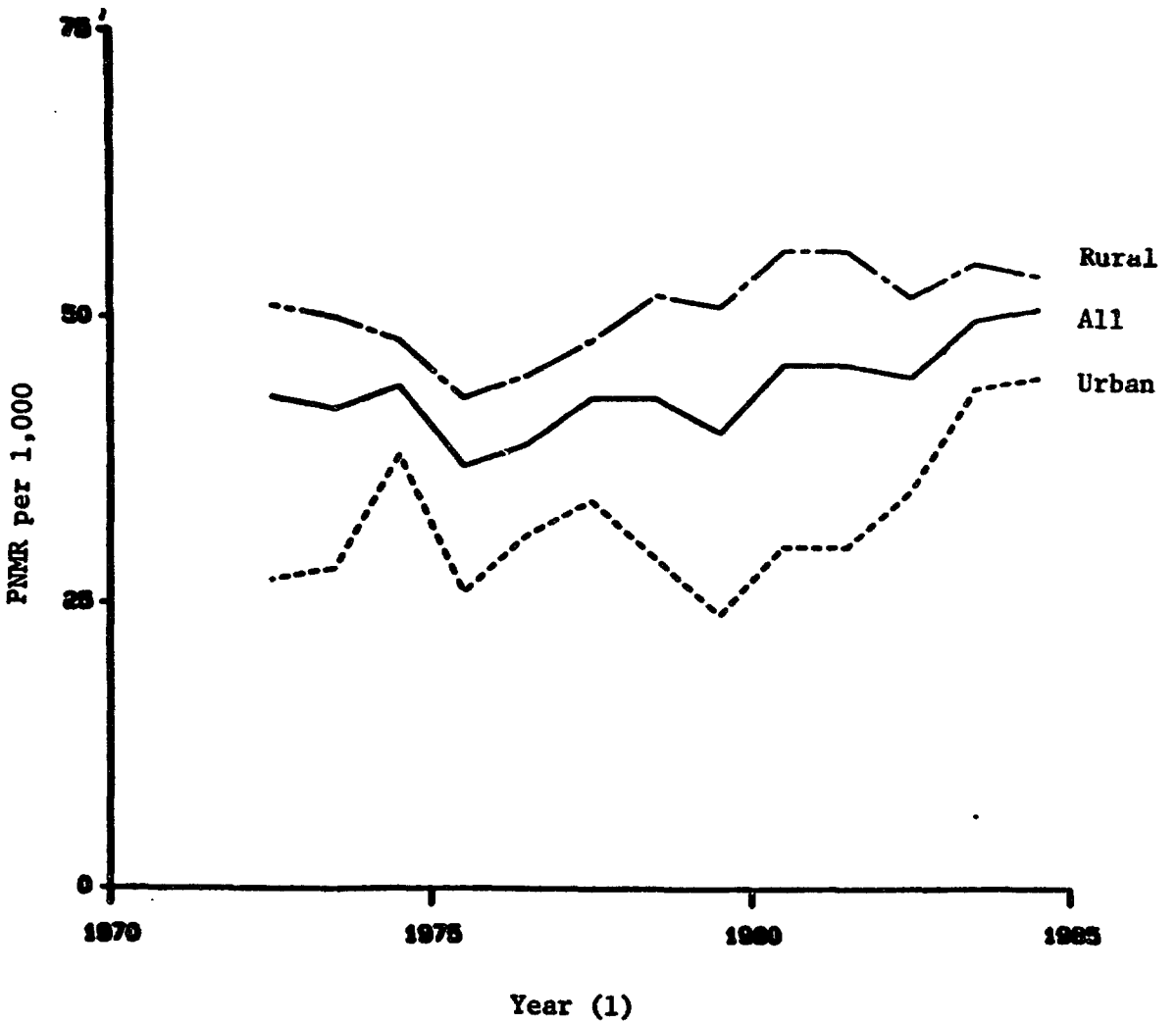
NOTE: (1) IMR 5 - [illegible] MOVING [illegible]

FIGURE 9. RURAL AND URBAN NEONATAL MORTALITY TRENDS IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)



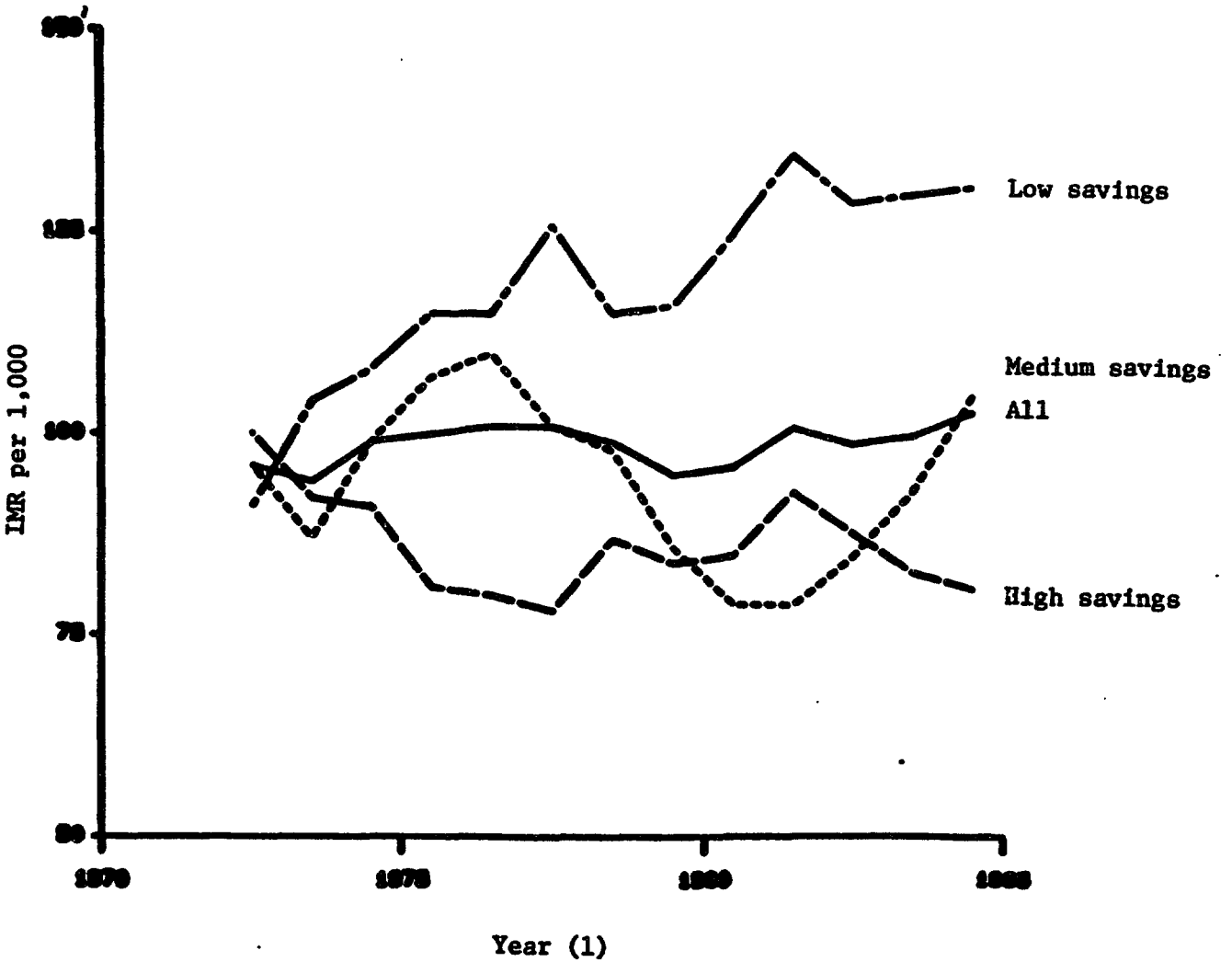
NOTE: (1) NNMR 5 - YEAR MOVING AVERAGE

FIGURE 10. RURAL AND URBAN POSTNEONATAL MORTALITY TRENDS IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)



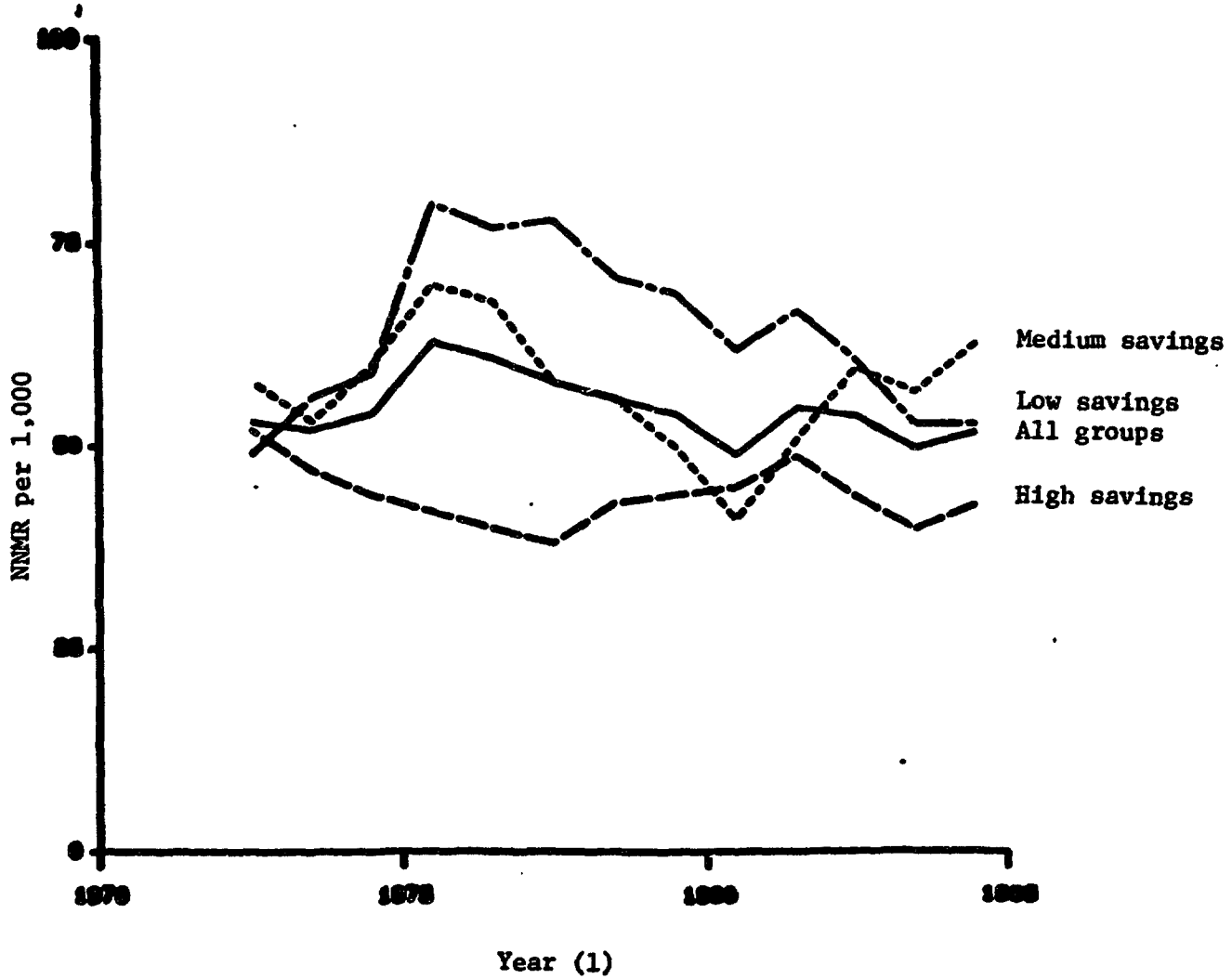
NOTE: (1) PNMR 5 - YEAR MOVING AVERAGE

11. ALITY TRENDS BY SAVINGS GROUP
IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)



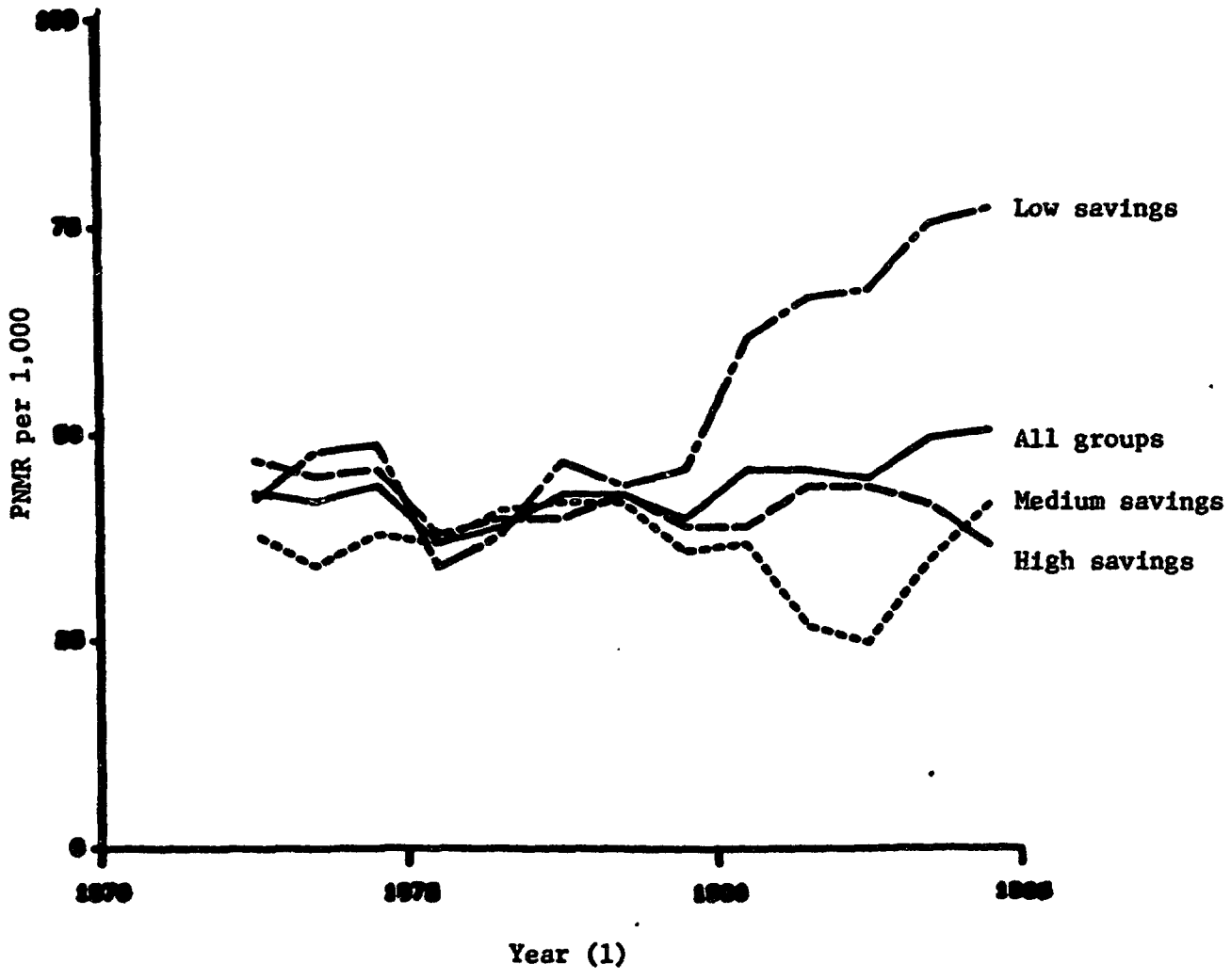
NOTE: (1) 5 - YEAR MOVING AVERAGE

FIGURE 12. NEONATAL MORTALITY TRENDS BY SAVINGS GROUP IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)



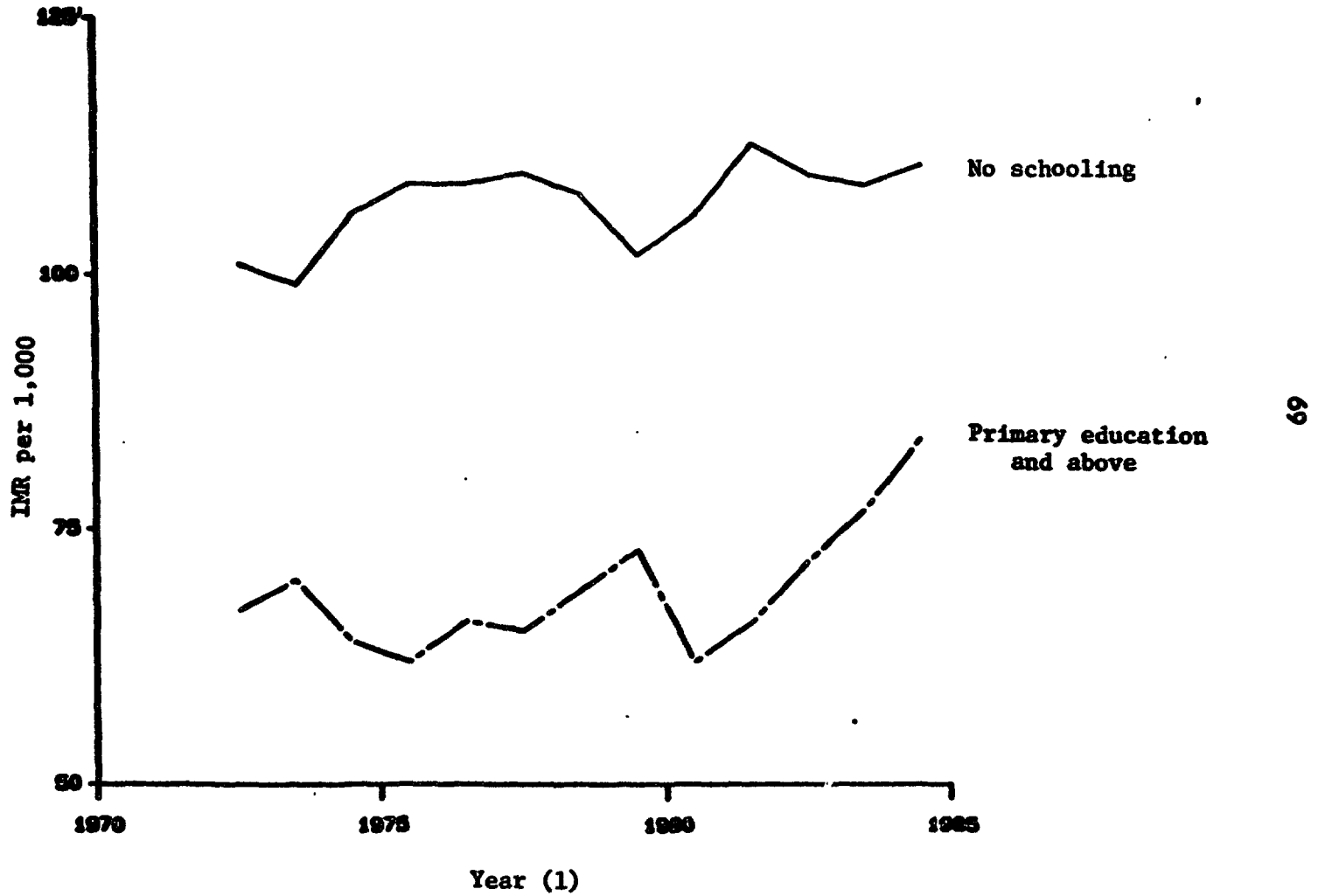
NOTE: (1) NNMR 5 - Year Moving Average

FIGURE 13. POSTNEONATAL MORTALITY TRENDS BY SAVINGS GROUP IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)



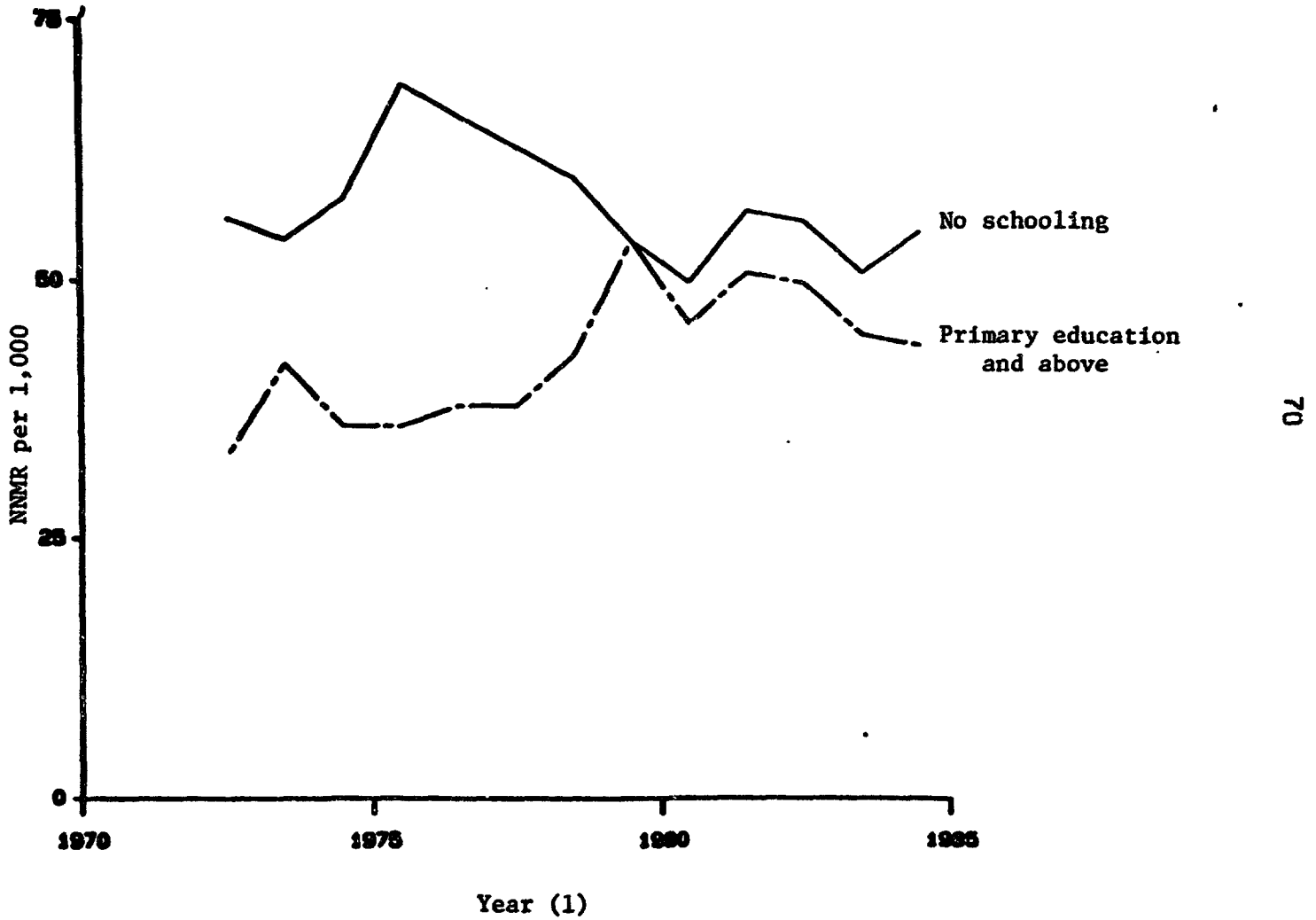
NOTE: (1) PNMR 5 - Year Moving Average

FIGURE 14. INFANT MORTALITY TRENDS BY MOTHER'S EDUCATION IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)



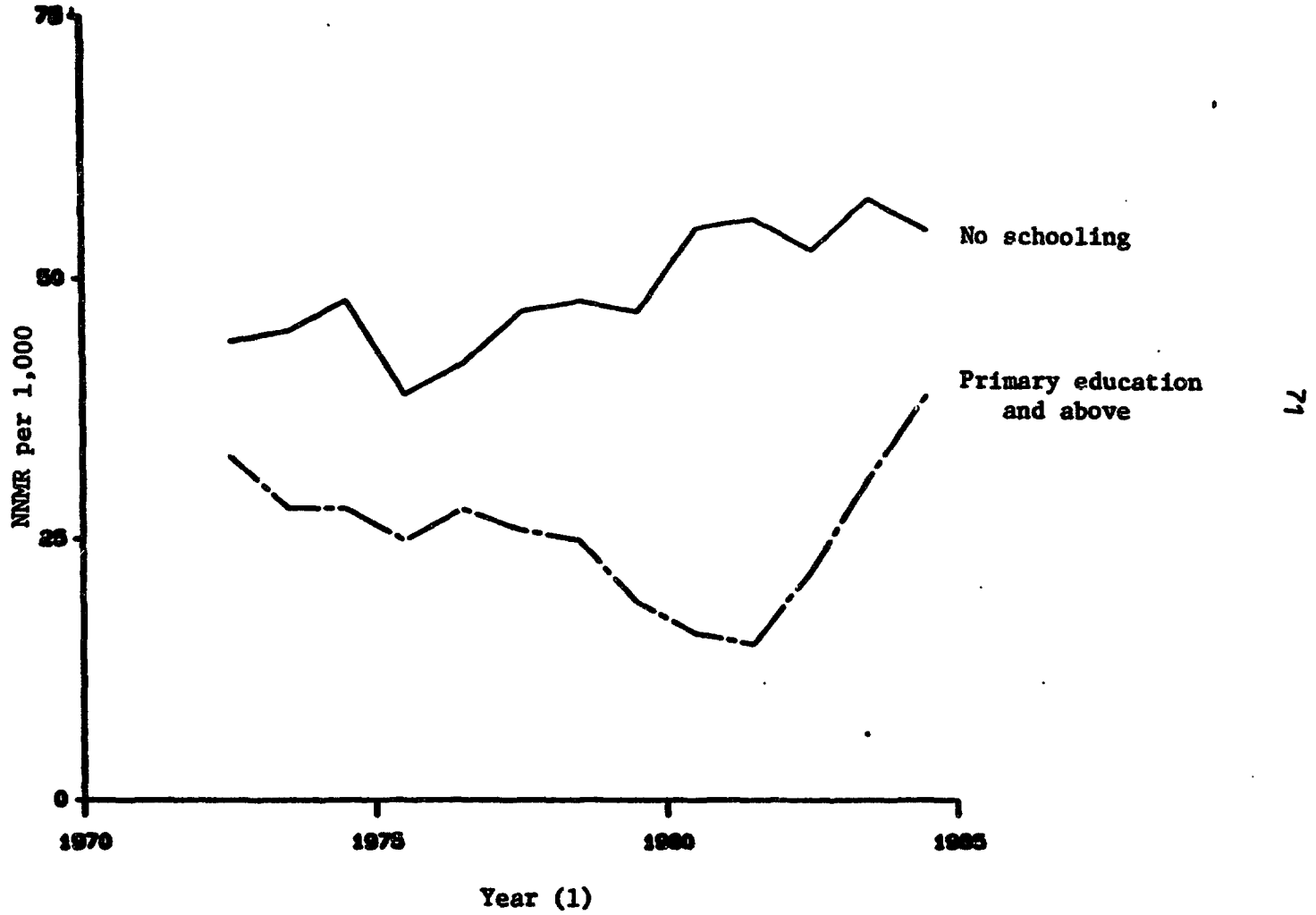
NOTE: (1) IMR 5 - Year Moving Average

FIGURE 15. NEONATAL MORTALITY TRENDS BY MOTHER'S EDUCATION IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)



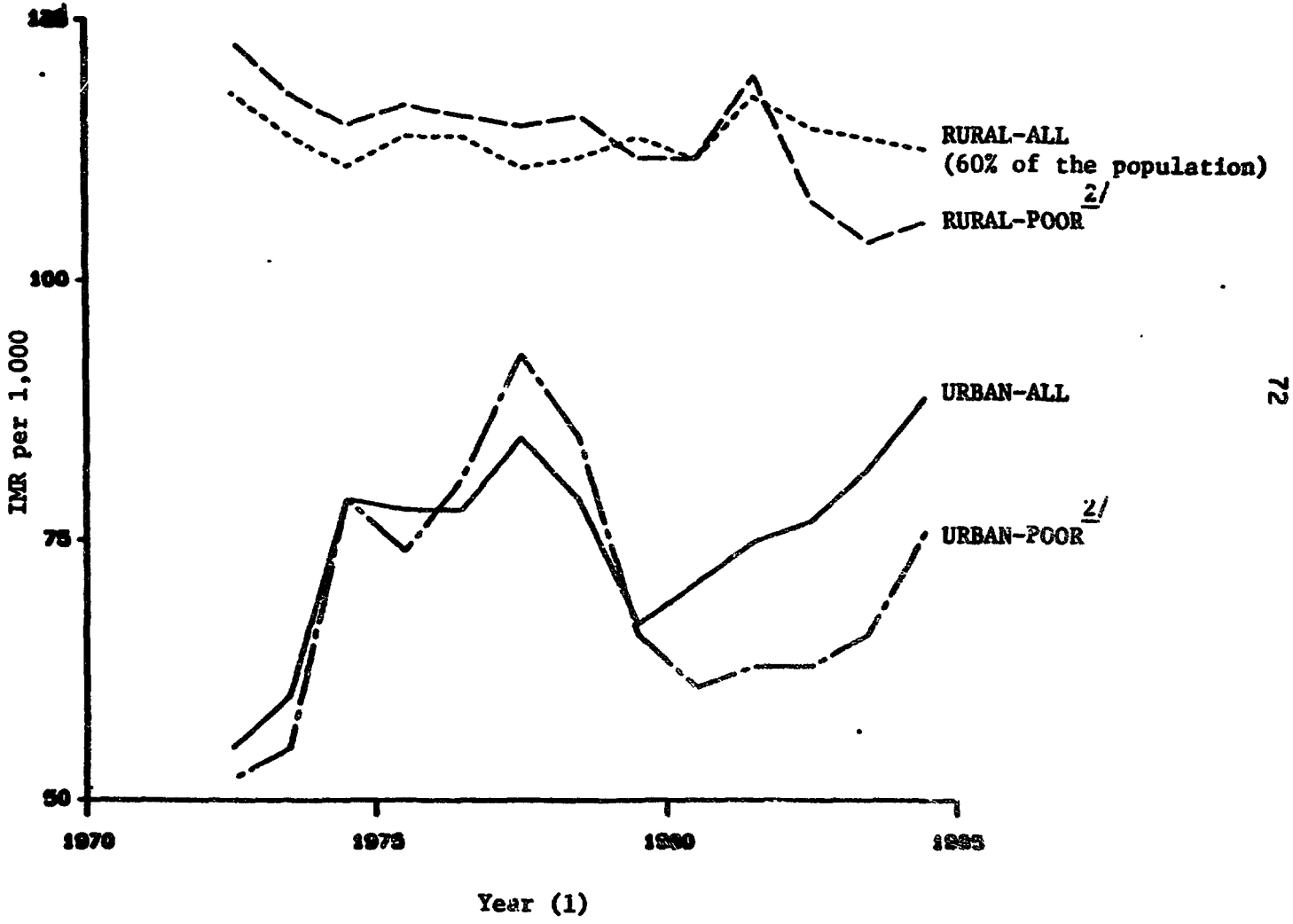
NOTE: (1) IMR_5 -- Year Moving Average.

FIGURE 16. POSTNEONATAL MORTALITY TRENDS BY MOTHER'S EDUCATION IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)



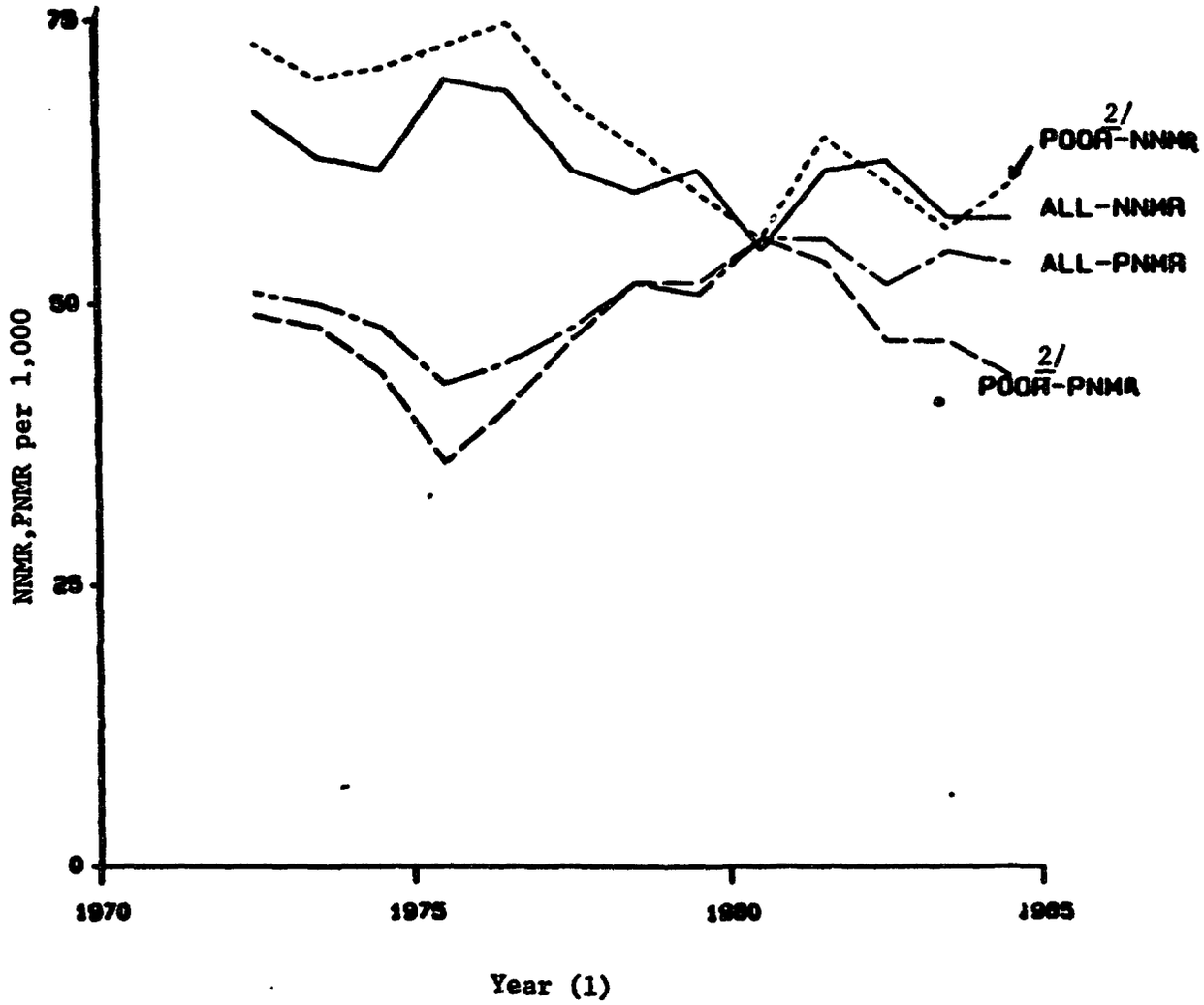
Note: (1) IMR 5 - YEAR MOVING AVERAGE.

FIGURE 17. INFANT MORTALITY TRENDS AMONG URBAN AND RURAL POOR IN COTE D'IVOIRE, 1970-86 (LSMS 1985/1986)



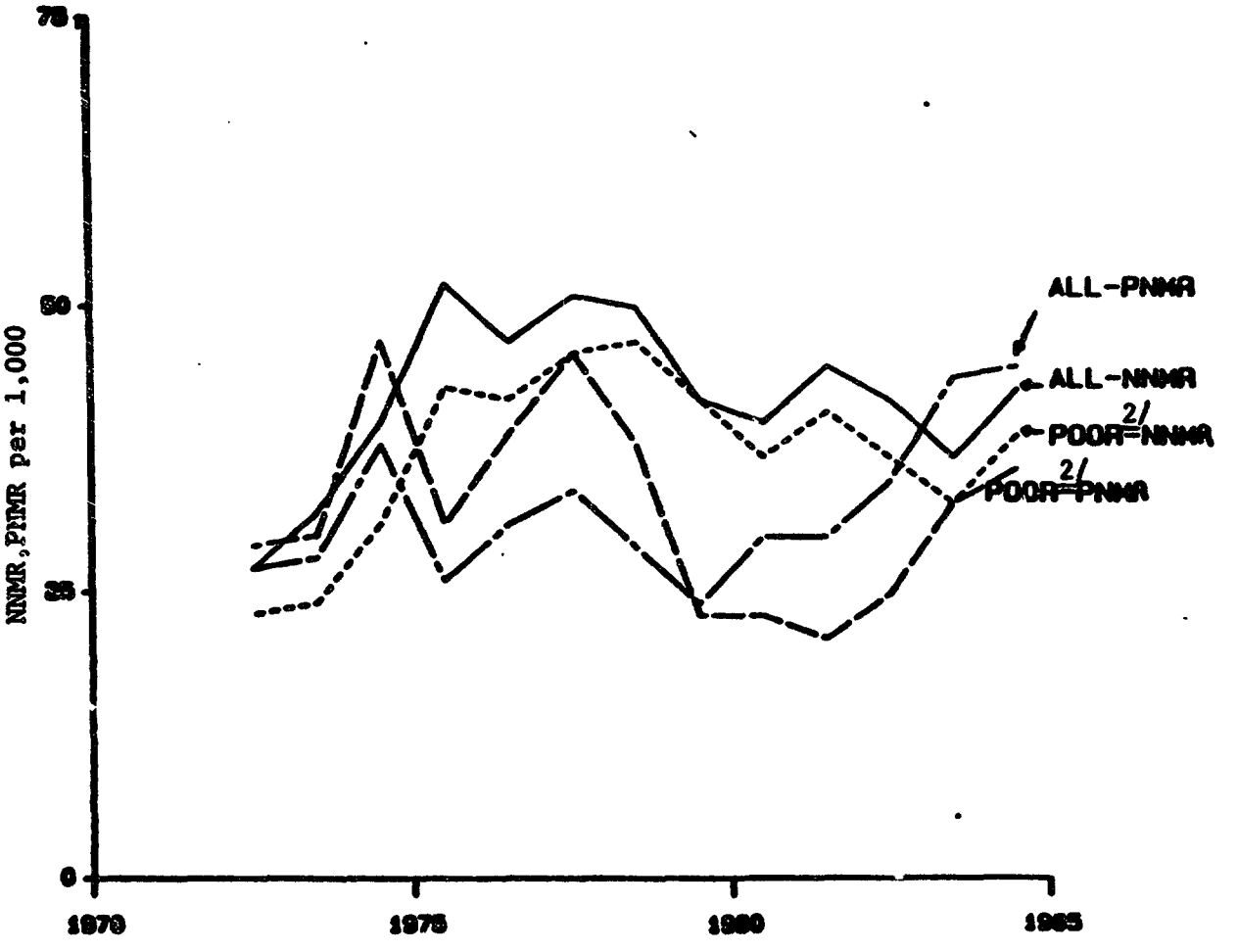
NOTE: (1) IMR 5 - YEAR MOVING AVERAGE.
(2) POOR: POOREST 60 PERCENT.

FIGURE 18. TRENDS IN INFANT MORTALITY COMPONENTS AMONG THE RURAL POOR IN RURAL COTE D'IVOIRE, 1970-86



NNMR NEONATAL - PMMR POSTNEONATAL
NOTE: (1) IMR6 - YEAR MOVING AVERAGE
NOTE: (2) POOR - POOREST 60 PERCENT

FIGURE 19. TRENDS IN INFANT MORTALITY COMPONENTS AMONG THE URBAN POOR IN URBAN COTE D'IVOIRE, 1970-86



NNMR NEONATAL - PMMR POSTNEONATAL

NOTE: (1) IMR6 - YEAR MOVING AVERAGE

NOTE: (2) POOR - POOREST 60 PERCENT

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