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Chapter Author: Ansley J. Coale

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## Introduction

ANSLEY J. COALE

OFFICE OF POPULATION RESEARCH, PRINCETON UNIVERSITY

THIS conference was planned to discuss the mutual influences in industrially advanced countries between changes in national population and changes in national economies. The conference was limited primarily to the causes and effects of variations in fertility and mortality, which are the principal determinants of changes in national populations. Questions of *local* population changes, often dominantly influenced by migration, were deliberately omitted. So were the causes and consequences of population change in underdeveloped economies. It was not the view of the planning committee that these topics were any less important than those we chose to emphasize; rather it was our view that demographic-economic relations on a national level in industrially advanced countries constitute more than adequate scope for one conference. The ensuing proceedings indicate that whatever weaknesses it had, the conference did not suffer from too narrow a focus.

The proceedings make accessible in a single volume a description of what demographers and economists think about economic influences on fertility and mortality, and about the influences of demographic factors on important economic variables. The papers are of first-rate quality and the discussion was lively and acute. The exchange of views between experts from two disciplines on something of mutual interest was, I believe, stimulating to both groups and it is to be hoped that the proceedings will have an interest as well for those who were not present.

When nearly twenty scholars are asked to write papers (each on a subject in which he has a special interest), the natural result is a somewhat diverse collection, each paper more easily understood and usually more immediately interesting to those who share the author's specialty. So it is with these papers. There are few readers indeed who would be equally at home with the technical demography in Norman B. Ryder's paper, the social-psychological survey material covered by David Goldberg, the theory of consumers' behavior in Gary Becker's paper, the statistics used by Richard and Nancy Ruggles, and the econometrics employed by Guy Orcutt and Alice M. Rivlin.

In other words, the proceedings do not and could not provide an

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integrated account of demographic-economic relations. In this situation I felt that the most useful introduction would be one devoted to a short statement of the theme of the conference to provide a background against which more highly specialized papers could be read. The informal essay that forms the rest of this introduction attempts to describe what the conference was about, without, however, trying to summarize the views of the participants.

Just as in the conference, there is more emphasis in this introduction on variations in fertility than in mortality. Fertility is emphasized because only industrially advanced countries are considered. Among such countries mortality differences are relatively slight. Moreover, mortality changes in the next decades are not likely to be strongly influenced by economic forces, nor is it probable that these changes will have major economic consequences. Expectation of life at birth varies only from sixty-four to seventy-three years among the industrialized countries, including under this term the European countries (except Iberia and the Balkans), Oceania, America north of the Rio Grande, Japan, and the Soviet Union. Also mortality is declining most sharply in the countries with the lowest life expectancy, so that differences are rapidly diminishing. In the countries with the lowest mortality there is little room for further declines in death rates except at the older ages. Unless on the one hand we are victims of a nuclear war or, on the other, the beneficiaries of a major break-through in the treatment of degenerative diseases, we can look forward to rather gradual further increases in life expectancy. These increases will not affect population growth nearly so profoundly as the variations we can expect in fertility. Nor will mortality improvements produce nearly such pronounced changes in age distribution as those already "built in" by past variations in fertility, or those to be expected in response to future fertility changes.

Fertility, on the other hand, has recently followed diverse courses in industrialized countries, and has a much wider current range than mortality. Gross reproduction rates vary from 1.03 in West Germany to 1.88 in Canada. The substitution of a gross reproduction rate of 1.88 for one of 1.03 would contribute an additional annual natural increase of 2.0 per cent to the rate of growth if mortality risks were unchanged. On the other hand, the range of mortality in industrially advanced countries—from a life expectancy of about sixty-four in the Soviet Union to one of about seventy-three in Norway—would yield rates of annual increase differing by only about 0.3 per cent, if fertility rates were the same in both instances.

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### *Economic Influences on Fertility*

Until the 1940's many demographers believed it possible to describe a characteristic course of fertility that one could expect in any area undergoing industrialization. This course was downward from the high fertility levels typical of pre-industrial agrarian economies to levels that they believed would be (without state intervention) even below the low rates found in western Europe in the 1930's.

Indeed until the 1930's every area that had reached an advanced stage of industrialization had experienced a prolonged and essentially unbroken decline in fertility. In the countries of northern and western Europe (and the overseas areas peopled by their emigrants) the decline had lasted at least forty years, and in some instances more than a century. Moreover, nearly universal patterns of differential fertility could be interpreted as evidence that the small-family custom had not yet completed its diffusion. Hence the slight revival of fertility in the late 1930's and early 1940's was viewed as merely a transitory interruption of the unfinished decline in response to economic recovery.

The classic pattern of differentials was a negative association between socio-economic status and fertility. Fertility tended to be lower among urban than rural families, among the educated than among the uneducated, among high income families than among low, and so forth. These differentials were attributed to a "cultural lag" in the acceptance of small families as desirable and in the mastery of the means to attain them. It was expected that the ultimate association of fertility to income would be positive, but that this correlation would arise when low-income families had accepted the restriction of births and had decided that they could afford only very small numbers of children. In fact a widely cited positive association between income and fertility existed in Stockholm in the 1930's, but Stockholm fertility was about the lowest in the world—at only some 40 per cent of replacement.

After more than twenty years of rising fertility in the United States it is clear enough that the revival in the late 1930's was anything but a temporary quirk. However, the interpretation of the baby boom as the natural consequence of prolonged prosperity is hardly more tenable than the earlier interpretation of the reversal in the 1930's as momentary. The next earlier period of notable prosperity in the United States—the 1920's—was a period of sharply falling fertility. In fact, as Dudley Kirk points out, the depressed 1930's produced *more* births by far than one would expect on the basis of an extrapolation of the trend of the

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prosperous 1920's. The observed high correlation between economic fluctuations and fluctuations in births is an association between deviations from trends. A prophet fully aware of this correlation and gifted with perfect foresight of the economic future would not have predicted in 1940 eighteen years of bumper birth crops.

Another basis for doubting any simple explanation of the postwar baby boom as the result of postwar prosperity is the variety of courses followed by fertility since World War II in industrialized countries. In countries where fertility had fallen to low levels by the mid 1930's there was a fairly general rise during the early years of World War II, and a nearly universal peak in 1946 or 1947 at a level much above the 1930's.<sup>1</sup> After the postwar spurt, however, trends in these countries have been quite varied. Following a brief decline during 1948-1950, fertility in the United States, Canada, Australia, and New Zealand rose rather steeply to levels that in 1956-1958 were well above the immediate postwar peak. Fertility in Norway in the mid 1950's was slightly above the level just after the war, while in the remaining countries of northwestern Europe the trend since 1947-1948 has been generally level or moderately declining. In no instance has there been a decline to the prewar levels. These countries have shared in the general prosperity since the war. But while immediately after the war the increase in fertility experienced, for example, by Sweden and New Zealand was similar—48 per cent above 1935-1939 in New Zealand, and 40 per cent in Sweden—continued postwar prosperity has been accompanied by fertility in New Zealand 7 per cent higher in 1956 than in 1945-1949, and in Sweden 10 per cent lower.<sup>2</sup>

At the same time countries with relatively high fertility in the 1930's (Russia, Italy, Spain, Portugal, and countries of eastern Europe) generally experienced continuing declines during and after World War II. Indeed, almost all of these countries now have lower fertility than the United States. Japan, after a brief postwar revival, has had an extraordinary decline, so that in 1957 Japanese fertility (as measured by the gross reproduction rate) was among the two or three lowest in the world. Yet many of these countries—for example, Italy and Japan—have enjoyed relative prosperity in many of the postwar years.

If depression and recovery do not explain the fertility reversal in the 1930's and the sustained rise since, how can we account for them? The

<sup>1</sup> West Germany was an exception.

<sup>2</sup> See Frank Lorimer's discussion for hypotheses about possible special factors affecting fertility in the English-speaking non-European countries.

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explanation is necessarily noneconomic in part. A reduction in average age at marriage, an increase in the proportion ever married, and a new record low in childlessness were developments not previously strongly associated either with national prosperity or with individual affluence; yet they account for much of the baby boom.

A hypothesis that would further diminish the importance of prosperity in accounting for the recent course of fertility was suggested during the conference discussion. This hypothesis is that when the custom of family limitation is in the later stages of its spread through a population, the fertility of that population is temporarily depressed below any tenable long-term level. There are two bases for the hypothesis. One is that *period* fertility will tend to fall below an equilibrium level because birth restriction by different cohorts will be bunched in the same period. The other basis is that a few cohorts at the peak of the fashion of birth control will carry the practice further than later cohorts who view family limitation more as a matter of course.

Period fertility would fall temporarily below an equilibrium level (defined as equal to the average fertility of cohorts long after family limitation has completed its spread) because many couples just taking up contraception might already have had all the children they wanted. A couple of this sort might have had, for example, three children when the wife is twenty-seven and, having discovered birth control, decided to have no more. Had they practiced contraception from marriage the third birth would have occurred, say, when the wife was thirty. Thus the diffusion of contraception through the population could mean that members of a series of marriage cohorts would simultaneously reduce fertility to an unusual degree.<sup>3</sup>

But the fertility of the marriage *cohorts* whose childbearing occurs at the culmination of the spread of contraceptive practice also tends to fall below the fertility of later cohorts. When birth control is still a new idea, keeping up with the Joneses means having fewer children. But when voluntary control of family size has become nearly universal, infertility no longer conveys any invidious distinction. In fact a large family may even take on a Veblenian value as a form of conspicuous expenditure.

The hypothesis that period fertility tends to swing below its equilibrium level suggests that there would have been a fertility minimum followed

<sup>3</sup> In fact, as Norman Ryder shows, if the spread of contraception results in a rising average age of childbearing and an increasing dispersion about the average age, period fertility is necessarily depressed relative to the fertility of cohorts then at the central ages of childbearing.

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by a revival in the 1930's even if there had been no depression and no subsequent boom. These economic events may have caused merely an accentuation of a sequence that would have occurred anyway. If this notion has validity, fertility in Japan should soon reach bottom, even under favorable economic circumstances, and then recover somewhat, an eventuality that seems the more likely in view of the drastic role played by abortion in achieving the low current levels. This hypothesis is not put forward with any real confidence, but merely as a possible alternative to a view that overemphasizes economic factors.

Data on differential fertility, while too complex to be summarized here, can be described in brief as showing for recent years only a slight relation between income and family size. In recent interview surveys specifically designed to explore the factors affecting fertility, income is found to be very weakly related to desired or expected family size, while a similarly slight relationship is found in Current Population Survey data between achieved fertility and income.<sup>4</sup>

While it can be confidently asserted that short-run economic fluctuations have a fairly predictable impact on short-run fertility variations, we can only guess what fertility would accompany an extended continuation of prosperity on the one hand, or a prolonged depression on the other.<sup>5</sup>

### *Economic Influences on Human Mortality*

The effect of economic variables on risks of dying in the industrially advanced countries is probably weaker and less direct than effects on fertility. From a very long-run point of view, of course, there has been a fairly intimate causal association between increases of life expectancy and industrialization. Mortality reduction has been the result of law and order and regularity of food supply, but overwhelmingly the consequence of purer water supplies, environmental sanitation, the gradual development of vaccines and serums, and in recent years remarkable progress in perfecting insecticides, chemotherapeutics, and antibiotics. It is hard to imagine that these developments in medicine and public health would have occurred *without* changes in industrial organization and techniques. An examination of the periods of most rapid mortality improvements in Europe or the United States makes it clear that the proximate force at work was some innovation in medicine or public health, not a period of unusual prosperity or industrial progress. Thus

<sup>4</sup> See David Goldberg's and Clyde V. Kiser's papers.

<sup>5</sup> See papers by Dudley Kirk and by Orcutt and Rivlin.

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mortality reduction was accelerated when large cities acquired better water supplies in the nineteenth century, and when such recent scientific advances as antibiotics and insecticides were introduced.

Perhaps the most remarkable instances of mortality reduction largely independent of economic change are to be observed in the low-income areas of the world today. In these areas medical innovations are being introduced from the industrialized parts of the world with startling effects on death rates, both in areas that are developing economically and in areas that are not. There may be some question about the permanence of the gains in longevity achieved in low-income areas unless profound economic and social changes occur soon. But it seems probable that the course of mortality in *industrialized* areas can be safely discussed without reference to prospective variation in strictly economic forces.

### *Mortality, Fertility, and Population Change*

Population growth equals net immigration plus the excess of births over deaths. Many national populations no longer experience large changes from net migration, and growth depends very largely on the balance of mortality and fertility.

The age structure of a population is an important determinant of births and deaths. Reproduction is limited to a particular segment of the life span, in industrialized countries births occur mostly to women twenty to forty, and mortality is increasingly concentrated in relatively advanced ages. The death rate is about eleven per thousand in England and Wales, where the life expectancy is seventy years, and only eight in Japan, where the life expectancy is sixty-six. The cause of this apparent anomaly is differences in the age distributions. Japan's population has a much smaller fraction over age fifty.

The age distribution of a population is also of major direct economic significance because age is a determinant of economic behavior. For example, consumption patterns are very different at different ages, and labor force participation is highly correlated with age.

The age structure of a population that has been affected neither by heavy recent gains or losses through migration nor by very large military losses is almost wholly the result of the past history of its fertility. Continued high fertility produces a population with many children and with numbers that rapidly diminish with age; continued low fertility produces a population with relatively few children and with a high proportion of the aged. A *decline* in fertility will yield a population that has few children and a temporary "bulge" in early adult ages, while a rise in fertility



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produces many children and a temporary deficit in early adult ages. These effects are illustrated by the United States age distributions of 1940 and 1957. The 1940 age distribution shows the effect of the preceding prolonged fertility decline, with a scarcity of children and relatively many persons in early adult ages. The 1957 age distribution has a high proportion of young children because of recent high fertility, a conspicuous trough resulting from the minimum fertility of the 1930's, and a high proportion over fifty, reflecting the high fertility before 1910.

Changes in mortality that have occurred to date have had very slight effects on the age distribution. In brief, the United States age distribution is very similar to the one that would exist had current mortality risks always prevailed while fertility followed its actual historic course.<sup>6</sup> However, our population is much *larger* and is growing faster than would be the case if mortality had failed to decline.

The interrelations in a closed population of growth, size, age distribution, fertility, and mortality can be described in a few summary statements.

1. Population size depends on the size at some previous date and the interim rate of growth.

2. The rate of population growth depends on fertility, mortality, and the age distribution. Growth increases with fertility, and decreases with mortality. It also is increased by an age distribution with high proportions in the ages of childbearing, and with low proportions in the ages of high mortality.

3. The age distribution is almost wholly determined by the past course of fertility.<sup>7</sup>

### *Population Change and Per Capita Output*

In this very brief statement the sort of population changes brought by high fertility will be contrasted with those brought by low fertility.<sup>8</sup> Mortality will be neglected as a contributing variable for reasons already given. I shall first discuss the effect of demographic variables on aggregate

<sup>6</sup> For an explanation of this fact see Frank W. Notestein's paper, and the references there cited.

<sup>7</sup> However, future variations in mortality *may* have a substantial impact on the age distribution if there is an unprecedented improvement in survivorship at advanced ages with trivial improvement at young ages.

<sup>8</sup> High fertility here means simply above low fertility, which in turn is taken as a gross reproduction rate at least high enough to insure replacement or, to be more concrete, high fertility means a level comparable to that now current in the United States or Canada, and low fertility means a level like that in France, England or Scandinavia.

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demand. Subsequently it will be assumed that deficiencies in demand can be ignored, and questions of the influence of population on the aggregate production function will be discussed.

### POPULATION AND EFFECTIVE DEMAND

The sort of population change produced by high fertility serves as a stimulus to aggregate demand. High fertility, of course, promotes more rapid growth than low fertility. Fast growth implies higher and more secure returns from producers' investment and a stronger tendency for consumers to buy durable equipment such as homes and furniture. High fertility also produces an age distribution with only a small proportion in the ages of labor-force participation. If the population of labor-force age is used as the invariant element in comparing age structures, it is clear that the labor force has more dependents to support if current and recent fertility are high. More dependents per earner tend to raise the consumption function at the expense of savings and exert an upward pressure on government expenditures, especially for education. In short, higher fertility raises the demand, *ceteris paribus*, for goods currently consumed, for durable consumers' goods, for producers' goods, and puts upward pressure on government expenditures.

A high fertility population in an industrialized country, where low mortality can be assumed, thus has many children relative to its adult population, and many persistent pressures toward higher expenditures—pressures toward inflation and high levels of employment.

### POPULATION AND PRODUCTIVITY

This section is a very short outline of how variations in fertility and mortality affect output per capita in industrialized countries. Full employment is assumed. The underlying concept employed is an aggregate production function where total output depends on inputs of labor, capital, and resources.

The principal analysis compares output per capita with low fertility and with high. Consider first labor input in relation to the size of the population. Low fertility tends, *ceteris paribus*, to yield a larger labor force relative to total population, for two reasons: because low fertility brings about an age distribution with a higher proportion in the ages of usual labor-force participation, and because low fertility increases the possibility of women's entering the labor force.

Next there is the question of the relation of labor inputs relative to resources. If we assume for the moment that the supply of capital is

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equally favorable with high or low fertility, the relationship to resources becomes essentially a question of economies of scale. High fertility ultimately produces more workers, and the problem is whether economies of scale in using resources tend to offset tendencies toward diminishing returns. There is no clear-cut answer except in the long run. Life expectancy having reached some seventy years, high fertility—even the modest sort of high fertility characteristic of the United States—implies quite rapid growth, to something like a billion persons in the United States in a century, six billion in two centuries, and one person per square foot in about seven hundred and fifty years. Ultimately, high fertility produces a population that overwhelms *any* finite resources, and diminishing returns must sometime become more important than economies of scale. But short-run predictions that larger populations would put a disastrous strain on resources have repeatedly proved wrong. Apparently there has been little rise in the cost of extracted products (farm products and minerals) relative to highly processed products. This fact does not *prove* that economies of scale have offset diminishing returns. After all, had population growth been less, raw materials might have become *cheaper* relative to other products. Also, the technological effort required to maintain the flow of useful resources at no higher relative cost might have been used to achieve greater productivity in other parts of the economy. But it nevertheless remains a tenable hypothesis that the real costs of using resources are fairly constant over a wide range of population size, and that high fertility would not on this account tend to produce lower per capita output for many years in the industrialized countries.

Two further points must be noted on the question of population size. Simon Kuznets emphasizes the crucial role of technical knowledge in raising productivity and speculates that if geniuses constitute a fixed proportion of the population, a larger population might contain more geniuses and attain faster scientific and technical progress. It was stated during the discussion of Kuznets' paper that because of the international transmission of information his argument applies to the population of the world rather than to a national population. Moreover, the extraordinary bursts of intellectual output in classic Greece, in Renaissance Italy, in the England of Elizabeth I, Bacon, and Newton, and in Budapest during the 1920's and 1930's bring into question the importance of numbers as such as a source of intellectual progress.

The second further point about size is that whatever the elasticity of resources as population grows there is one resource—living space—that inevitably becomes scarce. Harold Barnett recently quoted a passage

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from John Stuart Mill, who more than a century ago stated with typical eloquence the inevitable problem of space limitation:<sup>9</sup>

There is room in the world, no doubt, and even in old countries, for a great increase in population, supposing the arts of life to go on improving, and capital to increase. But even if innocuous, I confess I see very little reason for desiring it. . . . It is not good for man to be kept perforce at all times in the presence of his species. A world from which solitude is extirpated, is a very poor ideal. . . . Nor is there much satisfaction in contemplating the world with nothing left to the spontaneous activity of nature; with every rood of land brought into cultivation, which is capable of growing food for human beings; every flowery waste or natural pasture ploughed up, all quadrupeds or birds which are not domesticated for man's use exterminated as his rivals for food, every hedgerow or superfluous tree rooted out, and scarcely a place left where a wild shrub or flower could grow without being eradicated as a weed in the name of improved agriculture.

The final question about the effect of demographic variables on per capita output relates to the availability of capital. High fertility, by increasing the ultimate rate of growth of the labor force, increases the need for current investment in order merely to keep output per worker constant. If the labor force grows by 3 per cent a year, an investment of perhaps 9 per cent of annual output is needed merely to equip new workers. In short, high fertility, by raising the rate of growth, greatly increases the proportion of national income that must be devoted to investment in order to achieve any specific rate of increase in per capita output. But high fertility exerts an upward pressure on the proportion of income devoted to consumption, and hence tends to *depress* the proportion diverted to investment. The pressure for consumption is the result of more dependents per earner.

High fertility leads to faster population growth and more dependents per earner. Faster growth means, of course, greater numbers; and while in the long run a constantly growing population swamps any finite resources, the only certain effect in the near future is greater crowding. But faster growth requires more investment, and the greater burden of dependency that high fertility entails implies both dividing the output of each producer with more consumers and diverting a smaller proportion to investment. High fertility stimulates demand, but tends to reduce productivity per capita.

The effects of *mortality* on productivity can be dismissed more summarily. Additional reductions in mortality would add very little to the growth of the population. Even the perpetual avoidance of all deaths beginning in 1950 would have yielded a lower long-range growth rate

<sup>9</sup> John Stuart Mill, *Principles of Political Economy*, Bk. 4, ch. 6.

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than continuing the mortality risks then current, but adopting the fertility rates of 1957. If there are future major reductions in the risks of death, they must occur in what are now the later years of life and would tend to increase the proportion of the population beyond the now customary ages of retirement. But it is probable that health and vigor as well as life would be prolonged, and it is not certain that dependency burdens would be increased in the same proportion as the change in the age distribution.

When viewed in aggregate terms, the effects of demographic variables on the economy form a paradox of sorts: the growth arising from high fertility increases aggregate demand but reduces the full employment capability of the economy to increase its output per head.

### MORE DETAILED INTERRELATIONS

The synopsis just presented treats only uniform fertility trends (high and low), distinguishes only very broad groups in the age distribution, and treats output very nearly as if it were a homogeneous commodity. A fuller analysis of population would consider such questions as the age composition within the ages of labor force participation, the number of persons annually passing the usual age of labor-force entry, and so forth. A fuller economic analysis would note that demographic factors affect the *composition* of output as well as helping determine its total value at constant prices. The conference papers could touch only fragments of these detailed issues, and this introduction ends without touching them at all.

The participants in the conference are indebted to the Universities-National Bureau Committee for Economic Research for sponsoring the meeting, and to Princeton University for making available the Social Science Lounge of the Firestone Library. Serving on the planning committee with the writer were Edgar M. Hoover, Richard Ruggles, J. J. Spengler, Warren G. Robinson, *Secretary*, and Margaret MacDonald, who succeeded Mr. Robinson. Irwin Friend of the University of Pennsylvania organized the papers for the last session of the conference.

Cornelius J. Dwyer of the National Bureau of Economic Research did an exceptional job in preparing the papers and comments for publication. Not only was he an unusually skillful editor, who improved the quality of the contributions while shortening them substantially, but because of his technical competence as an economist he helped a number of the authors in clarifying their arguments. H. Irving Forman of the National Bureau prepared the charts.

**PART I**  
**The Analysis of Population Change**