WPS 0652

Policy, Research, and External Affairs

WORKING PAPERS

World Development Report

Office of the Vice President
Development Economics
The World Bank
April 1991
WPS 652

Background Paper for the 1990 World Development Report

Demographic Response to Economic Shock

Kenneth Hill

Economic downturns not associated with famine appear to have little short-term impact on mortality. Famines, whether associated with major economic downturns or not, appear to have major short-term effects on mortality.

Policy, Research, and External Affairs

WORKING PAPERS

World Development Report

WPS 652

This paper — a product of the Office of the Vice President, Development Economics — was prepared as a background paper for the 1990 *World Development Report* on poverty. Copies are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact the World Development Report office, room S13-060, extension 31393 (29 pages).

The clear division of the world in the 1950s and 1960s into rich countries with low fertility and mortality and poor countries with higher fertility and mortality was used to support strongly held views that economic development was necessary for demographic change (particularly a decline in mortality) and that demographic change (particularly a decline in fertility) was necessary for economic development.

Cross-sectional relationships between mortality or fertility and economic indicators have been used to argue both for and against national or international health or family planning interventions. Policymakers want increasingly to know to what extent short-run economic fluctuations result in short-run demographic fluctuations.

Hill addresses this question with special attention to the possible effects on mortality of the Third World economic crises of the 1980s. He examines the historical record, working backward from the recent past to periods before the demographic transition.

The historical record, he concludes, does not support the existence of strong short-run responses in mortality to economic change and sometimes not even longer-term relationships. Clearly the strong cross-sectional relationship now evident between mortality and economic status must have arisen through some such long-term relationship. But fertility and mortality levels are low in Cuba and Sri Lanka, for example, despite less-than-impressive improvements in economic development.

Economic downturns not associated with famine appear to have little short-term impact on mortality. Famines, whether associated with major economic downturns or not, appear to have major short-term effects on mortality. Recent evidence for such a conclusion (including China in the late 1950s and possibly Ghana in the early 1980s) is bolstered by the historical record from Europe.

Table of Contents

Tables

Figures

Introduction

The links between economic and demographic change, both long run and short run, are of central interest to policy development. The clear division of the world in the 1950s and 1960s into rich countries with low fertility and mortality and poor countries with high fertility and mortality was used as support for strongly-held views that economic development was a necessary precursor of demographic change (particularly mortality decline) and that demographic change (particularly fertility decline) was a necessary condition of economic development. In the more recent past, a number of developing countries have achieved low fertility and mortality levels despite less than impressive improvements in economic development (Sri Lanka and Cuba are obvious cases). However, as shown by Preston (1980, 1985) the cross-sectional relationship between mortality and per capita income has remained strong, even though the relationship has shifted over time towards a lower level of mortality for a given level of per capita income. Similar changes have taken place in the relationship between fertility and economic indices, as shown on a cross-sectional basis by the World Bank 1984 World Development Report study (World Bank; 1985).

The cross-sectional relationships between mortality or fertility and indicators of economic development have been used to argue both for and against national or international health or family planning interventions. The strong relationships are taken to indicate that only economic advancement will alter demographic rates substantially; the changing relationships are taken to indicate that interventions can and do alter the demographic rates independently of the economic indicators. Rather different concerns arose in the late 1970s and early 1980s about whether demographic changes (specifically declines in fertility and mortality) were slowing down prematurely, a process often characterized as 'stalling' (see Gwatkin;1980 for mortality and Gendell;1984 for fertility). In the late 1980s, the concerns changed again, to the adverse mortality effects of the third world debt crisis and recession, and of the macroeconomic policies introduced to remedy such situations (Cornia and Jolly;1987).

The policy issues have thus recently become increasingly concerned with the short run: to what extent do short-run economic fluctuations result in short-run demographic fluctuations. The object of this paper is to examine this question with special reference to the possible mortality effects of the third world economic crisis of the 1980s. However, because the question is difficult to answer using recent data only, the historical record will also be examined, working backwards from the recent past to periods pre-dating the demographic transition.

Demographic Response to Economic Fluctuations in the 1980s

Across the developing world, the 1980s have been characterized by debt crisis, recession and concomitant macroeconomic adjustment policies, often introduced in collaboration with international organizations such as the International Monetary Fund and the World Bank. The impact of such developments has in fact been quite uneven, much stronger in Latin America and sub-Saharan Africa than in Asia. Cornia et al. (1987) have argued that the effects on government expenditures and household incomes of adjustment policies have slowed mortality declines or contributed to mortality increases in much of the developing world. Their arguments are based largely on observed cross-sectional relations between development and mortality and on limited empirical or impressionistic data for a small number of case studies. However, in a review of measures of child mortality for countries with data that satisfy specified quality standards, Hill and Pebley (1989) find no evidence of any slowdown in the rate of decline in childhood mortality in the 1970s or 1980s except for some decrease in the absolute decline in child mortality in Asia, where child mortality has reached low enough levels for constant absolute declines to be impossible and where the impact of the 1980s recession has been least.

Though Hill and Pebley find no evidence of a slowdown in the rate of child mortality decline, they recognize that, for a number of reasons, it is not possible therefore to conclude that the economic recession has had no effect on child mortality. The reasons why such a conclusion cannot at present be drawn from the recent empirical record are as follows. First, the number of countries for which recent estimates of child mortality are available is small, particularly for sub-Saharan Africa. The countries for which estimates are available may not be representative of all countries and thus of overall experience. Second, child mortality declines may have continued during the 1980s despite adverse economic conditions because of the widespread introduction of immunization programs, oral rehydration therapy and other elements of primary health care. Third, the mortality response to an economic shock may be lagged, so that effects may only become visible some years in the future.

All these reasons argue for an examination of the historical record, which is less affected by selection effects, is not contaminated by the simultaneous introduction of child survival programs, and allows careful examination for lags. The sections that follow examine relationships between demographic variables and economic indicators for individual countries and for other broad recessions.

The Case of Chile, 1967-87

Chile is an interesting case study because it has suffered a number of economic jolts over the last three decades and has excellent demographic statistics. Structural adjustment style policies of fiscal restraint, tight money and exchange rate devaluation were introduced in 1974 after the Pinochet coup d'etat, and a further sharp downturn in the economy occurred in 1982, coinciding with the debt crisis recession.

Taucher (1989) has analyzed the relationships between economic and demographic indicators in Chile over the period 1967 to 1987. Using real gross domestic income per capita as the economic index, and a range of indicators of nuptiality, fertility and mortality, Taucher concluded that marriage rates and fertility for first, second and third, but not higher order, births were strongly associated with economic fluctuations, particularly with lags of zero and one year, whereas infant mortality (and its neonatal and post-neonatal components), adult mortality and fertility above birth order three were only weakly, if at all, associated with economic change.

Some of the variables in Taucher's analysis show an essentially flat secular trend (for example, the total marriage rate and fertility up to birth order three) whereas others show strong secular trends (notably infant mortality, fertility beyond birth order three, and younger adult mortality). In order to get a clearer picture of fluctuations as opposed to trends, Taucher's data have been de-trended using 11 year moving averages. For each variable, the ratios of the observed values to the 11-year moving average have been regressed on the corresponding ratios of GDI per capita, with lags of zero, one and two years. The results of these models are shown in Table 1. A negative relationship between infant mortality (and particularly post-neonatal infant mortality) and per capita GDI lagged by one year approaches significance at the five percent level, suggesting that there is some child mortality response to economic crisis. Both fertility variables show a positive relationship with GDI per capita lagged by two years, whereas the total marriage rate shows an immediate positive relationship. The adult mortality relationships show few significant relationships, though male and female mortality over age 65 is negatively associated with per capita income lagged by one year (significant at the five percent level for females, and ten percent level for males), and female mortality at ages 45 to 64 and 65 plus is positively associated with zero-lagged per capita income. Taucher examined age-standardized cause-specific mortality rates for adults from 1975 to 1985. Although she found no significant relationships between such rates and per capita income, deaths from tuberculosis showed trend-reversing increases in 1976 and 1982-83, one year after each major economic downturn, and deaths from cirrhosis were negatively correlated with per capita income lagged by one and two years.

Taucher accounts for her finding of a lack of a strong relationship between infant mortality and economic performance in terms of a number of countervailing factors operating during the period. Existing social programs were targeted at maternal and child health during the recession. The educational level of the population was improving, as was the proportion with piped water supply. The structure of fertility was also changing as fertility declined, with a sharp reduction in higher order births. Taucher (1988) has explained part of the apparent lack of response of infant mortality to economic crisis in Chile in terms of short-run changes in the composition of births by social class, whereby the poor (with high infant mortality) reduced their fertility by more than the better-off (with low infant mortality), such that overall infant mortality, a weighted average across both classes, could decline even though infant mortality within both categories could have increased. Assuming that the poor have higher fertility, and thus contribute disproportionately to higher-order births, the data suggest the opposite effect. The proportion of births that were

Table 1: Regression Coefficients (Elasticities) of Demographic Fluctuations on Per Capita Income Fluctuations: Chile, 1966-1987

Demographic Variable	Gross Domestic Income Per Capita Lag 0	Lag 1	Lag 2	Constant	Adjusted R^2
Infant Mortality Rate	0.091 (0.68)	-0.654 (0.06)	0.316 (0.26)	1.22	0.37
Neonatal Mortality Rate	0.099 (0.67)	-0.418 (0.22)	0.131 (0.64)	1.19	0.03
Post-Neonatal Mortality Rate	0.075 (0.79)	-0.841 (0.06)	0.460 (0.19)	1.26	0.40
Cumulative Fertility, Birth Orders 1-3	0.050 (.39)	0.130 (0.13)	0.305 (0.00)	0.51	0.92
Cumulative Fertility, Birth Orders 4+	-0.147 (0.25)	0.124 (0.46)	0.483 (0.01)	0.48	0.82
Proportion of All Births of Order 1	0.155 (0.05)	-0.024 (0.79)	-0.166 (0.07)	1.05	0.70
Proportion of All Births of Order 4+	-0.201 (0.04)	-0.042 (0.70)	0.210 (0.06)	1.00	0.71
Total Marriage Rate	0.333 (0.04)	0.086 (0.63)	0.141 (0.37)	0.43	0.69
Male Mortality Index, Ages 25-44	0.802 (0.12)	-0.384 (0.52)	0.289 (0.54)	0.27	0.20
Male Mortality Index, Ages 45-64	0.170 (0.21)	-0.127 (0.45)	-0.167 (0.23)	1.10	0.49
Male Mortality Rate, Ages 65+	0.218 (0.18)	-0.454 (0.07)	0.278 (0.12)	0.96	0.34
Female Mortality Index, Ages 25-44	0.135 (0.42)	-0.158 (0.48)	0.130 (0.45)	[illegible]	0.00
Female Mortality Index, Ages 45-64	0.293 (0.03)	-0.282 (0.08)	0.016 (0.88)	0.96	0.62
Female Mortality Rate, Ages 65+	0.384 (0.05)	-0.599 (0.03)	0.387 (0.06)	0.82	0.53

Annual observations are deviations from detrended series.

Values in parenthesis are probability values.

first births shows a positive relation with unlagged per capita income (and then a negative relation with per capita income lagged by two years, a possible 'echo' effect), whereas the proportion of births that were of orders four or higher shows a negative relation with unlagged per capita income (and then a positive relation with per capita income lagged by two years, again possibly an 'echo' effect).

The re-analysis of Taucher's data using detrended series confirms several of her findings. A positive relationship is found between the total marriage rate and per capita income in the same year, and between cumulative fertility for birth orders one to three and per capita income, though primarily at a lag of two years rather than one. However, the detrended series shows a positive relationship between the total fertility for birth orders four and over and per capita income lagged by two years, and suggests a negative relationship, significant at the ten percent level, between both the infant mortality rate and the post-neonatal mortality rate and per capita income lagged by one year. The magnitude of this effect is substantial, with an elasticity of close to one, but it may be partly a birth order effect (putting the unlagged proportions of first births and fourth plus births into a model relating the infant mortality rate (or the post-neonatal mortality rate) to per capita income lagged by one year reduces the significance and absolute coefficient size of all the variables).

In summary, the Chile example shows a significant fertility and nuptiality response to economic crisis, and suggests possible infant mortality and mortality over age 65 responses. These responses are in the expected directions (a negative effect of crisis on nuptiality and fertility, a positive effect of crisis on mortality) and have plausible lags (zero for nuptiality, one year for infant and old age mortality, two years for low and high birth order fertility). One apparently implausible relation is found, a negative relationship with no lag between crisis and older female mortality.

The Case of China, 1955-65

The case of China in the late 1950s and early 1960s is the most dramatic well-documented recent example of sharp demographic responses to economic or social crisis (Ashton et al.,1984). From the mid-1950s to around 1960, the birth rate fell by one half, the death rate increased by about 50 percent, and the infant mortality rate almost doubled. This demographic crisis coincided with the Great Leap Forward, launched in 1958. The proximate cause of the crisis appears to have been widespread famine: foodgrain production fell in 1960 to only seventy percent of its 1958 level, and per capita daily food energy dropped by a similar amount. The famine in turn resulted from a combination of factors - inappropriate agricultural policies, overly rapid urbanization associated with the Great Leap, climatic disasters, and a failure to compensate for grain shortages through international trade.

The economic data for China are not adequate to study the crisis period in detail. However, certain demographic features of the crisis can be examined. Feeney and Yu (1987) have calculated period parity progression ratios[1] from 1955 to 1981. The progression to first marriage was hardly affected by the crisis, the largest effect being a reduction of less than two percent in 1959. All the parity progressions reached minima in 1961, the drops being largest for the highest order births; progression from marriage to first birth dropped from a pre-crisis level around 97 percent to around 80 percent, whereas progression from sixth to seventh births dropped from around 90 percent to only 55 percent. The two facts that parity-specific fertility control was rare in China prior to the 1960s and that the progression to first marriage was little affected by the crisis suggest that fertility fell through a physiological reduction in conception rates (reduced fecundability, reduced libido, or possibly voluntary abstinence) or through an increase in fetal loss, whether spontaneous or otherwise.

The mortality effects estimated by Ashton et al. show large increases in infant mortality, to levels 80 percent higher than previously, in three of the four years of the crisis period, but suggest more than a doubling of deaths over age 10 in two of the four years. The mortality impact of the crisis, though severe on the young, was many times more severe on the population, and particularly the male population, over age 60.

The crisis in China was primarily one of famine rather than one of the overall economy, though in part the famine came about as a result of inappropriate economic policies, and the famine undoubtedly had major economic effects. The crisis affected fertility and mortality, but had little impact on nuptiality. The effects on mortality were particularly pronounced for elderly males, though elderly females and young children also faced greatly increased mortality risks.

The Demographic Effects of the Great Depression in Developing Countries

The 'great' depression of the 1930s preceded major declines in either fertility or mortality in the developing world. The demographic effects of the depression should thus be somewhat easier to detect than such effects of recent economic changes, because of the absence of changes brought about by other factors. The difficulty of such studies of the developing world is the

[1] A period parity progression ratio represents the probability of progressing from one parity to the next, for example from having one child to having two, calculated for a particular time period, in this case a year, across all durations of exposure.

shortage of data: only a handful of developing countries have registration data on vital rates accurate enough to trace short run fluctuations with any accuracy. In order to increase the number of cases studied, an alternative source of data has been developed.

Demographic Fluctuations, Age Distributions and Growth Rates

One type of information that contains information about past demographic fluctuations and is available for a large number of developing countries is the age distribution. Certain types of demographic fluctuation, notably changes in the birth rate or in child mortality, leave evidence of themselves behind in population age distributions. For example, a decrease in the birth rate implies a lower than normal number of births in a given period, and, other things being equal, a small cohort born in the period at all subsequent observations of the population, until such time as the cohort becomes so attenuated by mortality that its initial smallness is no longer perceptible. An increase in mortality in a period has a similar effect; because child mortality rates are much higher than mortality rates at older ages until late adulthood, an increase in mortality typically has a much more pronounced effect on the numbers of young children than on any other age group up to late adulthood. Thus fertility or mortality fluctuations should be perceptible in population age distributions for at least fifty years thereafter. Population censuses in many countries of the developing world from the 1950s onwards provide us with numerous age distributions to examine for evidence of systematic demographic fluctuations earlier in the century. Unfortunately, such age distributions are often distorted by errors, particularly of age reporting and coverage. A procedure that limits the effects of such errors is described below. It is very similar to, though more flexible than, a method proposed by Ntozi (1988) based on age ratios.

Let us assume that each country has an underlying population age structure that is smooth and unchanging over time. In this smooth age structure, the proportion of the population aged a is s(a). The true age distribution is like the underlying smooth one, except that it has superficial irregularities arising from demographic fluctuations in the past. The true proportion of the population aged a at time t, p(a,t), is given by the smooth proportion, s(a), multiplied by a factor $\delta(t-a)$ characteristic of the period of birth of the cohort.

The reported age distribution is distorted in two ways. First, the proportion of persons of age a is distorted by an age-specific error $\alpha(a)$ that does not change over time. Thus the reported proportion of the population aged a at time t, po(a,t), is given by

$$po(a,t) = \alpha(a)p(a,t) = \alpha(a)\delta(t-a)s(a)$$

Second, the census at time t records a proportion $\beta(t)$ of the total population, a proportion that is constant across all ages a. Thus if the true population at time t is $TP(t)$. and the observed total population is $TPO(t)$, then

$$TPO(t) = \beta(t)TP(t)$$

We can now write the observed population aged a at time t, $PO(a,t)$, as

$$PO(a,t) = \beta(t)TP(t)\alpha(a)\delta(t-a)s(a)$$

Similarly, the observed population aged a at time t+n, the next census, is

$$PO(a,t+n) = \beta(t+n)TP(t+n)\alpha(a)\delta(t+n-a)s(a)$$

The observed growth rate in the population aged a between times t and t+n, $ro(a,t:t+n)$, can then be calculated as

$$\begin{aligned} ro(a,t:t+n) &= [1/n]\ln\{\beta(t+n)TP(t+n)\alpha(a)\delta(t+n-a)s(a)/ \\ &\qquad \beta(t)TP(t)\alpha(a)\delta(t-a)s(a)\} \\ &= [1/n]\ln\{\beta(t+n)TP(t+n)/\beta(t)TP(t)\} + \\ &\qquad [1/n]\ln\{\delta(t+n-a)/\delta(t-a)\} \\ &= ro(TPO,t:t+n) + [1/n]\ln\{\delta(t+n-a)/\delta(t-a)\} \end{aligned}$$

Thus

$$\delta(t+n-a)/\delta(t-a) = \exp[n(ro(a,t:t+n) - ro(TPO,t:t+n))] \qquad (1)$$

That is, the ratio of deviations from the smooth underlying pattern is a function of the difference between the appropriate age-specific growth rate and the growth rate of the total population.

The right hand side of equation 1 is easy to calculate, but an iterative procedure is required to obtain period-specific estimates of δ. Using age data classified by five year age groups, two sets of estimates are obtained by assuming first that each right hand side value in equation 1 is equal to $\delta(t+n-a)$, that is, that $\delta(t-a)$ equals 1.0, and then second that each right hand side value is equal to $1.0/\delta(t-a)$, that is, that $\delta(t+n-a)$ is equal to 1.0. The two series are then averaged to obtain a first series of estimates of δ, δ', for both t+n-a and t-a. These δ' values are then used in equation 1 to obtain two more sets of estimates, one of $\delta(t+n-a)$ and the other of $\delta(t-a)$, which are in turn averaged to estimate a second series of estimates of δ, δ''. The iteration continues until the values of δ stabilize. In practice, only small further changes take place after ten or so iterations.

Age-specific growth rates have limitations as a source of information. If calculated for five-year age groups, they can merely indicate the approximate time location and magnitude of past demographic fluctuations. They cannot distinguish between fertility and mortality effects. In real populations, they may also be effected by international migration, though such migration is generally small by comparison with fertility and mortality and is also unlikely to be concentrated in particular birth cohorts. Some residual effects of age misreporting, and particularly of changing age misreporting over time, may also distort patterns. However, age-specific growth rates can be used to identify common patterns over a large number of countries. These patterns can then be further elucidated by the study of the small number of countries with more extensive data.

Calculating Age-Specific Growth Rate Fluctuations

The deviations of age-specific growth rates from averages across all age groups are likely to be robust to certain types of data error. To increase robustness further, growth rates have been calculated only for countries with at least three censuses, and thus two sets of intercensal growth rates, since the Second World War, and have been calculated separately for males and females. Patterns of age misreporting that are not constant across censuses will thus tend to average out, and errors that are not constant across censuses but vary by sex will appear as systematic deviations between male and female patterns of change.

The calculations have been done as follows. For each country, sex and intercensal interval the age-specific growth rates were calculated for all five-year age groups. Each growth rate was assigned to each year of the five-year time period during which the population of the age group at the later census was born, and the reciprocal of each growth rate was assigned to each year of the five-year time period during which the population of the age group at the first census was born. When five-year time periods did not coincide with calendar years, growth rates were assigned to portions of calendar years, depending on the census dates. Thus for example for the age group 40-44 enumerated first at end-June 1958 and second at end-September 1965, the growth rate is ascribed to the time period exactly 40 to 45 years before the second enumeration date, that is, October 1920 to September 1925 (in practice, a quarter of the growth rate was ascribed to 1920, and three quarters to 1925, and a whole value for each year 1921 to 1924). The reciprocal of the growth rate is ascribed to the time period exactly 40 to 45 years before the first enumeration date, that is, July 1913 to June 1918. The average annual growth rate for each calendar year is then obtained, and this average annual series is used as the basis for the second iteration. Once the changes brought about by further iterations are very small, the process is stopped, and the resulting series of δ values are accepted. The process is repeated for all other intercensal intervals available, and final estimates for the country are obtained by averaging the δ estimates for each calendar year from each intercensal interval. A measure of agreement between the intercensal intervals is obtained by calculating the standard deviation for each calendar year from 1900 to 1950, and adding them up.

Each 'country' series has been further averaged into a 'regional' series by simply finding the average deviation across the countries of a region for each calendar year observed. Each country has equal weight in a region, regardless of the number of censuses the country may have had. Thus a country with only three censuses, and thus two sets of growth rates (the minimum used) has the same weight in the regional results as a country with seven censuses, and thus six sets of successive growth rates. It may be noted in passing that the more diversity there is in the dates of censuses within a region, the smoother the sequence of growth rate differences is likely to look. If all censuses are held on the same day in years ending in zero, each five year period will be represented by a horizontal line, and the series will not look smooth.

The average deviations by calendar year, sex and region, are shown graphically in Figure 1. The regions that have been used are South America (SAM), Central America and the Caribbean (CAC), sub-Saharan Africa (SSA), Middle East and North Africa (MENA), South Asia (SAS) (including Mauritius), and East and South-East Asia (ESEA). The countries included in each region, and the years of the census age distributions used, are shown in Appendix Table 1.

At first glance, all six regions show superficially similar patterns. Cohorts born in the early part of the twentieth century are larger than expected, those born in the 1930's and 1940's appear to be smaller than expected, and those born in the 1950's appear to be average or slightly larger than average. Closer examination suggests some different patterns, however. SAM and CAC show remarkably similar patterns, though the fluctuations are larger in the second group. Cohorts born around 1900 are large, decline somewhat to around 1905, rise again to a peak around 1910, remain high until declining sharply around 1920, recover briefly in the late 1920's, decline very sharply through the 1930's to a minimum around 1940, then rising steadily to the late 1950s. Patterns for males and females are practically identical. The main features are large cohorts between 1900 and 1920, and small cohorts between 1930 and 1950.

SAS and ESEA also have very similar patterns. The saw-tooth patterns that both show up to 1930, with peaks on years ending in zero and troughs on years ending in five, must be a consequence of age or date heaping[2]. Since the age-specific growth rate calculations are unaffected by proportionately unchanging heaping on terminal digits of age, the observed pattern is probably due to some additional heaping on terminal digits of year of birth, the heaping on years of birth ending in zero being greater than that on years of birth ending in five. Changes in the extent of misreporting from census to census could

[2] Age heaping is the widely observed practice of preferentially reporting ages that end in particular digits, generally 0 and 5, resulting in excess numbers (or 'heaps') of people appearing as, for example, age 40 relative to those appearing as age 39 or age 41.

also produce a saw-tooth pattern. The remaining features show cohorts of above average size from 1910 to 1930, cohorts of much below average size in the late 1930s and 1940s, and then generally above average sized cohorts in the 1950s. Male and female patterns are similar for ESEA, but show some differences in SAS, particularly from 1900 to 1940. Since the sex ratio at birth is unlikely to change much over time, variations in δ by sex must be due to differences by sex in mortality, migration or age misreporting. In the South Asia region, changes in sex differentials of mortality are a likely explanation.

SSA shows a rather simple pattern, with cohorts of above average size from the early part of the century, followed by cohorts of below average size for the 1940s and early 1950s. However, the region is represented by only three countries, and age reporting is particularly bad. The MENA region has larger than expected cohorts born up to about 1915, smaller than expected cohorts from 1915 to 1925, a recovery to slightly above normal in the late 1920's, much below average sized cohorts through the 1930s and 1940s, with a return to normality in the 1950s.

Tentative interpretations of the patterns appearing in Figure 1 are as follows. The above average growth rates for the cohorts born in the 1900s may reflect relatively large birth cohorts throughout the developing world, or they may reflect the substantial mortality declines (in absolute, not relative, terms) that the elderly have enjoyed since 1950. The small cohorts born in the late 1910s and early 1920s in the MENA region may reflect reduced fertility and possibly increased child mortality associated with the disruption caused by the First World War. The small cohorts surviving from around 1920 in SAM and CAC may reflect the high mortality associated with the 1919 influenza epidemic, though individual series do not show a clear effect. The small cohorts from the 1930s in SAM, CAC and MENA must be associated with the Great Depression, and accounted for either by reduced fertility or by increased child mortality. For all regions, the largest negative deviations from a smooth age distribution occur in the late 1930s and early 1940s, is clearly associated with the Second World War. The effect is particularly sharp in ESEA, reflecting widespread fighting and Japanese occupation in many of the countries, though whether fertility fell or child mortality rose cannot be determined from the age distribution. It is interesting to note that the Second World War had a stronger effect on population change than the Great Depression, even in non-combatant nations of sub-Saharan Africa and the Americas. In all regions, the late 1940s and 1950s show a return to normalcy, with no surge of growth except in the ESEA region. However, it should be remembered that rapid mortality decline at ages high enough to have substantial mortality rates will affect comparisons across long time intervals of 40 or 50 years.

Even though some of these interpretations are stretching the data, and may seem a bit fanciful, the results in Figure 1 show beyond doubt that demographic rates fluctuated quite substantially in the developing world prior to the onset of the demographic transition. As was noted earlier in the discussion of China, parity-specific control of fertility[3] through contraception or abortion was unusual prior to the demographic transition. In such circumstances, changes in fertility would arise from changes in union formation (delayed or accelerated marriage), spousal separation (possibly associated with fluctuations in short-term migration), changes in coital frequency (changes in libido or abstinence), changes in probabilities of conception (associated with nutrition), and changes in foetal loss (induced or spontaneous). Of these, only union formation can be examined with the sort of data available to us, though analyses by Lee (1981) of data for England over three centuries prior to the demographic transition suggest that foetal loss played an important role in fertility fluctuations consequent upon economic changes. On the mortality side, given that both preventive medicine and curative medicine reached only small proportions of the population, fluctuations would arise largely from variations in susceptibility and resistance, in both of which nutrition would be expected to play a key role.

<u>Case Studies of the Demographic Impact of the Great Depression</u>

In order to progress beyond the broad indication of demographic response in Figure 1, and the fanciful interpretations given above, it is necessary to turn to the cases of the few countries with adequate registration data covering the relevant period. Relationships between demographic indicators and growth rate fluctuations will be examined, to help confirm some of the interpretations given above, and demographic fluctuations will then be related to economic indicators as well. Three such countries will be examined: Chile, Costa Rica and Sri Lanka.

Chile

The birth rate, death rate and infant mortality rate for Chile from 1910 to 1950 (Mitchell;1983) are shown in Figure 2, together with deviations δ from a smooth age distribution for each year and gross domestic product at constant (1960) prices. Gross domestic product shows three substantial downward deviations, one around 1920, one in the early 1930s, and a brief deviation in 1943 and 1944. The infant mortality rate appears to be above trend around 1920 and again in the mid-1930s, but shows no clear deviation from trend in the mid-1940s. The birth rate does not fluctuate sharply from year to year (except

[3] That is, practices of fertility regulation that vary with the number of children already born to a couple, as opposed to practices such as breastfeeding that regulate fertility after every birth regardless of family size.

for an implausibly large jump in 1928), but drops from a general level around 40 per thousand prior to 1930 to a general level in the low 30s after 1930. Around these levels, 1918 and 1919 appear to have been years of low birth rate, 1927 to 1929 (and outstandingly 1928, possibly an error in the series) years of high birth rate, and the late 1940s show a modest upturn. The death rate shows a similar pattern to that of the infant mortality rate, with a general decline over the period interrupted by two reversals, around 1920 and in the mid- to late-1930s. The fluctuations implied by age-specific growth rates agree closely for males and females; they suggest above average cohort size from 1910 to 1915 and from 1925 to 1930, and below average cohort size from 1935 to 1940, and to some extent during the 1940s also. These growth rate fluctuations agree quite closely with the fluctuations around a rising trend in the net birth rate, the birth rate multiplied by the probability of surviving to age one, over five year periods.

A superficial view of Figure 2 suggests mortality increases following the GDP declines around 1920 and in the early 1930s, and a sharp decline in fertility (with no subsequent recovery) at the time of the 1930s GDP decline. Results of a regression analysis of detrended values of the birth rate, death rate and infant mortality rate on detrended GDP values with lags of zero to three years are shown in Table 2. Though the amount of variance accounted for by the economic variables is small, the relationships found have plausible signs and lags. The crude marriage rate and the birth rate are both positively and significantly associated with current (unlagged) GDP, but are not significantly associated with lagged GDP (though the negative sign for a lag of one year for both marriages and births suggests some bringing forward of future marriages and births as a result of good times, or postponement to the next year as a result of economic bad times). The association of the birth rate with unlagged GDP might be taken as suggesting a mechanism operating through foetal loss rather than through conception. Both the crude death rate and the infant mortality rate are negatively and significantly associated with GDP lagged by two years, but show no significant association at other lags. No mechanism for a lag of two years springs to mind.

The case of Chile early in the present century thus supports some of the earlier conclusions and speculations. The deviations of cohort sizes from smooth expected sizes do follow fluctuations in demographic rates quite closely. The economic reversals that occurred around 1920 and in the early 1930s were associated with substantial demographic responses, notably an immediate decline in births and marriages, and by an increase in both infant and overall mortality two years later. On the basis of these relationships, an increase of GDP to 10 percent above trend would be associated with an immediate increase in the birth rate of four percent, and a decrease two years later of 4.5 percent in the death rate and of three percent in the infant mortality rate.

Costa Rica

Figure 3 shows the birth rate, death rate and infant mortality rate for the years 1926 to 1950, the value of exports and imports at current prices for the years 1910 to 1946 (all from Mitchell,1983), and cohort deviations δ from expected smooth cohort sizes for periods from 1910 to 1950, for Costa Rica. Unfortunately, the demographic sequence is only available from 1926, because of a major discontinuity in the sequence of numbers of births between 1925 and 1926.

The birth rate fluctuates narrowly in the mid to upper 40s from the late 1920s to 1950, the values in the mid-1930s being slightly below trend. The death rate appears to fluctuate around 23 per thousand into the early 1930s,

Table 2. Relationships Between Detrended Demographic and Economic Variables; Chile, 1910 to 1950

Demographic Indicator	Economic Indicator GDP	GDP -1	GDP - 2	GDP - 3	Constant	R^2
Birth Rate	0.37 (0.02)	-0.19 (0.24)	0.20 (0.23)	0.09 (0.55)	0.52	0.10
Death Rate	-0.03 (0.83)	0.13 (0.37)	-0.45 (0.00)	0.16 (0.24)	1.20	0.21
Crude Marriage Rate	0.74 (0.00)	-0.09 (0.73)	0.13 (0.64)	0.32 (0.20)	-0.09	0.21
Infant Mortality Rate	-0.16 (0.20)	0.17 (0.22)	-0.31 (0.03)	-0.04 (0.79)	1.35	0.10

Figures in parentheses below coefficients are P-values. Figures in bold are significant at five percent level.

and then starts a decline interrupted by peaks in 1935 and 1942. The infant mortality rate appears to decline fairly steadily throughout the period, though with fluctuations around the trend and a sharp spike in 1942. The estimates of cohort size deviation show above average growth around 1910, and below average growth from the early 1930s to the late 1940s, but very little in the way of fluctuations from 1915 to the early 1930s. Economic conditions, as measured imperfectly by the current value of both imports and exports, show strong economic performance in the late 1920s and in the 1940s, and weak performance in the early 1920s and throughout the 1930s.

The estimates of demographic performance based on age specific growth rates appear to follow the economic indicator quite closely, lagged by two or three years. The demographic indicators based on registration data, however, show no apparent relationship either to the economic indicators or to the demographic indicator based on age distributions. This lack of relationships is confirmed by regressing the birth rate, death rate and infant mortality rate on the imports and exports variable, lagged by zero to three years. Regression results are shown in Table 3. None of the coefficients are significant at a five percent level, and their signs are often implausible. Thus the demographic rates based on vital statistics fail to show any short

Table 3. Relationships Between Detrended Demographic and Economic Variables; Costa Rica, 1926 to 1950

Demographic Indicator	Economic Indicator IMPEXP	IMPEXP-1	IMPEXP-2	IMPEXP-3	Constant	R^2
Birth Rate	0.03 (0.65)	-0.02 (0.69)	0.05 (0.38)	-0.01 (0.92)	0.94	0.14
Death Rate	-0.67 (0.13)	0.12 (0.63)	0.59 (0.08)	-0.56 (0.13)	1.48	0.05
Crude Marriage Rate	0.19 (0.50)	0.10 (0.54)	-0.11 (0.63)	-0.03 (0.91)	0.86	0.23
Infant Mortality Rate	-0.52 (0.34)	0.14 (0.67)	0.40 (0.33)	-0.41 (0.38)	1.36	0.00

Figures in parentheses below coefficients are P-values. Figures in bold are significant at five percent level.

term relationship between demographic and economic variables, though the lack of consistency of such demographic rates with the growth rate fluctuations suggests the possibility of problems with the vital rates.

Sri Lanka

Demographic and economic series for Sri Lanka from 1926 to 1950 (Ceylon;1953) are shown in Figure 4, together with deviations from average growth rates for cohorts born from 1910 to 1950. The features that stand out from Figure 4 are a mortality peak for both the death rate and the infant mortality rate for 1935 and a sharp mortality decline from 1946 to 1950. The birth rate trend has no such marked features, but appears to decline gradually through the early 1930s, recovering gradually through the 1940s. The deviations δ from a smooth age distribution show little change from the 1910s to the early 1930s, sharply smaller cohorts from the late 1930s and early 1940s, followed by a recovery to somewhat above expected cohort sizes in the late 1940s. The economic series, of export volume on a base of 1934-38 equal to 100, shows rapid expansion to 1929, a decline through most of the 1930s, followed by a strong increase through the 1940s.

The economic series and the growth rate series show a similar pattern of decline through the 1930s, followed by increase through the 1940s. The birth rate series shows a rather similar pattern, but the two mortality series show no increase in the 1930s with the exception of the sharp mortality spike in 1935[4], though the declines in the late 1940s mirror the improvement in the economic indicator. Thus no very clear association appears in the short run between economic change and demographic change, though the effective birth rate, the product of the birth rate and the probability of surviving to age one, is rather similar to the economic series from 1930 onwards. Regression analysis of the detrended demographic rates on detrended export volume with lags from zero to three years fails to identify strong short-term relationships. None of the coefficients, shown in Table 4, are significant at the five percent level, and many of the coefficients are of implausible sign (for example, all the coefficients of export volume with annual deaths are positive, such that, if export volume is a reasonable indicator of economic conditions, better economic conditions imply more deaths).

Table 4. Relationships Between Detrended Demographic and Economic Variables; Sri Lanka, 1926 to 1950

Demographic Indicator	Economic Indicator EXP	EXP - 1	EXP - 2	EXP - 3	Constant	R^2
Birth Rate	0.15 (0.36)	-0.37 (0.06)	0.27 (0.16)	-0.26 (0.25)	1.19	0.26
Death Rate	1.13 (0.27)	0.04 (0.97)	1.16 (0.29)	1.10 (0.40)	-2.33	0.00
Infant Mortality Rate	0.65 (0.51)	-0.16 (0.87)	0.60 (0.57)	1.14 (0.38)	-1.15	0.00

Figures in parentheses below coefficients are P-values. Figures in bold are significant at five percent level.

As in the case of Costa Rica, vital registration data for Sri Lanka fail to show any clear relationship between economic fluctuations and short-run demographic response. Fluctuations in age-specific growth rates do indicate a period of low growth in the 1930s, probably associated mainly with a gradual decline in the birth rate during the period, assisted by one sharp upsurge in infant mortality.

[4] The mortality spike in 1935 was attributed by contemporary observers to a malaria epidemic in that year. The early 1930s were characterized by mass unemployment in Sri Lanka, so the economic effect of the depression was probably greater than the export sequence suggests. The mortality decline in the late 1940s coincided with the introduction of public assistance payments in 1946, and major increases in public expenditures on health from 1945.

Pre-Industrial England

Extensive analysis has been carried out of time series of demographic measures in England covering the period from the 16th to the 19th centuries (Wrigley and Schofield; 1981). In an examination of short-term variations in vital rates and prices, Lee (1981) found the following relationships between prices and vital rates:

1. Grain prices were positively associated with mortality over two or three years, and then negatively associated, such that the net effect over five years was close to zero. Price variation accounted for only a small proportion of the variance in mortality, but the association was none the less very significant. The peak effect of a price change was delayed by two years. The relationship between prices and mortality weakened into the 18th and 19th centuries.

2. Grain prices were negatively associated with marital fertility, with an effect beginning with a lag of only about three months, and peaking at 10 months. Such lags suggest that foetal loss may have played an important role. A positive echo is found after 24 months, but the net effect over five years is still strongly negative. The relationship remains strong over all three centuries.

3. Grain prices are negatively associated with nuptiality, the effect being strongest in the same year. The effect of prices on fertility through nuptiality, however, appears to be negligible.

The long run relations between economic and demographic conditions in England during the period may have been far from typical. Wrigley and Schofield (1981) characterize the accommodation between production and population in England as 'a fertility-dominated low-pressure system' through 'wide, quiet fluctuations in fertility', as opposed to the 'mortality-dominated high-pressure system' through 'sudden, sharp mortality spasms' often portrayed as the norm. Mortality in England varied little in the medium and long term with economic changes; such mortality 'crises' as did occur arose from 'independent and unpredictable visitations of infectious disease.' Fertility, on the other hand, fluctuated substantially over the three centuries, and these fluctuations 'appear to have borne a close relation to secular economic trends'. Over the longer run, the fertility reactions resulted from the operation of the marriage system rather than through control of marital fertility.

Conclusions

A number of studies over the last few years have raised the prospect of substantial increases in mortality as a result of the structural adjustment policies and resultant economic recession in the developing world in the

1980s. Some studies have failed to find clear evidence of such increases in mortality (or reductions in the pace of decline). Hill and Pebley (1989), for example, examine child mortality estimates for five-year periods for those countries with acceptable data, and find no evidence of any change in the pace of decline of child mortality. They note, however, that contemporaneous factors such as child survival programs could have disguised the effect of economic fluctuations on child mortality. Behrman (1988) finds no evidence of a relation between mortality and economic factors in the short run, and finds no convincing empirical evidence of mechanisms through which such a relation would exist.

A strategy for increasing the number of observations over that available for the very recent past and for reducing the influence of confounding factors is to examine the historical record for evidence of demographic responses to economic fluctuations. Taucher (1989), using data for Chile from the late 1960s to the late 1980s, found a strong relation between both nuptiality and fertility up to and including third births and economic factors, but found little or no relation between such factors and fertility after the third child, infant mortality or adult mortality. However, a re-analysis of her data using detrended series confirmed the relations between economic change and fertility (at low and high parities) and suggested a response, lagged by one year, of infant mortality also.

A review of age distributions collected over the last four decades in developing countries suggests that in most parts of the world (exceptions are East Asia and sub-Saharan Africa) the numbers of survivors of births occurring during the Great Depression in the 1930s are below the numbers to be expected. Such low numbers of survivors could have arisen as a result of reduced fertility during the depression, or of increased child mortality. The numbers of survivors of births in the 1940s are small for all regions. An examination of three countries with more extensive data suggests that the small numbers did not in general arise from increases in mortality (though mortality in Chile apparently did vary with economic conditions, lagged by two years (the same lag as Lee (1981) found between mortality and grain prices in England three centuries earlier), and probably arose from reductions in fertility, though again no significant relationships could be found between fertility and lagged economic indicators (again with the exception of Chile, where fertility apparently reacted to economic change in the same year, similar to Lee's finding for England of a fertility response to grain prices starting at a three months' lag, and peaking at a nine or ten months' lag; the 'echo' found by Lee at 24 months in the English data is not evident in the Chilean data however).

The lack of demographic response to economic change prior to the second World War in two of the three countries studied in detail may be due in part to shortcomings of the data. The age distribution evidence for a large number of countries shows without doubt that some sort of demographic disturbance occurred during the 1930s, and it is reasonable to assume that it occurred as a result of the Great Depression. This disturbance may have had both fertility and mortality components, as in Chile, but in general the fertility component appears to have been larger than the mortality component. Such a finding would be in agreement with Lee's conclusions about economic and demographic relations in England prior to the industrial revolution.

In summary, the apparent lack of response of mortality to the economic crisis of the 1980s may not be surprising. The historical record does not support the existence of strong short-run responses of mortality to economic change, and in some cases does not even support the existence of strong longer-term relationships, though clearly the strong cross-sectional relation now evident between mortality and economic status must have arisen through some such long-term relation. The clearly-documented cases of mortality crises, such as the case of China in the late 1950s, have been associated with widespread famine. In one case of apparently rising mortality in the early 1980s, that of Ghana, famine may well have been the precipitating factor also. Thus economic downturns not associated with famine appear to have little short term impact on mortality, whereas famines, whether associated with major economic downturns or not, appear to have large short-term impacts on mortality. The recent evidence for such a conclusion is bolstered by the historical record from Europe.

FIGURE 1 : Deviations from Smooth Cohort Size by Region, Sex and Year of Birth, 1900 to 1950

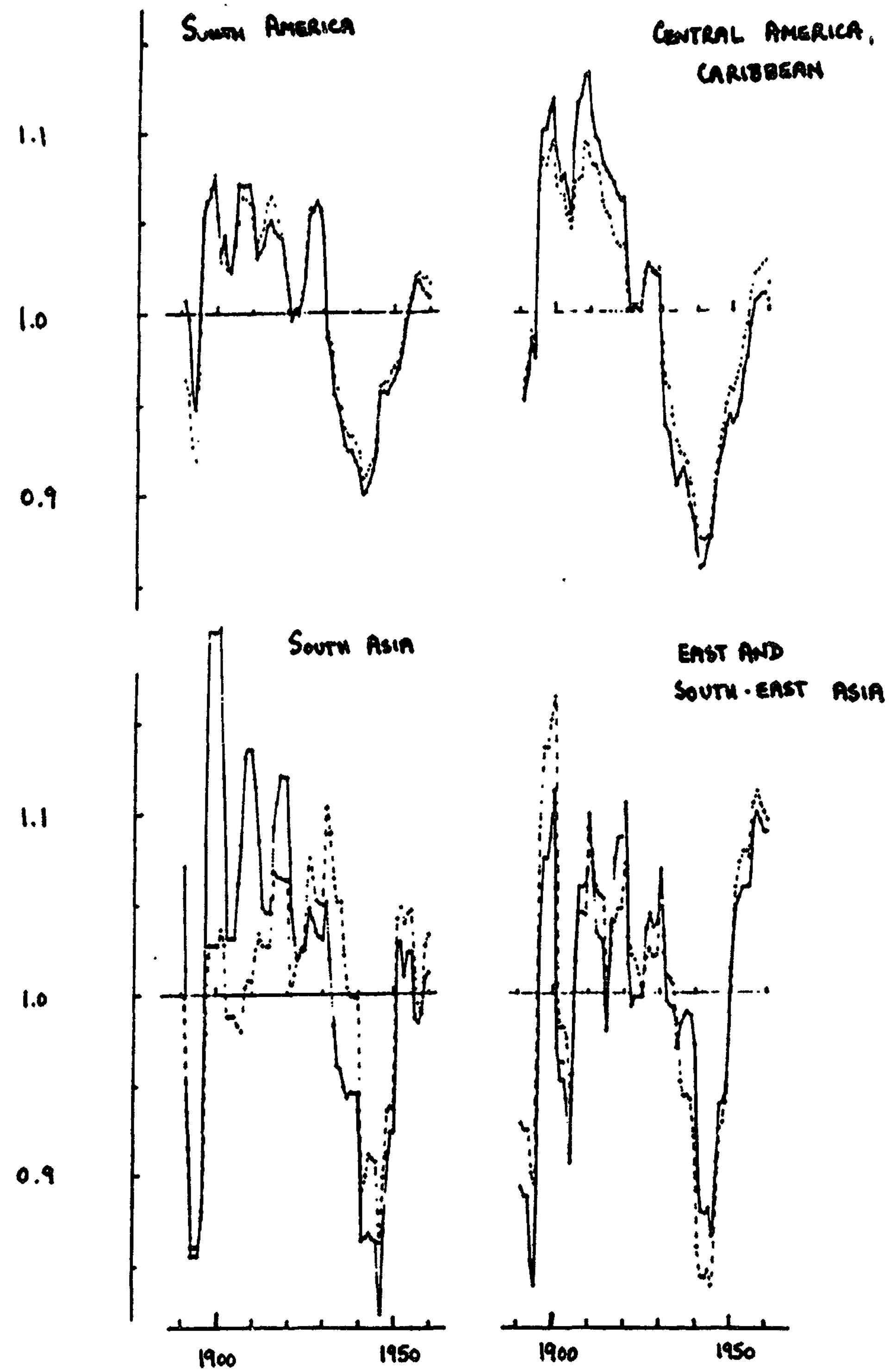


FIGURE 1 : Continued

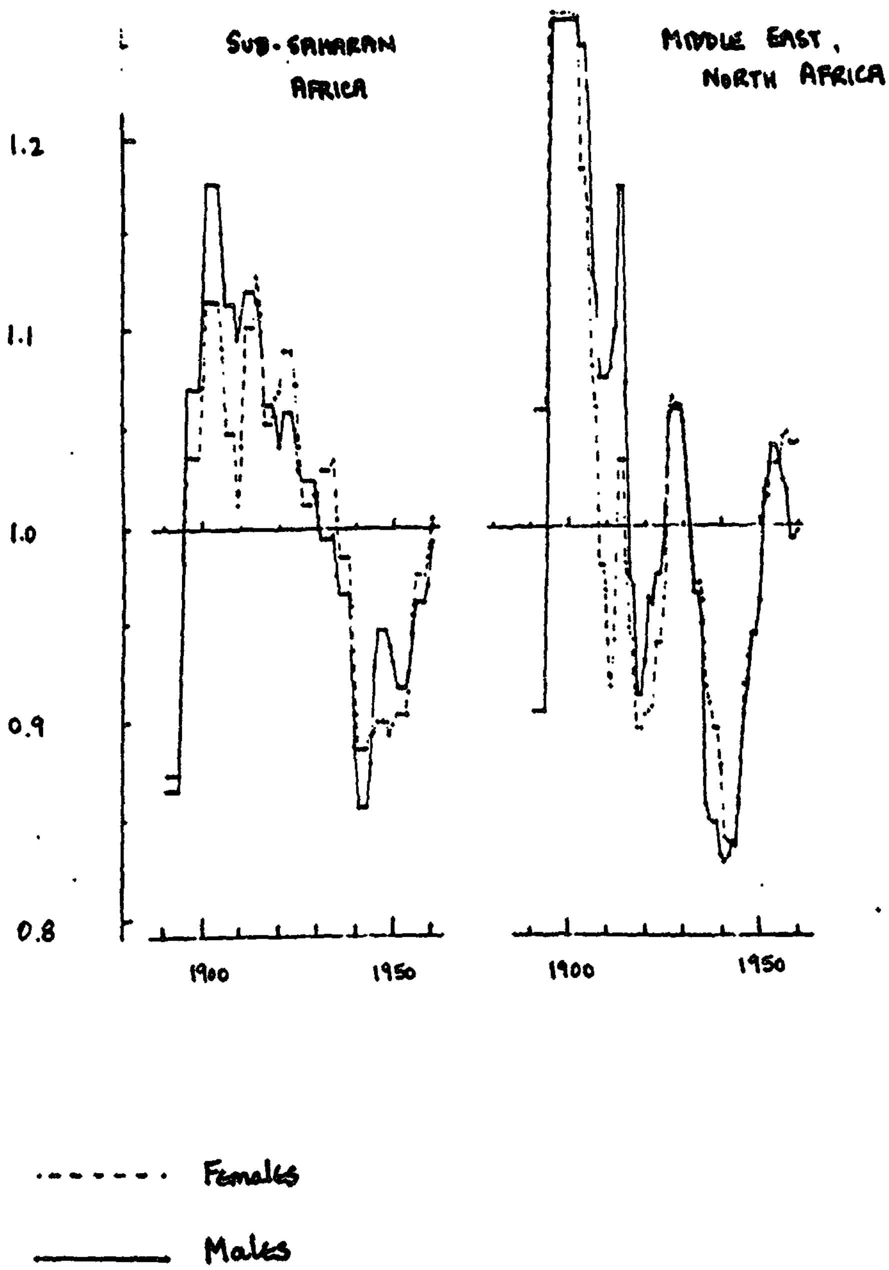


FIGURE 2 : Demographic and Economic Change, 1910 to 1950; Chile

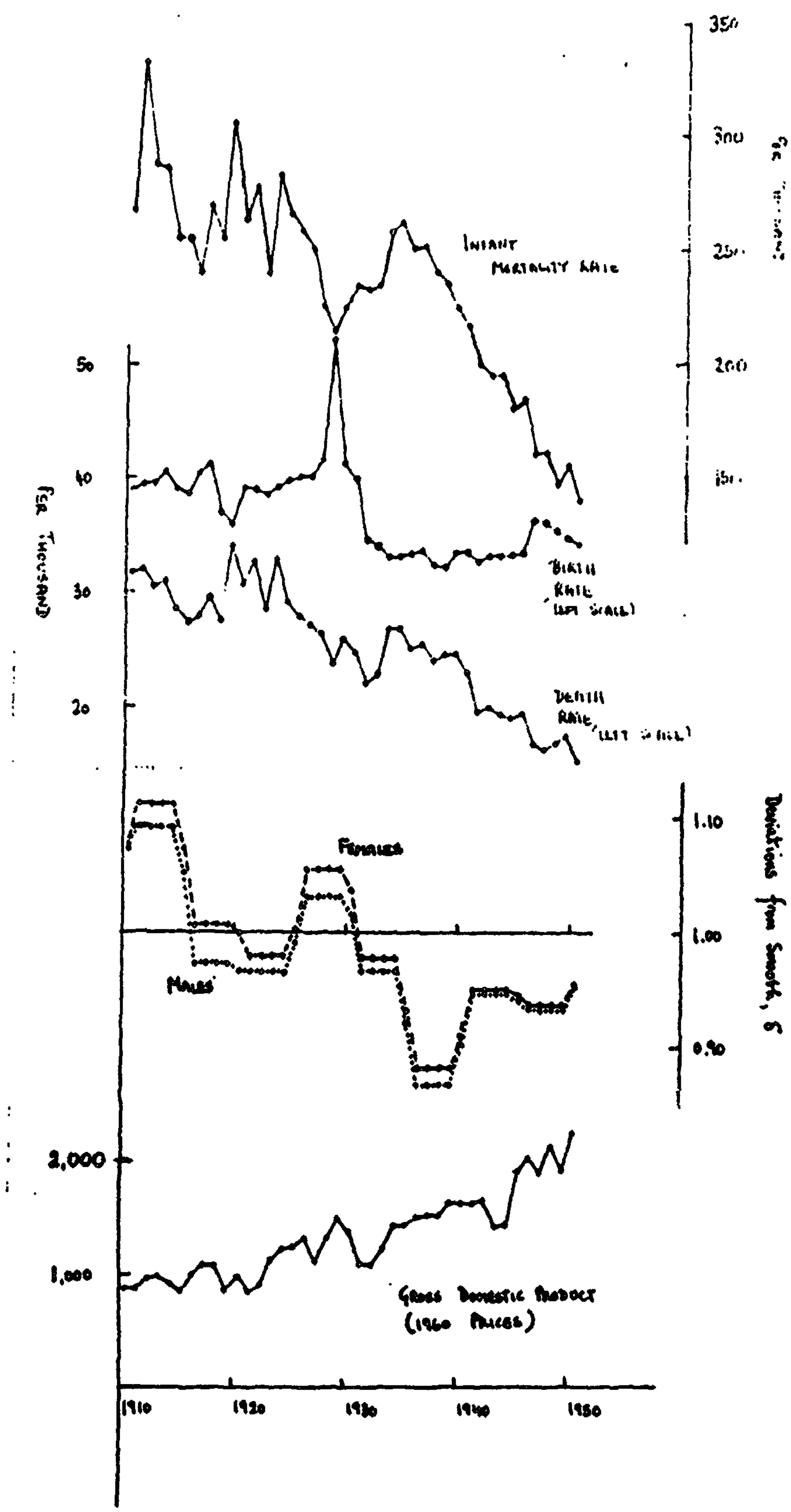


FIGURE 3 : Demographic and Economic Change, 1910 to 1950: Costa Rica

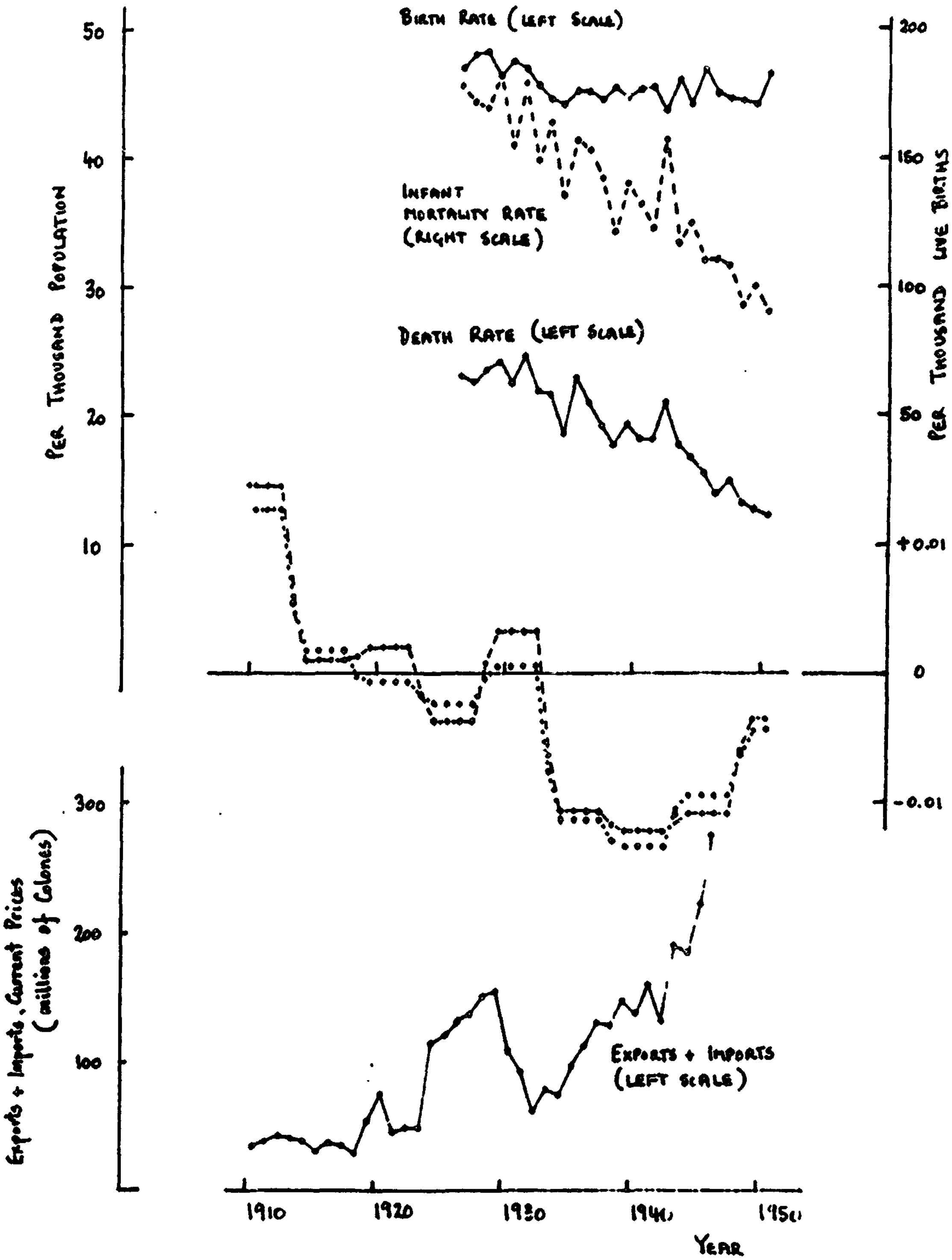
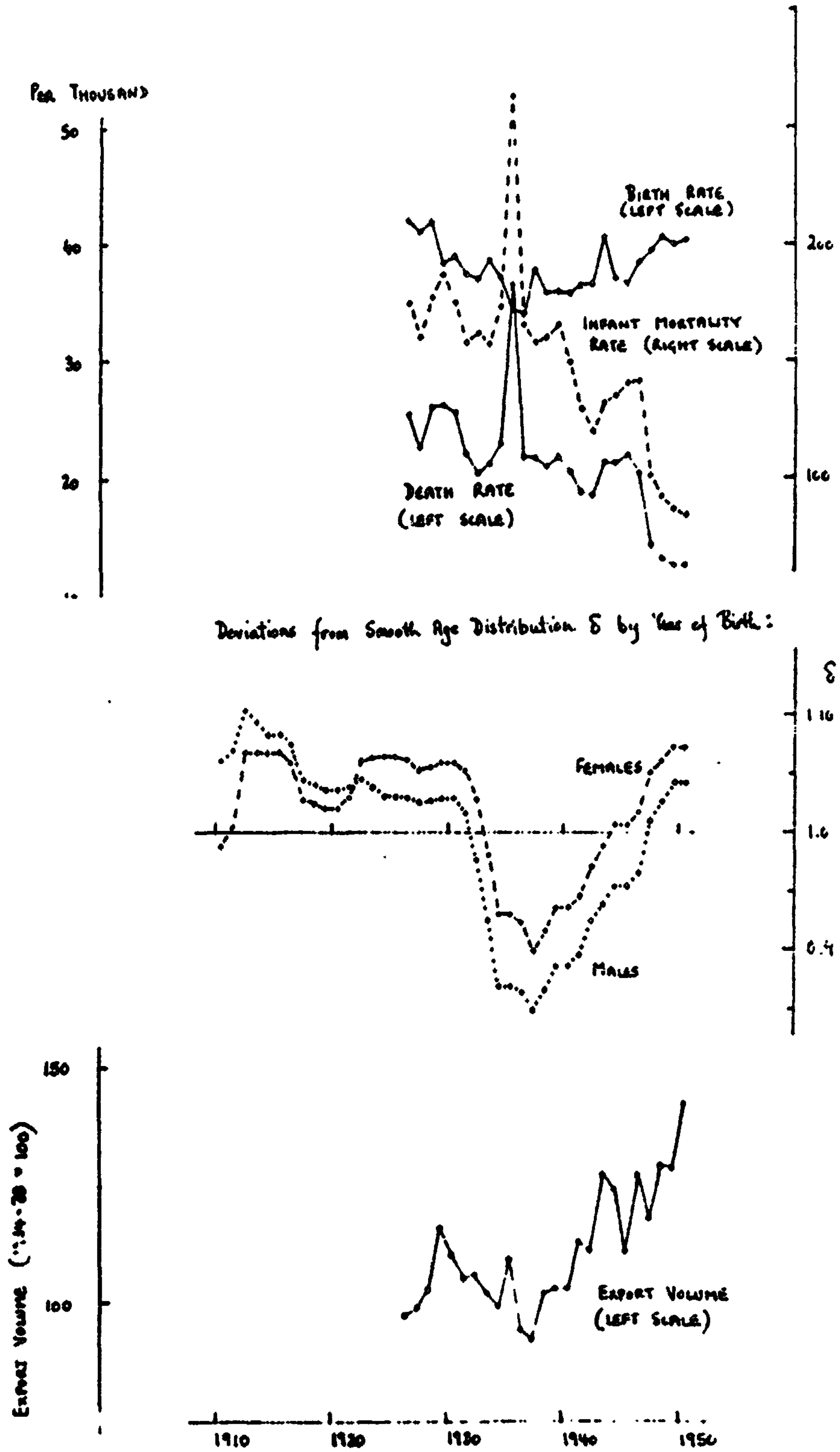


FIGURE 4 : Demographic and Economic Change, 1910 to 1950: Sri Lanka



Appendix Table 1: Countries and Censuses Included in Age-Specific Growth Rate Calculations.

Region	Country	Censuses
South America	Argentina	1960, 1970, 1980
	Brazil	1950, 1960, 1970
	Chile	1952, 1960, 1970
	Colombia	1951, 1964, 1973
	Ecuador	1950, 1962, 1974
	Paraguay	1950, 1962, 1972
	Peru	1961, 1972, 1981
	Venezuela	1950, 1961, 1970
Central America and Caribbean	Costa Rica	1950, 1963, 1973
	Dominican Republic	1950, 1960, 1970
	Guatemala	1950, 1964, 1973
	Honduras	1950, 1961, 1974
	Jamaica	1953*, 1960, 1970
	Martinique	1954, 1961, 1967
	Mexico	1950, 1960, 1970
	Nicaragua	1950, 1963, 1971
	Panama	1950, 1960, 1970
	Puerto Rico	1950, 1960, 1970
Sub-Saharan Africa	Ghana	1960, 1970, 1984
	Kenya	1962, 1969, 1979
	Mozambique	1950, 1960, 1970, 1980
North Africa and Middle East	Iraq	1957, 1965, 1977
	Tunisia	1956, 1966, 1975
	Turkey	1950, 1955, 1960, 1965, 1970
South Asia	Bangladesh**	1951, 1961, 1974
	Mauritius	1952, 1962, 1972
	Pakistan***	1951, 1961, 1981
	Sri Lanka	1953, 1963, 1971
South-East Asia	China, People's Rep	1953, 1964, 1981
	Hong Kong	1961, 1971, 1976*
	Korea, Republic of	1955, 1960, 1966, 1970, 1975
	Malasia, Sabah	1951, 1960, 1970
	Philippines	1948, 1960, 1970
	Thailand	1960, 1970, 1980

* Age distribution derived from large sample aurvey.
** East Pakistan in 1951 and 1961
***West Pakistan in 1951 and 1961

References

Ashton, Basil, Kenneth Hill, Alan Piazza and Robin Zeitz (1984) Famine in China, 1958-61. Population and Development Review. Vol.10 No.4, pp.613-645.

Behrman, Jere (1988) A Survey on Socioeconomic Development, Structural Adjustment and Child Health and Mortality in Developing Countries. Paper prepared for the seminar 'Child Survival Programs: Issues for the 1990s',held by the Institute for International Programs, Johns Hopkins University, Baltimore, 21-22 November 1988.

Ceylon (1953) Economic and Social Development of Ceylon, 1926-1950. Columbo: Ministry of Finance

Cornia, G.A., R. Jolly and F. Stewart, eds. (1987) Adjustment with a Human Face. Oxford: Clarendon Press.

Gendell, Murray (1985) Stalls in the Fertility Decline in Costa Rica, Korea and Sri Lanka. World Bank Staff Working Papers NO. 693. Washington D.C.: World Bank.

Gwatkin, Davidson (1980) Indications of Change in Developing Country Mortality Trends: The End of an Era? Population and Development Review, Vol. 6, No.4.

Feeney, Griffith and Jingyuan Yu (1987) Period Parity Progression Measures of Fertility in China. Population Studies Vol.41 No.1, pp.77-102.

Hill, Kenneth and Anne Pebley (1989) Child Mortality in the Developing World: A Case for Guarded Optimism. Forthcoming in Population and Development Review

Lee, Ronald D. (1981) Short-Term Variation: Vital Rates, Prices and Weather. Chapter 9 in Wrigley and Schofield, Op. Cit.

Mitchell, Brian R. (1983) International Historical Statistics: the Americas and Australasia. Gale Research Co.: Detroit, Michigan.

Ntozi, James P.M. (1988) Estimating Age Distributions from African Successive Censuses. African Population Conference. Liege: International Union for the Scientific Study of Population.

Preston, Samuel (1975) The Changing Relation Between Mortality and Level of Economic Development. Population Studies, Vol. 29, No. 2.

Preston, Samuel (1985) Mortality and Development Revisited. World Bank Staff Working Papers, No. 683. Washington D.C.: World Bank.

Taucher, Erica (1988) Efecto del Descenso de la Fecundidad en la Mortalidad Infantil. Estudion Tecnico 57s. Estudios sobre Mortalidad y Salud Infantil. Ottawa, Canada: International Development Research Centre.

Taucher, Erica (1989) Behavioural Factors in Demographic Responses to Economic Crisis. Paper presented to Informal Session I.13, IUSSP 21st International Population Conference, New Dalhi, September 1989.

World Bank (1984) World Development Report 1984. New York: Oxford University Press.

Wrigley, Anthony and Roger Schofield (1981) The Population History of England. Cambridge, Mass.: Harvard University Press.

PRE Working Paper Series

	Title	Author	Date	Contact for paper
WPS632	The Macroeconomics of the Public Sector Deficit: The Case of Argentina	Carlos Alfredo Rodriguez	March 1991	R. Luz 34303
WPS633	The Macroeconomics of the Public Sector Deficit: The Case of Thailand	Virabongse Ramangkura Bhanupongse Nidhiprabha	March 1991	R. Luz 34303
WPS634	Trends in Developing Country Exports, 1963-88	Bela Balassa	March 1991	WDR Office 31393
WPS635	Exchange Rates and Foreign Trade in Korea	Bela Balassa	March 1991	C. Cuskelly-Young 39413
WPS636	Economic Integration in Eastern Europe	Bela Balassa	March 1991	C. Cuskelly-Young 39413
WPS637	Poverty in Poland, 1978-88	Branko Milanovic	March 1991	WDR Office 31393
WPS638	Researching the Trade-Productivity Link: New Directions	James Tybout	March 1991	D. Ballantyne 37947
WPS639	The High Cost of Protecting Uruguay's Automotive Industry	Wendy E. Takacs	March 1991	D. Ballantyne 37947
WPS640	The Impact of Policy in African Agriculture: An Empirical Investigation	William Jaeger	March 1991	A. Yideru 34663
WPS641	Intertemporal Substitution in Consumption: Evidence for Some High- and Middle-Income Countries	Karsten N. Pedersen	April 1991	M. Hileman 31284
WPS642	How a Change in Brazil's Sugar Policies Would Affect the World Sugar Market	Brent Borrell	April 1991	A. Kitson-Walters 33712
WPS643	Regional Integration among Developing Countries, Revisited	Andras Inotai	April 1991	D. Ballantyne 37947
WPS644	Trade and Payments Arrangements in Post-CMEA Eastern and Central Europe	Constantine Michalopoulos David Tarr	April 1991	M. Colinet 34698
WPS645	Poverty, Policy, and Industrialization: Lessons from the Distant Past	Ben Polak Jeffrey G. Williamson	April 1991	WDR Office 31393
WPS646	The Developmental Effectiveness of Aid to Africa	Tony Killick	April 1991	S. King-Watson 33730
WPS647	Growth Rates and Aggregate Welfare: An International Comparison	Nanak Kakwani	April 1991	B. Rosa 33751

PRE Working Paper Series

	Title	Author	Date	Contact for paper
WPS648	Who Paid the Bill? Adjustment and Poverty in Brazil, 1980-95	M. Louise Fox Samuel A. Morley	April 1991	WDR Office 31393
WPS649	An Observation on the Bias in Clinic-based Estimates of Malnutrition Rates	Margaret E. Grosh Kristin Fox Maria Jackson	April 1991	B. Diallo 30997
WPS650	Administrative Valuation of Soviet Agricultural Land: Results Using Lithuanian Production Data	Karen Brooks	April 1991	C. Spooner 30464
WPS651	Taxation of Financial Assets in Developing Countries	Christophe Chamley	April 1991	A. Bhalla 37699
WPS652	Demographic Response to Economic Shock	Kenneth Hill	April 1991	WDR Office 31393