Box 10 b

DISCUSSION PAPER

Preliminary material and interim research results circulated to stimulate discussion and critical comment

Active Life Profiles for Different Social Groups: a contribution to demographic accounting, a frame for social indicators and a tool of social and economic analysis

by Dudley Seers

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Active Life Profiles for different social groups: a contribution to demographic accounting, a frame for social indicators and a tool of social and economic analysis*

(A progress report on an international research programme.)

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This report starts with a brief illustration of the basic idea of an 'active life profile' and outlines a new technique of constructing it. The life profile has some analogies with the national income account as an additive frame for statistics (in this case social), suggesting both uses and dangers. In order to investigate the potential benefits and costs of applying the technique in different types of country, an international research programme was set up, covering Brazil, Britain, Hong Kong, Kenya and Malaysia. One requirement for this technique is appropriate life tables, and the problems of constructing these are considered, and also of fitting social indicators into the profile. Some tentative conclusions are drawn from comparisons between life profiles in different countries, social groups, regions, etc, throwing new light on issues of equity. Then examples are given of age-weighted index numbers which can be derived from life profiles. Possibilities opened up for research are discussed, eg of relating profiles of economic activity to those for housing, health, etc, and extending profiles with the help of time budgets. Finally, there is a provisional evaluation, drawing attention to the importance of time as a dimension of welfare, in many ways more fundamental and important than income.

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*Most useful comments on a draft were received from Andrew Abelson, Renaud Decoster, Timothy King, Joseph Lee, D. Ramprakesh and David Vetter. I am particularly in the debt of Henry Lucas, whom I consult whenever a question comes up that exposes my ignorance of demographic techniques. One point of terminology: whenever I use the word 'active' I am referring to economic activity as conventionally defined in labour force statistics.

Active Life Profiles for different social groups: a contribution to demographic accounting, a frame for social indicators and a tool of social and economic analysis*

I The Basic Idea and the Principles of Construction

The idea of an active life profile is quite simple. Life expectancy is partitioned into constituent parts - the 'expected' time that someone born in a certain year will spend at school, in employment, in retirement, and so on, at the school enrolment rates, etc, of that year, and allowing for mortality (Seers 1977).

Thus a male child born in 1970 in the State of Sergipe in Brazil (one of the poorest) had a life expectancy of 51.6 years, a female 56.0, at the mortality rates for that year. These figures can be broken down (Table 1) to show broadly the time expected to be spent by each sex in various states at 1970 rates of mortality, school enrolment, employment, etc, for each age group.

Table 1: Active life profiles for children born in Sergipe, Brazil, in 1970 by sex

	State	Expected duration (years) Males	Females
	Below school age	4.4	4.5
	Of school age, not in school	2.4	2.4
Educational activity	(In school	6.3	6.5
	(In higher education	0.2	0.1
Economic activity	(Employee	13.9	4.2
	(Self-employed (or employer)	16.7	4.1
	(Unpaid family labour	1.9	1.0
	Inactive	5.8	33.1
	Total life expectancy at birth	51.6	56.0

Source: Costa and Vetter (1982).

The table reveals that, while there is not much difference - indeed surprisingly little - between the active life profiles of men and women up to the end of school age (a situation one would not expect to find in the Middle East, say), they diverge sharply thereafter. It also brings out the importance of self-employment in a peasant economy and the (typically) longer life expectancy of women.

An active life profile can in principle be constructed separately

not only for each sex but also for any ethnic group, area, social class, etc. This suggests that it may prove a supplement to income distribution in social analysis, in some ways more useful and certainly easier to prepare.

There are two requirements, a life table showing the relevant stationary population, and age-specific data for the states to be quantified (in school, as an employee, etc) in respect of the classifications derived.

The expected time that a particular cohort of the section of the population concerned will spend on average between the xth and the $(x+1)$th birthdays in a particular state i can be written as e^i_x. This is obtained from their expectation of life during that year (allowing for mortality before and during it), e_x, and the prevalence of that state during the year (eg the school enrolment rate), α^i_x.

$$\text{Thus} \qquad e^i_x = e_x \alpha^i_x \ .$$

The expected life during that year, e_x, can be obtained from a life table: using the conventional symbol ℓ_x for the number of survivors of the cohort of 100,000 to age x, and assuming that those who die in a year live on average 6 months, which would be the case if mortality were constant within the year,

$$e_x = \frac{\frac{1}{2}(\ell_x + \ell_{x+1})}{100{,}000} \ .$$

α^i_x can be taken from age-specific tables showing the prevalence of school enrolment, etc, of males/females, rich/poor, etc, for the age concerned. If the tables refer to a particular date, eg of a census or a sample survey, then each person has to be classified into one of a set of mutually exclusive states at the date concerned (eg that if shown as a schoolchild, then was not economically active as well) and that the average prevalence during the year is represented by the proportion shown for that date (ie to put it simply, movements between states cancel out).

The total lifetime expectancies of time spent in state i, Σe^i_x, or E^i can be summed to the total at-birth expectancy of life, Σe_x, or E, as in Table 1:

$$E = \Sigma E^i = \Sigma(\Sigma e^i_x) \ .$$

The assumption is that the various states i, etc, exhaust between them all the possibilities at each age.[1]

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[1] These expectancies are average. As Joseph Lee has pointed out in correspondence, these equations could be expressed in total man-years for each cohort.

(More comprehensive statements of the method are to be found in the country studies, referred to below.)

II The Background to Active Life Profiles

It will be seen that active life profiles draw on many types of statistics - mortality, education, labour force, etc - all fitted into one additive framework. This suggests some analogy with national income accounts, which similarly fit various types of economic statistic into an additive frame. In fact, it is easier to understand the origins of the active life profile and what possibilities it opens up if we divert briefly to discuss national income statistics.

Although national income accounts had been developed to meet the needs of Keynesian employment models in the 1930s, they took on an additional role after the war with the Harrod-Domar model. Economic growth would, it was believed, solve the severe social and political problems of the 'Third World'.

The compilation of national income estimates gave a great stimulus to statistical collection, tabulation and analysis. Concepts like 'investment' had to be clarified and inconsistencies eliminated in definitions and in estimates (because statistics of production by sector, of factor incomes and of expenditure by purpose produced mutual checks). Eventually the conventions became formalised in a 'system', the SNA (UN Statistical Office 1968).

Many avenues of economic research were opened up by the SNA because of its various dimensions. While national income estimates have often been used quite naively, they have made possible much empirical work, such as comparisons of economic structures between countries and over time, and provided a framework for index numbers of output, consumption, etc, leading to insights into economic dynamics, some of which have proved valuable. Since the total of different types of output equals the total of different types of expenditure and the total of factor incomes, patterns of interaction can be traced - between growth and capital investment, for example.

However, the national income *per se* is no longer as important as it once appeared, especially in countries of the 'Third World'. Disillusion with the Harrod-Domar model first became widespread with the realisation towards the end of the 1950s that output did not depend just on the stock of capital, but also on other factors, qualified manpower in particular. This was intuitively obvious, especially to anyone familiar with conditions in Africa at the time of independence, but it was reinforced by research into production functions. A great impetus was given to 'manpower planning' and thus to policy emphasis on education, the determinant of the stock of qualified manpower.

A rather more serious weakness of the application of growth models emerged in the 1960s. It became obvious that even fast economic growth was not solving social problems and would not necessarily do so. In fact, an aggregate such as the national income clearly has only very limited welfare significance in countries compartmentalised by social, ethnic or geographic divisions - ie in nearly all countries, especially in Africa, Asia and Latin America.

One response to this realisation was a renewed interest in income distribution.[2] It was demonstrated that increases in the national income gave a quite undue weight to those in the higher income brackets (a one per cent increase in the income of a person with $100,000 a year raises the national income much more than doubling an income of $250).

There was also another response, heightened interest in social indicators.[3] Attention became focussed on mortality, especially life expectancy at birth, an overall index of mortality. Not merely is dying at an early age tragic in itself: a low expectation of life implies a poor quality of life even for survivors. It indicates one or (usually) more of the following: poor nutrition; clean or inadequate water; polluted air; unhealthy climate; bad housing conditions; occupational hazards of health and accidents; personal danger (due to crime and traffic); inability to obtain medicines or appliances; parental ignorance (due, inter alia, to low levels of education); etc.

Above all, life expectancy apparently reflects the prevalence of endemic diseases, such as malaria and yellow fever, especially among the young - since the expectation of life is greatly influenced by infant and child mortality, nearly half of which is typically attributable to parasitic and infectious diseases. Of critical importance, therefore, are basic health services, especially preventative.

Mortality is not unrelated to income: the higher the income of a group (or district), the lower the prevalence of many factors that shorten life. But this is only broadly speaking: many of these dimensions of welfare are not associated very closely with income. Thus in the Middle East, despite the highest per capita income levels in the world, mortality remains relatively high.

Life expectancy is a better indicator than income of the 'gap' between nations. In sharp contrast to the national income, the experience of the poor has a greater impact on life expectancy

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[2] Chenery et al (1974) section XI.

[3] There were also attempts to construct composite measures such as the Physical Quality of Life Index, but these lacked a basic rationale in either selection of indicators or weighting structure.

than that of the rich. It is rather unlikely that national average life expectancy would rise without any reduction in the mortality of the poor. This is so for two reasons. The poor are more numerous and their lives are more easily lengthened: expectancy approaches asymptotically a limit (around 80 years for females, 74.5 for males) so big increases that have been general in national average expectancy in the past two decades, as shown in successive issues of the World Development Report (World Bank), imply some increases at least in the lower half of the social scale. These would not, however, necessarily imply any redistribution of income, nor even a big and widespread improvement in social conditions among the poor in the dimension indicated above (which, from other sources appears very doubtful): they may be due largely to the spread of public health services.

On another tack, new forms of social research have been developed. The time a child could expect to spend in the educational system was studied,[4] so was the time in economic activity.[5] However, those carrying out these researches made no attempt to estimate the time spent in other types of activity, nor was there much social differentiation.[6]

Sir Richard Stone (1972) was the first to construct a complete table for each sex, showing the expected duration of different types of educational activity, as a by-product of his transition matrices. The stock of people aged x in state i, namely ℓ^i_x (eg children entering school), can be adjusted by allowing for deaths and movements to other states (eg dropping out of school or emigrating) and for new entrants from other states, to obtain ℓ^i_{x+1}, ℓ^i_{x+2}, etc.

Transition matrices can be constructed for each sex in the school age group in an industrial country because education statistics enable estimates of the proportions making each transition, the possible number of which are few. In fact, apart from 'repeaters', early deaths and emigrants, children pass on to the next stage of the educational system at the end of each year. (In Britain, virtually all children of statutory school age are enrolled in a school, so 'dropouts' do not raise any real difficulty.)

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[4] Stockwell and Nam (1963).

[5] Eg Kpedekpo (1969). See also references in Lucas (1982). The seminal work was Wolfbein (1949). Psacharopoulos (1981) surveys a large number of longitudinal studies of economic activity.

[6] Curiously, Stockwell and Nam (op cit) made no distinction between males and females. They did, however, suggest the construction of 'school life tables' for each sex separately, and other social breakdowns. Swee-Hock (1965) gave separate working life tables for males of Malay, Chinese and Indian origin.

It would, in principle, be possible to handle those of working age in the same way, but this is quite impractical because of lack of data on movements between the various active states, which occur throughout the year, and can be in any direction. So when Stone reached the trasition from education to employment he came to a dead end, as Table 2 shows. In the early 1970s, the possibilities of extending his profiles to cover the whole lifetime in any detail appeared to be exhausted in the absence of records of each individual transition.

Table 2: Active life profiles for males born in England and Wales in 1965-6

	State	Expected duration (years)
	Below school age	4.5
Educational activity	(In school	11.4
	(In higher education	1.0
Economic activity	(Employee (Self-employed or employer (Unemployed	47.2
	Economically inactive	6.8
	Total life expectancy at birth	71.0

Source: Stone 1972.

Also, of course, it is not possible, using this technique, to construct profiles covering even educational states for social classes, ethnic groups, areas, etc, unless these are identified in the sources.

Yet Stone's work represented a major step towards an obviously important goal: a unified system of social statistics. He tried to encompass these in his 'system of social and demographic statistics' (SSDS) - the manual for which he wrote (UN Statistical Office 1975). A central thread runs through SSDS, the use of time, analogous to the use of income in the SNA, which is, however, a much more tightly structured system (Seers 1976).

The multiple decrement technique described at the beginning of this paper can be considered from one point of view as a device for passing the barrier Stone encountered.[7]

[7] The technique also provides a much easier way of estimating E^i_x even for educational states, especially in non-industrial countries, where young people often re-enter school well beyond their 20th birthday, and education data anyway are poor. However, of course, where transition matrices can be constructed, they provide a great deal of additional information on flows and sequences. And they permit actual

It would be pleasantly tidy if I were able to say that, knowing the literature, cited above, on educationally and economically active phases, I saw the possibility of drawing on their techniques to fill out Stone's table and also compile it for various social groups. But I actually came to take this step in quite a different way. Whilst in Kuala Lumpur in 1977, working on the social and demographic statistics of Malaysia, I had been looking for a comprehensive additive framework that would provide for these data some of the benefits of the SNA for economic statistics: ie enforcing consistencies in concepts and definitions, and between the data from different statistical sources. I did not know about this particular table of Stone's until I discussed the idea with him subsequently on a visit to Cambridge. Nor did I realise that other people had already applied multiple decrement techniques in different fields (indeed I did not then know what 'multiple decrement' meant!),[8] until Henry Lucas at IDS pointed out - somewhat to my consternation! - that what I now know as the multiple decrement technique had been developed earlier by others for parts of the life profile.

I only gradually came to see that, while in applying this technique to the whole life span I had only taken a small step beyond Stone and other pioneers of temporal analysis, I had opened up a way of exploring within a single framework the whole social structure, both statically and over time, in more dimensions (apart from male/female, the geographical, social and ethnic planes) than was possible using data on incomes. This technique particularly lends itself to international comparisons since if time is the numeraire there is no exchange rate problem.

III The International Research Programme

But it does not follow that constructing life profiles is worthwhile. Many statistical proposals are put forward simply on the basis of perceived benefits, without assessment of their feasibility, or how the cost/benefit comparison might vary by type of country. This is indeed in general true of UN statistical manuals, and it is very damaging. Government statistical offices are encouraged by such publications, and also often by aid agencies, to produce statistics for purely technical reasons (often reinforced by the agency's own needs).

In the case of the SNA, the consequence has been the expenditure

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mortality to be used for each state, so the same mortality rate does not have to be assumed for all states at the same age.

[8] I was in fact too unsure of life profiles to propose them in my report to the Malaysian Centre of Development Studies. I suggested instead a priority for anthropometric measures.

of considerable finance and skilled manpower on the generation of many estimates of very low quality - which are then treated as facts. Typically, primary data sources for national income estimates cover less than 50 per cent of the total (often less than 25 per cent). So estimates of, for example, economic growth, investment, etc, are the product mainly of hypotheses, eg that food production and own-account dwelling construction are functions of the (assumed) rate of increase of the rural population; that production by small-scale manufacturers bears a constant relation to that recorded for larger firms in production censuses; that distributive margins do not change over time, etc, etc. The error margins are immense: an estimate of growth of (say) two per cent in per capita income means in many countries no more than that it probably ($p = 0.95$?) did not rise by more than four per cent - or fall.[9] National income analysts are often analysing no more than hypotheses.[10]

Moreover, movements in income aggregates are of doubtful significance, for either desision-makers or social analysts if they cover a heterogeneous population whether by social class, ethnic group or geographical region. Components such as 'savings' or 'profits' mean little unless broken down to show how much accrue to foreign firms.

I am not arguing that it was wrong to develop and promulgate national accounts. The mistake was to assume that one system was applicable for all types of countries.[11] Claims that a certain statistical improvement should be introduced in any particular country are really irrelevant unless one discusses likely applications there (both official and other) and secondly, the administrative costs, especially where professional resources, such as the time of statisticians and computers, are scarce. A crucial question is what new data would be required and what this would cost to collect.

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[9] Indeed the expected error is not symmetrical unless one is using a very restrictive definition of income: as economies become monetised, increases in cash activities will in principle show up in the national income, whereas declines in unpaid work for the household or village will not. Improvement in data gathering has similar biassing effects.

[10] Eg an analyst may estimate zero changes in food consumption per capita in a country of tropical Africa by dividing the rate of increase of output by the rate of increase of rural population - but then all he is likely to get is what the national income estimator had <u>assumed</u> as the trend in food consumption per capita.

[11] It is true that the manual of the SNA contains a separate chapter on its application in developing countries, but this really only suggests a simplified version: it does not explore different systems appropriate for different types of developing (or, for that matter, developed) countries with different development strategies.

Statistical policy, that much-neglected subject, consists in weighing this in any country against expected benefits.

So (in Seers 1977), while I suggested that a life profile system would be a useful new statistical tool, I urged that it should be tested in different types of country. But here again I must make a confession. I took no step to initiate such a programme: the subject is rather outside my normal field, which has provided plenty of work. In 1979, the paper caught the eye of David Roberts of the OECD Development Centre in Paris, and Yves Berthelot, then Director of Research there, offered some contribution to financing an international programme to test the system.

In the event, because of the Centre's own financial problems, the assistance was not enough to pay for the work in each country. But its backing, reinforced afterwards by the active participation of David Roberts, was vital. It gave me the incentive to organise the research, and provided travel funds that made it possible for me to visit two of the key countries taking part, and for a workshop to be held at the Institute of Development Studies in June 1981 at which those doing the research in each country could discuss the problems they had encountered and look at the first results.[12]

The countries included in the programme were Brazil, Britain, Hong Kong, Kenya and Malaysia. This list has a certain rationale. It covers the main continents; the countries therein range from an industrial one with well developed statistics to one where the population is mainly rural, and the statistical system is rudimentary; it includes countries with very different ethnic and social structures and of great diversity in size (both in area and population). I would like to say that this balance was deliberate. However, I must in honesty add that the choice of these particular countries in each continent reflects mainly my personal contacts with the Directors of the respective statistical offices at that time - Izaak Kerstenetzky in Brazil, Sir Claus Moser in Britain (later John Boreham), Ramesh Chander in Malaysia (later Khoo Teik Huat). (In Brazil, the project later received strong support from the Technical Director of IBGE, Marco Antonio de Souza Aguair.) The Kenya connection was originally through Michael Ward of IDS, who made a preliminary trial of the method in Nairobi. The Director of Statistics in Hong Kong, Colin Greenfield, later offered to test the technique there too, and this provided a useful complement to the others,

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[12] This workshop was also attended by Andrew Abelson (SSRC), Richard Allen (ODA), John Blacker (LSHTM), and Renaud Decoster (INSEE), Zachary Gichohi (Central Bureau of Statistics, Kenya), Colin Greenfield (Director of Statistics, Hong Kong), Timothy King (World Bank), Sheila Macrae (UNFPA), D. Ramprakash (CSO), Sir Richard and Lady Stone, Dr K. Uemura (WHO), Brian Van Arkadie (OECD) and Ken Williams (UNICEF), apart from those actively involved in the country studies.

geographically and in other ways.

In Brazil, Hong Kong and Malaysia, government statistical offices took on themselves responsibility for the country studies, but in Britain and Kenya, their own resource shortages ruled this out. In Britain the work was done by Henry Lucas, a Research Officer at IDS. In Kenya, profiles were constructed first by Juliette Stephenson, who has been based at IDS, and carried further by David Roberts. They all received considerable help from official statisticians.

Those carrying out the country studies were asked to make use of existing data to produce life profiles for different areas, ethnic groups, social classes, etc, as relevant in the country concerned and also to make comparisons over time, using the national population census at the beginning of the 1970s as a point of reference. This would enable the costs and benefits of the technique in different types of country to be assessed with a view to surmising whether its more general application would be worthwhile.

Reports have been published on the workshop and the preliminary country studies (see OECD Development Centre 1982,[13] Costa and Vetter 1982, Census and Statistics Department, Hong Kong, 1982,[14] Lucas 1982, and Kwon Kwan Kit 1982;[15] the Kenya report is not yet ready).[16]

IV Appropriate Life Tables

Just as the national accounts estimator has few primary data for the main sectors in most countries and is forced to proceed by hypotheses, so those constructing life profiles have to face the fact that death registration is usually very incomplete, especially in rural areas. Consequently, life tables for about 50 per cent of countries have to be constructed indirectly, by applying hypotheses to partial data from censuses and surveys: using the technique of Brass (1975) for estimating infant and/or child mortality, and one of the model life tables of Coale and Demeny (1966) to obtain mortality estimates for the remainder.[17]

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[13] This was prepared by David Roberts.

[14] This was supervised by Colin Greenfield.

[15] The Malaysia project was supervised by Ong Seng Wah (who attended the workshop at IDS) until his untimely death at the end of 1981.

[16] In the meantime, see Michael Ward (1979) and Juliette Stephenson (1981).

[17] Bucht and Chamie (1982) show that there is a reasonable degree of consistency between results from direct and indirect methods where these are comparable (eg in Tunisia

In Malaysia, death registration is believed to be fairly comprehensive, but those carrying out the project took account of adjustments by the US Bureau of the Census to both census tables and mortality rates for ethnic groups and the rural population, in the light of a special Post Enumeration Survey and a Household Expenditure Survey, and also discrepancies revealed in the research for this programme.

In Brazil, death registration is also very incomplete, outside the main cities, but a life table for the country as a whole had already been constructed for 1970 (Simoes and Dias, 1976). The range of results for Brazilian States is wide. Life profiles are evidently quite sensitive to errors in the level of mortality assumed, which affect particularly states that are more common in the higher age groups. They might also be sensitive to errors in the assumed structure of mortality, though the variation in this is somewhat constrained, especially since mortality is, after the first year, an increasing function of age.[18]

In the case of Kenya, life tables only recently became available (for 1979) and there is bound to be some doubt about their accuracy. Earlier Michael Ward (1979) argued that an adaptation would permit the spirit of the approach to be kept. This consisted of working out for each age group the probability of being in a certain state, drawing on the same prevalence information as the life profile approach - a^1_x. Thus for school attendance in 1979, the following probabilities are obtained:

		Males	Females
Age	At primary school	0.84	0.80
10-14	At secondary school	0.01	0.01

These estimates are naturally (like ordinary published school enrolment ratios for those of school age) sensitive to the effects of variations in past fertility and current mortality on the actual age structure within the group concerned. Moreover, of course, they cannot be added together to form life

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and Turkey), though much depends on which 'model' is chosen (and independent comparisons for Senegal as less reassuring). The Brazilian study in this programme reports on a comparison of both methods in Sao Paolo, with reasonably consistent results. The Malaysian study showed that although all models appear seriously to overestimate infant mortality, they yield fairly good approximations of total life expectancy (especially for females).

[18] Since mortality reflects economic and environmental influences (such as water supply) common to both sexes, the comparison of differences between their life profiles may not be so much affected by possible errors in mortality estimation.

profiles. However, they can be constructed even in countries where mortality data are non-existent or unusable, for example much of tropical Africa.

V Accommodating Social Indicators in the System

The other main set of practical issues arises out of the estimation of the states of time use. The assumption mentioned earlier, that people spend their whole year in the state they use to describe themselves in response to a census or survey question, raises big practical questions. People may change their activities during the year. The effects of such movements, which may be numerous for some people, are unlikely to cancel out.

They may anyway not spend their whole working week in one activity. Many women combine part-time employment with housework. A significant number of those enrolled at school work for money as well, perhaps through regular truancy. Different statistical sources may anyway show different states - an adolescent may appear as enrolled at school in educational data or census statistics, but as an employee in a labour force or establishment or household survey.

Even if one had all the necessary information on every individual, arbitrary decisions would still have to be made in order to allocate each to one activity state or another (or in some fractions between them). Such decisions may already be incorporated in the primary tabulation. Thus in Hong Kong, students who report employment of 15 hours or more during the week preceding the census are counted as employees, not students. As the report on the Hong Kong study points out, this leads to exaggeration of the time spent in employment, underestimation of that in education. But on the other hand, there are usually reasons why time in education is overestimated: the fact that a child is enrolled in a school (the information normally available) does not by any means imply that he or she attends full-time - or even at all![19]

Similar problems arise over the insertion of labour force statistics into the system. The category of 'not economically active' is a residual. Many people, especially adolescents, are included here, even though they are, for example, working in small and/or illegal establishments. This category will also contain all wives who have not been shown in the course as active. In a rural area, in fact, wives of peasants commonly help with the farm work, especially at seasons of peak labour demand such as sowing, weeding, harvesting, etc. They also make clothes, weave baskets, etc. Such unpaid 'productive'

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[19] These practical problems make one realise the limitations of the statistics commonly used - eg 'school years'- in manpower economics (quite apart from the great variation in the content of education).

labour may take up most of their time, but it is rarely shown in census or survey returns.

In all countries, there are times in the annual agricultural cycle when even those shown as economically active work very little. Yet it would be misleading to count them as partially 'unemployed', which conceptually requires them to be seeking work, whereas typically there is none available in the rural areas, especially at such times. Indeed, those who are shown as 'unemployed' in labour force tables are normally helping with the various activities of the household, 'productive' and other, while they look or wait for work.[20]

The root of the problem is that concepts underlying labour force statistics such as 'normal working week' or 'economically active' or 'unemployment' have little meaning in a peasant economy, ie in most of the world (including Brazil, Kenya and Malaysia).

One of the great advantages of a comprehensive framework is that, as pointed out above, whatever definitions are used, consistency is forced on them (which does not rule out different definitions being used for other purposes).[21] Again, the field of national accounts provides analogous examples: capital formation, which is a concept far from unambiguous in economic theory, has to be defined in a way that does not overlap with current consumption, and equals total savings (of all kinds).

The British project in fact estimated time spent in various inactive states. But even with the help of the comprehensive British health and prison statistics, it was not possible to distinguish them from economic activity, because those away for a short time sick, in particular, are not normally forced to give up their job. Nor is it possible to distinguish between being in hospital and 'absent sick'. So expected durations in these categories are not additive and have to be treated as memorandum items. Similar data have been tabulated for Hong Kong. The results are as follows:

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[20] I once asked a headmaster of a secondary school in Sri Lanka what had been the employment experience of his school leavers of the previous year. He replied, 'They are all unemployed.' When I said, in astonishment, that some must have been helping in the family farm or shop, he replied, 'I meant that none of them managed to get jobs with the government'! This attitude must also be reflected in the answers to questions in censuses and labour force surveys.

[21] Those who compile profiles for either educational or employment states (see previous references) are not compelled to face such severe boundary problems.

		Expected duration (years)					
		UK (1971)		UK (1977)		Hong Kong (1981)[a]	
		Male	Female	Male	Female	Male	Female
Absent sick from work[b]	<60	1.39	0.55	1.37	0.51	n.a.	n.a.
	>60	0.61	0.02	0.61	0.02	n.a.	n.a.
		2.00	0.57	1.98	0.53	n.a.	n.a.
In hospital	<60	0.11	0.11	0.08	0.09	0.05	0.04
	>60	0.12	0.20	0.13	0.22	0.04	0.05
		0.23	0.31	0.21	0.31	0.09	0.09
In prison		0.15	0.006	0.12	0.004	0.14	0.005

[a] The Hong Kong data refer only to government hospitals and exclude maternity cases and new born babies (an estimated five per cent of total hospital time). The elder hospital patients there are over 65 not over 60.

[b] In receipt of sickness benefit which requires absence of at least three days. The lower expectancies of periods in receipt of sickness benefit for women reflect lower labour force participation, and thus eligibility for these benefits.

Here again, the issues raised by this technique point to the practical limitations of commonly used statistics, especially derived indicators, such as productivity, which tacitly assume constant average time at work: this could lead to serious errors of interpretation. Many of the sources of data show people as economically active when they are in fact away from work for one of these reasons for at least some periods.

Turning to a brief interpretation, it is interesting to note that in the United Kingdom both sexes show a declining tendency to spend time away sick. In addition, perhaps contrary to general belief, there has been a decline in the prevalence of both hospitalisation and imprisonment, except in the case of the over 60s, where the increase in the total expected period in hospital is doubtless due to lengthening of life.[22]

Corresponding data are available for Hong Kong for one year only, 1981. The statistics for expected time in prison are strangely very similar to those for the United Kingdom for each sex. However, the rate of hospitalisation is much lower in Hong Kong especially for elderly females, raising interesting questions about the adequacy of public hospital services there, or possibly a greater tendency in Britain for families

2. The decline in total expected stay in prison may be due in part to the increased proportion of juveniles serving relative short sentences (partly because of the overcrowded state of British prisons).

to reject elderly relatives - judging from total life expectancy at birth, health in the two countries is not very dissimilar (see the next section).

VI Social and Economic Analysis

National average life profiles for each sex in five countries are shown in Table 3.[23] It is perhaps necessary to clear up one point here before we push the analysis further. When I refer in what follows to proportions (eg of school-age children enrolled in school) which can be calculated from life profiles, a mortality gradient is taken into account. However, the Hong Kong study shows that these proportions are not very different from those taken from the raw data (except of course for the elderly). Thus a rise in the school enrolment rate taken from comparing life profiles would almost certainly reflect a rise in the crude enrolment ratio.[24]

One might ask, therefore, why transpose the data in this way? The answer is that the statistics then fit into a single analytical framework. Moreover, one may well wish to exclude the effects of fluctuations in past birth rates.

The length and structures of life profiles are somewhat similar for two pairs of countries. In Brazil and Malaysia, where there are large peasant populations, time in both self-employment and unpaid family labour is much longer, especially for females in Brazil; in Britain and Hong Kong the characteristic working life is spent in employment for males, and even to a large extent for females.

Enrolment in schools is relatively low in Brazil and Malaysia, where children can expect to spend about 7½ years in primary and secondary study taken together (as against about 10 in Hong Kong and in England and Wales).[25] However, in higher education, while in all four countries females are worse off than males, the average duration is much higher for both sexes in Britain than the other three. In this respect Brazil is slightly better placed than Hong Kong,[26] much better than

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[23] Differences in pre-school life reflect mainly differences in age of starting school.

[24] For Hong Kong, the male school enrolment rate (ie the proportion of children aged 5-14 at school) rose from 80.2 per cent in 1971 to 84.1 per cent in 1981: the rate taken from life profiles, weighted by the age structure of a stationary population, rose from 80.0 per cent to 83.8 per cent.

[25] This similarity in school provision between these two countries contrasts strongly with the difference in hospital provision, implied by data in the previous section.

[26] In Hong Kong, data on educational participation will, of course, include a prevalence among newly arrived immigrants, who are unlikely to attend institutions of higher education.

Table 3: Active life profiles for each sex, in Brazil, Peninsular Malaysia, England and Wales, and Hong Kong

	Expected duration (years)							
	Brazil (1970)		Peninsular Malaysia (1970)		Hong Kong (1971)		England and Wales (1971)	
	Male	Female	Male	Female	Male	Female	Male	Female
Pre-school[a]	4.6	4.7	5.7	5.7	6.2	6.3	4.8	4.8
Of school age, not at school	2.2	2.2	0.8	0.9	n.a.	n.a.	n.a.	n.a.
Primary school	5.3	5.2	5.3	5.0	7.1	7.0	6.4	6.4
Secondary school	2.1	2.1	2.7	2.0	3.1	2.7	4.3	4.3
Post-secondary education	0.33	0.26	0.16	0.14	0.32	0.19	1.45	1.25
Employer/ self-employed	16.0	2.1	16.0	4.8	6.7	1.6	4.1	1.1
Employee	17.5	5.9	18.4	6.4	34.2	18.3	37.2	23.6
Unpaid family labour	1.9	0.7	3.2	5.0	0.5	0.9	-	-
Unemployed	n.a.	n.a.	n.a.	n.a.	1.8	1.0	2.3	1.2
Inactive	9.7	38.5	8.0	34.2	7.4	37.0	8.3	32.5
Total life expectancy at birth	57.5	61.6	60.1	64.1	67.4	75.0	68.9	75.2

a Including nursery school.

Source: Country Studies in the Life Profile Programme.

Malaysia.[27]

It will be seen that in each country about half the expected duration of a female life is 'inactive' - much more so in the case of Brazil. This is of course a highly technical use of the word: it generally means that they are engaged in housework - in Hong Kong the time spent inactive was broken down, and females born in 1970 could expect to spend 32 years in housework out of 37 inactive (and 3 'retired', 2 in various other states).[28]

It is possible to construct active life profiles for a big variety of sub-divisions of the population, the main requirement being that useable life tables exist or can be constructed for them.

In Britain, separate profiles were shown for each sex for England and Wales on the one hand, Scotland on the other;[29] in Malaysia for four main regions; and in Brazil for each of the 26 States (including the Federal District), which involved using the Brass technique to adjust the national life table for differences in mortality, taking the rate for ages 0-2 as a proxy for the level in 1970 in each State, and assuming the same age structure of mortality. (Hong Kong is of course too small for a geographical breakdown to be feasible.)

The most striking differences in the length and composition of life were between the States of Brazil, especially those in the South in contrast to the North-East: the difference in life expectancy is as much as 18 years between males in Rio Grande do Sul and Alagoas.[30] On the other hand, in both Britain and Malaysia, the geographical variation is very much less.[31]

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[27] This refers to 1970. There was a big expansion of tertiary education in Malaysia in the 1970s: its expected duration for those born in 1979 was close to the Brazilian figures of 1970.

[28] Of course, especially in peasant families (of which there are not many in Hong Kong), housewives may also be engaged in 'productive' but unpaid labour.

[29] Many demographic data in Britain are compiled separately for Scotland (and Northern Ireland) and cannot easily be used to produce UK tables. The British study concentrates on England and Wales, in some cases making use of UK prevalence rates.

[30] However, it should be borne in mind that life tables for each State are only estimated from partial data.

[31] However this may be due, in the case of Malaysia, to the fact that life tables for each of the four regions were constructed as a weighted average of national life tables (allowing for ethnicity and degree of urbanisation); no mortality data specific to the region were used.

In Malaysia, however, there is a notable variation between each ethnic group (Table 4). The sample size for Indians is rather small, and the estimates for some of the States, especially higher education, are subject to non-negligible sampling error. However, the general picture is clear enough. Life expectancy in 1970 was about the same for Malays and Indians, but longer for Chinese, no doubt due to higher incomes and associated advantages in health services, nutrition, etc. This is true for each sex, but the contrast is greater for females because sex differences in mortality are much lower for Malays and Indians.

In educational terms, the Malays were intermediate between Chinese and Indians in all categories but the higher stages, where Indian enrolment was comparable to that of Malays. In

Table 4: Active life profiles for each ethnic group by sex: Peninsular Malaysia, 1970

	Expected duration (years)					
	Malay		Chinese		Indian	
State	Male	Female	Male	Female	Male	Female
Pre-school	5.6	5.7	5.8	5.8	5.6	5.7
Not at school (6-9 years)	0.8	0.9	0.7	0.8	0.9	1.0
Enrolled in school	7.9	7.0	8.7	7.7	7.3	6.0
- primary	5.2	5.1	5.6	5.3	4.8	4.4
- lower secondary	1.9	1.5	2.1	1.7	1.9	1.1
- upper secondary	0.6	0.4	0.8	0.6	0.6	0.3
- tertiary	0.14	0.09	0.21	0.18	†	†
Economic activity	38.1	17.1	38.7	14.8	32.7	14.4
- employer/ self-employed	19.8	6.6	13.7	2.9	6.8	1.2
- employee	14.5	3.7	22.1	8.9	24.7	12.3
- unpaid family labour	3.8	6.8	3.0	3.0	1.1	0.9
Inactive	5.9	29.9	9.7	41.5	11.6	33.5
Total life expectancy at birth	58.4	60.7	63.6	70.7	58.0	60.6

† Sample size too small.

Source: Kwok Kwan Kit 1982, based on special tabulations from a two per cent sample tape of the 1970 Population Census and revised life tables, 1970.

all states of economic activity, Chinese of both sexes showed rates intermediate between those of Malays and Indians; the contrast between the patterns of economic activity between Malays and Indians is very marked for both sexes, for reasons indicated in the Malaysian country study.

In Malaysia, life profiles were also estimated for the 'rural agricultural group', which contains most of the poverty households picked out in the development plan as a matter for special policy concern (Table 5). The main difference between this group and Malays as a whole is a higher rate of economic activity, in part attributable to lower enrolment for those aged over 10 in educational establishments.

Table 5: Active life profiles for the rural poor by sex: Peninsular Malaysia, 1970

States	Expected duration (years) Males	Females
Pre-school	5.6	5.7
Not at school (6-9 years)	0.9	1.1
Enrolled in school	6.9	5.9
- primary	5.1	4.7
- lower secondary	1.4	1.0
- upper secondary	0.4	0.2
- tertiary	0.03	0.01
Economic activity	41.8	24.2
- employer/self-employed	24.5	8.5
- employee	12.2	6.2
- unpaid family labour	5.1	9.6
Inactive	3.1	23.6
Total life expectancy at birth	58.3	60.4

Source: Kwok Kwan Kit 1982, based on special tabulations from a two per cent sample tape of the 1970 census, and revised life tables, 1970.

In the British project, a big social differential can be shown more directly, because it was possible to construct life profiles for different social classes. Summary life tables are published for 'socio-economic groups', though only in a very abridged form. These life tables have been expanded by the Brass technique to give survival rates for five-year age groups, but socio-economic classes 1, 2, 3, 4 and 14 have been grouped together (broadly, Professionals, Employers and Managers), and also classes 7, 10, 11 and 15 (the semi-skilled and

unskilled manual workers). All in each household were classified according to the current (or most recent) occupation of its head. The results applying the various prevalence rates are shown in Table 6.

Table 6: Active life profiles for each of the main social classes, by sex, in England and Wales, 1971

State		Expected duration (years) Males Manual workers	Males Prof/Man/ Empl†	Females Manual workers	Females Prof/Man/ Empl†
Pre-school		4.2	3.5	4.4	3.8
Nursery school		0.55	1.2	0.44	1.0
Primary school		6.4	6.1	6.7	5.6
Other full-time education	< 16	4.1	5.0	3.9	5.2
	> 16	0.86	2.5	0.99	1.9
Full-time employment		39.5	42.3	16.4	15.1
Part-time employment		0.89	0.61	6.1	4.6
Other active		2.8	1.1	4.6	3.3
Inactive	< 60	0.80	0.38	15.6	19.6
Inactive	> 60	6.1	8.9	13.2	16.7
Total life expectancy at birth		66.1	71.4	72.3	76.8

†Professionals, Managers and Employers.

Source: Lucas 1982.

It will be noted that up to the end of education, the profiles are rather similar within each social class, whichever the sex. Subsequently, they are rather similar within each sex but differ greatly between the males and females of the same class.

What is also striking about this table is the variation in life expectancy by both social class and sex. The working classes have a significantly lower life expectancy than those higher up the socio-economic scales but this is outweighed by the sex difference, which is especially high for the working class: the life expectancy of a working-class female is more than that of a male of what I shall call the professional classes.

The almost universal greater longevity of women in all nations

is slightly puzzling. After all, those in the same household share the same water supply, air, housing, exposure to infection, etc. Indeed, males may get more food than females and in some cultures they may be given preference in medical attention. On the other hand, they also often take more marijuana, tobacco, alcohol and other toxic drugs.[32] Perhaps more important, a large proportion of them are economically active, working in factories, mines, construction sites, railways, etc. Such work raises mortality both directly, because of occupational diseases and accidents, but also because of stress, reinforced by the strains of travel to and from work.

This also help explain the variation in the gap between the lengths of male and female lives. It is much wider for Britain and Hong Kong than Brazil or Malaysia (Table 3) and also within Malaysia among the Chinese (Table 4). As Table 3 shows, in Hong Kong and Britain males can expect to spend a much greater proportion of their life as employees. So can the Chinese in Malaya.

But the differential among the professional classes in Britain (Table 6) would not be consistent with this explanation. A possible explanation is that, although a high proportion of males in this class are employees, their work is mostly 'white collar', ie less physically exacting and hazardous (whereas many of the female employees in the 'manual workers' class work in fact in offices).

However, the sex differential is so big and so universal that females must have a physiological advantage (as is apparently true in general of other species), though this might well vary according to ethic origin.

VII Construction and Uses of Age-Weighted Indices

Index numbers can be generated within the system as for the SNA. Here we use the standard age structures as weights, thus

$$I_{b}{}^{e}{}_{x}{}^{\cdot}{}_{t}{}^{a}{}_{x}$$

where b is the age structure base (eg a 1970 census) and t is some subsequent year. Such indices permit answers to the hypothetical questions like: what would have been the school

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[32] In Britain and Hong Kong, and among the Chinese in Malaysia, the males may be particularly addicted to tobacco and alcohol (possibly also opium among the Chinese). In Hong Kong, tuberculosis helps explain the particularly high mortality among males, and Goldman (1980) points out that drug addiction is a cause of tuberculosis. It would be interesting to construct life profiles of smoking, drinking, etc for each sex to correlate with life expectancy.

enrolment ratio if the enrolment ratios for each age group had changed, but the age structure had not?[33]

Table 7 from the Malaysian country study shows how one can 'explain' the changes in the life profile. It appears that the substantial increase in the scope of the organised labour market (viz the increase in employment at the expense of unpaid family labour) was not just due to the decline in mortality. On the other hand, the apparent rise in economic inactivity was due entirely to increased longevity, and if one allows for this there was really a fall, not a rise, in self-employment. Similar comparisons were made for Hong Kong.

Table 7: Active life profiles for males born in Peninsular Malaysia 1970 and 1979, using for 1979 both 1970 and 1979 life tables

State	Expected duration (years) 1970	1979	1979†
Pre-school	5.7	5.8	5.7
Of school age, not in school	0.8	0.6	0.6
In school	8.0	8.4	8.2
In higher education	0.16	0.34	0.33
Employee	18.4	21.9	20.8
Self-employed/employer	16.0	16.2	15.0
Unpaid family worker	3.2	1.8	1.7
Economically inactive	8.0	8.7	7.9
Total life expectancy at birth	60.1	64.7	60.1

†Using a 1970 life table.

Source: Kwok Kwan Kit 1982.

The Brazilian team carried out an analogous and interesting experiment in spatial analysis. After estimating active life profiles for males and females in each of the 26 States using its stationary population, they repeated the calculation using throughout the life table of the State with the lowest mortality, Rio Grande do Sul. An excerpt from the results is given in Table 8.

[33] This is similar to the concept in common use among demographers and population analysts some decades ago, a 'standardised death rate' using a stationary population for weighting. The Malaysian country study points out that (as is true of all such weighted index numbers) the variable assumed constant in the weighting system (in this case mortality) is implicitly taken to be independent of the variables being weighted, which may mislead.

Table 8: Active life profiles for males born in Sergipe and Rio Grande do Sul in 1970, and in Sergipe using Rio Grande do Sul mortality rates

State	Expected duration (years)		
	Sergipe	Sergipe†	Rio Grande do Sul
Pre-school	4.4	4.8	4.8
Of school age, not in school	2.4	2.7	1.6
In school	6.3	7.2	9.2
In higher education	0.2	0.2	0.4
Employed	13.9	17.4	17.2
Self-employed/employer	16.7	21.8	18.7
Unpaid family labour	1.9	2.2	3.4
Economically inactive	5.8	9.6	10.6
Total life expectancy at birth	51.6	65.8	65.8

†At Rio Grande do Sul mortality.

Source: Costa and Vetter 1982.

The authors of the Brazilian study say that 'it is precisely in this last type of comparison that the real value of the Seers method becomes apparent since it permits the impact of mortality on "life chances" at birth to be shown in a very clear and concise way.' Thus it can be seen that a new-born child's greatly increased prospect of schooling in Rio Grande do Sul than in Sergipe is in part due to lower levels of child mortality in the former but more to higher levels of school enrolment. On the other hand, the apparently big difference in the prospective duration of life as an employee is due entirely to the estimated mortality difference - far fewer children born in Sergipe live through to retirement.[34] The prospective time in self-employment (or as an employer) would actually be higher in Sergipe than in Rio Grande do Sul if one allowed for mortality, whereas in the original figures the difference is the other way round.

Experience with age-weighted indices shows that changes in the age structure can influence the significance of comparisons over time between coefficients such as 'scholarity' or employment rates. This is true even when two different

[34] This suggests that the common practice of discussing the supply of labour in terms of fertility rates and labour force participation is inadequate.

stationary populations are used[35] - and these will be much more alike than the corresponding actual populations when the latter are expanding (as in Brazil) especially in that they will give much less weight to the younger age groups. This implies that before any such comparisons are made from crude data (as is normally the case) it is worth asking whether one is not actually getting the effect of changes in age structure.[36]

VIII Some Research Possibilities Opened Up

(i) Other types of life profile

Profiles of active life are not, of course, the only types possible. There are many parallel dimensions of life, for each of which profiles could in principle be constructed, always of course adding up to the same total life expectancy. Such profiles have been constructed for marital status. (For these transition matrices can be used: the alternative states are sufficiently few, and changes between them sufficiently infrequent.) However, the method outlined above could also be used for many other dimensions. Since life profiles in various dimensions have, naturally, the same total, the possibility is opened up of research relating, for example, health to economic activity.

A by-product of the British project in this research programme was a housing life cycle showing how long the members of a cohort could expect to spend in rented or owned dwellings.[37] The results are shown in Table 9 which brings out strikingly the different housing patterns of different social classes.

It was also possible to show, in the England and Wales study, relations between the main active states and health states (according to the respondents' description of themselves in household surveys), as an example of the sort of cross relations that can be measured (see Table 10).

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[35] Though when the Malaysian life profiles for the different ethnic groups were standardised in this way, the comparisons were not much affected

[36] An interesting experiment in the Malaysian project was to compare the 1970 life profiles using a 1979 stationary population, with the 1979 life profiles using a 1970 stationary population. (This is like comparing the results of Paasche and Laspeyres indices in economic statistics.)

[37] The Kenya study (Roberts forthcoming) will contain estimates of how long children could expect to be 'wasted' (low weight for age), 'stunted' (low height for age) and combinations of these.

Table 9: Housing life profiles for males, England and Wales, 1971

Status	Expected duration (years) Manual workers	Prof/Man/ Empl†
Owner	21.2	55.3
Tenant, public housing	31.4	5.9
Tenant private housing (furnished)	1.6	1.8
Tenant private housing (unfurnished)	12.0	8.4
Total life expectancy at birth	66.1	71.4

†Professionals, Managers and Employers.

Source: Lucas 1982.

Table 10: Matrix of summary active and health profiles for those aged over 15, by sex, England and Wales, 1971

Active state	Expected duration (years) Health State: Well	Absent from activity sick†	Other sick	Total
MALES				
Full-time education	1.5	0.02	0.03	1.6
Full-time employment	40.2	1.18	0.36	41.7
Active part-time	2.2	n.a.	0.12	2.3
Inactive	7.9	n.a.	0.02	7.9
Total	51.9	1.1	0.5	53.5
Total life expectancy at birth				68.9
FEMALES				
Full-time education	1.5	-	0.01	1.5
Full-time employment	22.9	0.55	0.22	23.7
Active part-time	8.6	n.a.	0.18	8.8
Inactive	25.5	n.a.	0.01	25.6
Total	58.6	0.6	0.4	59.6
Total Life expectancy at birth				75.2

†Counting only absences of at least three days.
n.a. = not applicable.
Source: Lucas 1982.

(ii) Labour supply research

One advantage of the life profile, especially at the present time of high unemployment, is that it permits study of the effects on unemployment (for a given level of demand for labour) of raising the school-leaving age, or providing more university-level education, or promoting periods of study leave, or discouraging labour force participation, or encouraging early retirement.[38] The scope for such policy depends of course on the pattern of the demand for labour, but policies could be chosen (eg only giving study leave for certain courses) that helped match the structure of the supply of labour to the demand.

But a further step can be taken. When we talk of somebody being active for a year we do not really mean he was active the whole year. No work at all is usually done at weekends, during holidays, statutory or otherwise, and some days are lost, whether for sickness of other reasons. Altogether such absences account for perhaps 200 days a year for those at school or 150 days for members of the labour force in industrial countries, rather less where a six-day or seven-day week is worked, as it often is by those self-employed in agriculture or trade. Moreover, even on 'workdays' only a minority of the day is actually spent at work, say about 8 hours out of the 24.

If tables were expressed in hours, instead of years, it would be possible to study the effects on employment of policies such as shortening the number of hours in the working week, or lengthening annual vacations, or declaring more statutory holidays.

One could also, of course, do this directly by comparing the national total hours of work demanded (or to be demanded) with the number actually available on different assumptions about the working week, etc. But such comparisons, using the actual population, would reflect fluctuations in the labour force due to past 'baby booms' and changes in mortality, etc. A more fundamental analysis would be possible if one used a 'stationary population'; trends could then be obtained in the structure of labour supply due to changes in factors other than fertility and mortality.

(iii) Extension to non-active states

A further step would be to integrate this type of analysis with time budget studies. The unified framework for time analysis would be the whole of life expectancy - E years x 365 days x 24 hours.[39]

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[38] The range of such various 'work-sharing' possibilities is discussed in Emmerij (1980).

[39] Ignoring leap years: de minimis non curat statistica.

Suppose time budgets show the average daily time spent year-round by somebody aged x in active states is t_x hours, then for a prevalence rate (as above) of α^i_x for some state, obtained from censuses or surveys, the average expected hours a year spent in such as state will be $e_x \alpha^i_x t_x \times 365$. Time budgets also show the time in non-active states such as sleeping, shopping, etc, which sum to $(24 - t_x)$ hours. If β^j_x represents the fraction of this time spent in any particular non-active state, j, such as sleeping or shopping, the annual hours spent on average in such a state will be $\beta^j_x (24 - t_x) \times 365$. Provided that αs and βs have been defined so that they exhaust all possible uses of time, the total hours expected in all states in a lifetime will be the average daily pattern multiplied by the days in a year and the expected total life, ie

$$\int [\Sigma \alpha^i_x e_x t_x + \Sigma \beta^j_x e_x (24 - t_x)] \times 365 .$$

Of course, in practice, time budgets are not likely to be available in sufficient detail, but one needs to establish the territory to be mapped, ie the complete life profile, in terms of time use, although parts of it will have to be left blank, for the foreseeable future anyway.

Even incomplete time budgets throw a great deal of light on issues such as 'underemployment', especially its seasonality. They can also reveal (to the extent responses are honest) 'informal' economic activities. They could show increases in welfare due to reductions not only in working time but also in time spent queuing or searching for products - both invisible to the national income accountant (as, of course, is involuntary unemployment). In all these cases, the results are more significant when mortality decrements were applied.

Time budgets would also help dispose of the problem mentioned above of how to allocate people to different states, when they work less or more than 'full time' in any of them. Indeed, using an integrated life profile, covering the whole 24 hours, the need to allocate somebody to one part-time activity or another would disappear. Moreover, the welfare implications of changing working time by shortening the working week could be better compared with those of reducing employment. So time budgets could be used to develop more meaningful life profiles, as well as to extend them. Morbidity surveys (Ho 1982) would help establish the expected time absent from economic activity, as well as yielding health life profiles.

(iv) Sequential analyses

Although detail of activity by age group has not been shown here, it is available in the working tables for each country. Sequential research would be carried out to bring out the interaction between different states (eg between life patterns and causes of death). Also, of course, this approach could readily complement cohort analysis.

Life profiles could also be prepared for starting points other than birth - eg at age 20. These could show expected patterns for special groups, such as university graduates (provided the basic data on mortality and prevalence are available).

IX Costs and Benefits of Constructing Active Life Profiles

The experience so far gained in the international research programme permits an evaluation which, although provisional, is not likely to be greatly amended.

All the country studies suggest that the costs of the technique are relatively light (though new data collection would have improved the detail, range and quality of the tables). Special computer programmes have to be worked out, but once these have been tested, they can be left unchanged for a number of years, and dead time on computers can be utilised.

Certainly a good deal of professional work (several man-months) was necessary to carry out each study, but this was because the approach raised new issues and required evaluation. As the Brazilian study points out, the technique makes it possible to extract more of substance from material such as population censuses which are undertaken anyway.[40]

Developing the system will cost less resources than the national accounts for another reason. Here the process is breaking down an aggregate which has already been estimated and is unlikely to be revised as a result of further statistical collection; the national income, by contrast, is built up from sectoral detail, and any new survey generally requires revision of the whole set of tables.

The importance of accurate life tables, however, comes out. In many countries, where death registration is incomplete and these have been constructed by artificial methods, the profiles may be seriously biased, and in some countries Michael Ward's compromise in Kenya (see above) is doubtless all that can be attempted.

The biggest drawback is the possibility of misinterpretation. The central issue posed in this analysis is hypothetical - what would be the life profile if mortality rates remained unchanged, and also the prevalence of various states? The answer tells us neither what has happened to any particular cohort, nor what is really expected to happen to the cohort concerned (since in fact mortality rates can be expected to decline and prevalance rates to change). Indeed the question itself is somewhat unreal, because prevalence rates may not be independent of mortality. A life profile is not quite such an easy concept to grasp as it seems at first sight.

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[40] It is possible, moreover, to make use of a sample from the census (in the Brazilian case, a one per cent sample).

This is a valid objection. However, the public learns to understand hypothetical concepts, as has been shown by the general acceptance of 'fixed price' series in national accounts, indeed, of the total life expectancy itself. Certainly, professional researchers are not likely to be misled.

A further problem: the distinguishing characteristic may be either constant or variable. People very rarely indeed change their sex or race but some climb out of (or fall into) a socio-economic group once or twice in a lifetime, and many move residence more frequently.

This last possibility creates further practical problems of interpretation of the results for some countries and some areas. In the Brazilian State of Sergipe, one from which people emigrate, the life profile shows the pattern of life of those who remain in the State (or if they leave, their profile upto their departure). For a largely immigrant population, like that of Hong Kong (the same would be true of Nairobi and the State of Sao Paolo), there is another qualification: not merely will the life tables reflect the combined mortality experience of natives and immigrants; the prevalence rates must understate the probability of the natives obtaining higher education since they have certain advantages[41] - and overstate their probability of employment.[42] In nations like Kuwait or Saudi Arabia, where the numerous immigrants are mostly temporary, and by no means integrated into the local population, only life profiles for natives, based on their mortality and prevalence rates, would have much meaning.

On the benefits side, some advantages have been demonstrated above. The life profile system does, like the SNA, force those using it to rethink definitions and concepts so as to make them mutually consistent (see the discussion above of the classification of children enrolled at school who are also economically active). Indeed, much of the time spent by professional statisticians in establishing new profiles was taken up in conceptual clarification, which is very desirable anyway.

This has already led to improvements in official statistics. The Malaysian Department of Statistics has introduced changes, as a result of this research, in the design of questionnaires to identify the extent of school attendance (as distinct from enrolment) and employment of teenagers. Moreover, problems revealed when the department tried to construct life tables for rural areas have led to revision of the national tables. Consideration is now also being given to extending the coverage of labour force surveys to those aged 10-14 and over 65, because of the significant rates of economic activity in these

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[41] See the discussion of Hong Kong educational data above.

[42] Sex comparisons may be affected too, because most immigrants are males.

groups. Such improvements, as a result of this research programme, may alone have justified the costs, since these have been low.

A second and less predictable advantage, stressed by the Brazilian team, is that putting together life profiles has permitted, indeed compelled, different sections of a statistical office (demographers and those responsible for statistics on education and the labour force, etc) to work together - occasions for this are rare in large official statistical organisations.

Thirdly, it is clear that the profiles are flexible and can be extended when new data emerge.

Fourth, various types of analysis are facilitated. As examples in the country studies show, the profiles have permitted movements in variables such as employment or school enrolment to be studied while 'holding constant' fertility and/or mortality. In particular, one can indicate how much of apparent changes in the rates of unemployment, ill-health, etc can be attributed to changes in the age structure.

Fifth, the use of time as a numeraire has permitted direct comparisons between countries, without any need for reduction to a common currency. Income comparisons, on the other hand, whether between countries or periods, always raise serious practical and conceptual problems of 'price deflation'. (The use of estimated 'purchasing power parity' exchange rates can reduce apparent differences in national income per capita by more than 50 per cent, depending on the technique used.) The conclusions often depend very much on, moreover, which country or year is used as a weighting base: in comparisons of distribution the need for different price indices (eg for the richest 10 per cent) is usually overlooked.

Sixth, the increasing emphasis on social factors in statistical development in the past quarter-century, has been carried further. Life profiles provide a system of social accounts, somewhat analogous to the system of national accounts. It is true that the framework covers only those social indicators that can be expressed in terms of duration, thus omitting structural data such as doctors per 1,000 of the population; but these are 'input' indicators, of influences on welfare, not of welfare itself.[43]

On applications, however, it is really too early to say: nobody could have imagined what could be done with national income accounts when they were first prepared. (In one of the countries covered, a comparison of life profiles appeared to be socially so significant that its publication was suppressed!). Social analysis can certainly probe more deeply,

[43] Structural data do not fit readily into the system of national accounts either.

using time rather than income as a numeraire, ie separately for both sexes, different ethnic groups, etc: data on income or consumption can only be tabulated for households. (Leazear and Michael (1982) have shown the importance of the much neglected dimension of intra-family distribution.) Income data in distribution tables are also far from complete: they exclude 'imputed' income, not merely farming on own account, etc, but also shares in the undistributed profits of companies, as well as most 'informal' and all illegal activities.

Economists assume almost automatically that 'distribution' means distribution of income: by opening up the issue, life profiles may make it easier for them to see the significance of other more fundamental dimensions, such as the distribution of economic power.[44]

Some important decisions are customarily ignored by economists, such as delaying taking a job in order to continue one's education, or to devote one's self to housework (eg to raise children), or retiring early. These influences on the supply of labour, which are often irreversible, cover a large proportion of the most important micro-economic decisions, especially those taken by women. Trends in them may have major implications especially for unemployment. They would hardly have been so cursorily treated in economics if women had played a bigger role in the profession.

So the development of temporal analysis would provide an escape from some of the limitations of income analysis without casting aside the crutch of quantification.[45] It would also facilitate inter-disciplinary research, showing for example the effects on employment patterns of the length and nature of education, or of ill-health in childhood (due, for example, to undernourishment). The interaction between economic and social variables can be explored within this single framework, viz the brief discussions above of the effect of the pattern of life on its length.

It would be interesting to see whether life profiles in other European countries, Eastern or Western, show the same patterns as those of England and Wales, whether there are marked differences (eg in the patterns of female life) between Kenya and Tanzania. One could also compare changes over periods too long to handle with income analysis (eg Britain in 1870 and 1970).

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[44] To use time means in a way reverting to the approach of classical economists, especially Marx, who gave a central role to time as a numeraire, eg in developing the concept of 'surplus value'.

[45] I repeat that income analysis is not valueless: it needs to be supplemented.

This approach would seem to have possible applications for planning now that structural change is increasingly on the agenda. One would, in principle, not only analyse past social progress but also express social targets (eg in development plans) in terms of lengthening and improvement in life profiles. Improvements consist not merely in increases in total life expectancy and in school attendance, but also reductions in the time spent in undesirable states, eg unemployment and ill-health, etc, whether we are speaking of nations or particular social classes or age groups or areas where such problems are serious. 'Equal opportunity' targets between sexes, ethnic groups, etc, could be illustrated in this way, as Henry Lucas points out - they could be useful in Malaysia, for example, where government policy is to eliminate the educational and other advantages of the Chinese minority, and also to treat rural poor as a priority group (Table 5).

Temporal statistics would make it possible to develop new types of economic analysis. At present, the basic assumptions in economic decisions are that we aim to maximise our lifelong incomes and optimise their allocation; an alternative hypothesis would be that we are attempting to live out our normal lifespan and optimise its profile, ie that time is our scarce resource.[46]

The choice of crops by peasants, for example, clearly reflects the desire to minimise the risk of dying from hunger; some high-yielding crops, in which they would specialise if they were just maximisers of expected income, are particularly vulnerable to drought, crop diseases, etc. Their choice also reflects an understandable desire to minimise the time spent in stoop labour (long periods of which means ill-health and reduced life expectancy, apart from serious discomfort). On the other hand, in rich countries increasing numbers of people clearly prefer increments of leisure to increments of income, once a basic level of living has been achieved - shown for example by the increasing demand for part-time jobs, periods without paid work, early retirement, etc. These increases in welfare cannot be captured in income analysis - which in fact would treat such tendencies as purely negative. Attempts to convert them into monetary equivalents are inevitably highly arbitrary.

Active life profiles provide a framework which may be useful to an economics based on time use. It should not be forgotten that the sum which is being disaggregated, the life expectancy at birth, is the most meaningful single measure of welfare. Who would prefer for their child a short life at a high income to one of at least half-a-dozen decades, provided it was not lived in dire poverty? And the approach fits the growing

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[46] A point made in Sharp (1981) which contains a useful survey of the state of the art in academic discussion of temporal economics, and a summary of relevant research.

interest in the 'life chances' of different social groups, and in the 'quality of life'.

Income, on the other hand, is of course important, not merely in increasing life expectancy (among the poor), but also in reducing the time spent on chores and increasing the amount and uses of leisure. But surely it is only one means to improving the length and quality of life - which it can indeed both shorten and damage (eg by causing 'diseases of affluence', neuroses, exposure to criminal violence, travel accidents, etc).

To put the matter succinctly, income is not welfare, nor even a proxy; it is one input into welfare, whereas the pattern and length of life are its dimensions.

Despite some initial doubts, I have come to the conclusion that active life profiles are worthwhile, wherever usable life tables exist or could be constructed. The conclusions of the national statistical offices which carried out national projects is the same. The Hong Kong Census and Statistics Department (1982:para 37) study states:

> The Seers method of estimating life expectancy at birth for each state of the life cycle offers a tool for integrating the various social and demographic statistics in Hong Kong, and in doing so brings new insights into facts that are inherent in the data. Depending on the availability of resources, it is planned to extend this system to cover other types of life cycle profiles that are of relevance to the study of social change. Since August 1981, Hong Kong has been undertaking a continuous General Household Survey on a month-to-month basis to collect data on the labour force and a wide variety of social topics. Information generated from this survey will be useful for the future life cycle analysis.

The Statistical Department of Malaysia (Kwok Kwan Kit 1982: para 82) concludes that apart from improvements in Malaysian statistics:

> In the subsequent analyses of the life cycle profiles, either over time or between important population subgroups, the country study shows that the profiles and their component life states provide useful information on socio-economic changes arising from the development process and at the same time they indicate succinctly the main socio-economic differences characterising the population subgroups. A more complete range of profiles, particularly over a period of time, would enable the overall changes and changes in subgroup differentials to be monitored. It should perhaps be stressed that similar types of analyses can and have been done using similar types of socio-economic and demographic data, but these analyses must be of an ad hoc nature for lack of a common framework. The life

expectancy approach provides the means of integrating these diverse statistics into a common additive framework.

The Brazilian team anticipates that 'special tabulations now needed to generate life cycle profiles will become standard tables in official statistical publications.'

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