CICRED'S SEMINAR

"Demographic dividends", "windows of opportunity" and development: age-structure, population waves and cohort flows

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OF "DEMOGRAPHIC DIVIDENDS", "WINDOWS OF OPPORTUNITY" AND DEVELOPMENT: AGE-STRUCTURE, POPULATION WAVES AND COHORT FLOWS

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"The time has come the Walrus said to talk of many things,
Of [dividends and cohort flows, of waves and troughs and swings,…]"

(with profound apologies to Lewis Carroll, 1832-98, *The Walrus and the Carpenter)*

The Significance of Age-structure for Policy and for Development

In a recent study published by RAND, David Bloom, David Canning and Jaypee Sevilla (2003, *The Demographic Dividend: A New Perspective on the Economic Consequences of Population Change*) succinctly outlined a theme underlying the questions to be discussed at this seminar. Thus their study has set out for us parts of the agenda at this meeting. Their focus, it is true, was on macro-level economic development, but what they are saying carries across into every policy domain, including social and environmental. One can go further than this and argue that their analysis also has implications at the micro- and family-level. To quote from their abstract:

> "For decades, economists and social thinkers have debated the influence of population change on economic growth. Three alternative positions define this debate: Population growth either (1) restricts [what they call the *pessimistic* theory], (2) promotes [the *optimistic* theory], or (3) is independent of economic growth [the *neutralist* theory]. Proponents of each explanation can find evidence to support their cases. All of these explanations, however, focus on population size and population growth. In recent years, however, the debate has given insufficient attention to a critical issue: the *age-structure* of the population (that is the way in which the population is distributed across different age-groups), which can change dramatically as fertility and mortality rates change… Because people's economic behavior and needs vary at different stages of life, changes in a country's age-structure can have significant effects on its economic performance" (Bloom et al 2003: xi).

The recognition of the applied importance of age structure as a factor in economic change and thus policy has come about very recently. As there had been an historical interest in this question, particularly among theoretical mathematical demographers (eg Keyfitz 1968) treating it both as an issue in its own right, and because of an interest in the properties of stable and quasi-stable population models, the puzzle is why empirical interest in the topic came about so late. Without delving into epistemology, it does seem that concerns over the high growth seen in the post-war United Nations projections and similar forecasts drove the development of methodologies in demography that could allow these trends to be mapped more accurately (eg indirect estimation of vital rates). At a more theoretical level, and until ageing became an emerging issue, this led to a focus in the demographic community on dynamics, on demographic transition and migration, rather than on structures. Conversely, in applying demography to development issues, the use of blunt indicators of population size and growth in planning meant that the integration of demographic factors into economic planning models was not very satisfactory at an operational level (UNFPA 1989; Pool 1994a).

Emerging Paradigms

By the late 1990s, however, an interest in age-structure in relation to policy was starting to emerge. It seems to have evolved from at least four groups of researchers, all of whom are represented among the presenters at this meeting.

Firstly, there is a general interest in ageing that was referred to above, and which goes back at least until the 1980s. Concern in the developed countries, particularly in the Economic Commission for Europe, resulted in a special section on this being devoted to the topic in the Programme of Action produced by the *International Conference on Population and Development*, Cairo, 1994. The issue has also been advocated as among priorities in the developing world, even in Africa where structural ageing (the percent of the population at older ages) is a distant prospect. Among those developing countries that will see ageing sooner than that, however, is China. Its State Planning Commission research groups, from which Yan Hao, a participant here, is drawn, have paid a great deal of attention to this issue, along with other aspects of their age-structural transition.

The problem with a great deal of the focus on ageing *per se*, such as at the ICPD[1], has been that it has put emphasis on this one phase of an age-structural transition and essentially neglected much of the rest. The remaining three paradigms cover the whole transition. In keeping with this approach, the present seminar will deal with ageing only in passing as a part of a wider analysis of age-structural transitions.

Secondly, and in this latter vein, there is the work of Bloom and his colleagues, represented at this seminar by Bo Malmberg, stressing age-structure, and also focusing on the benefits, "demographic dividends" or "bonuses", that age-structural changes may produce for many countries, especially developing ones. The roots of their paradigm go back to the 1980s, although the "seminal Coale-Hoover study,…[1958]" provides an exceptional example of such an approach far earlier than this (Bloom et al 2003: 20).

This paradigm sees societies going through a series of age-structural changes. These phases are determined by the relative weights of each of the major life-cycle stages, measured by the proportions at young, intermediate or older ages. At an early stage the population is disproportionately weighted towards childhood; at the middle phase the working ages dominate; and at a late stage the oldest ages dominate. The "demographic dividend" arises when the society is at a middle phase and dependency ratios are low.

Thirdly, overlapping with this model but coming from a different demographic tradition and thus carrying different implications, is the emphasis, particularly in Latin America, on "windows of opportunity". This model was carried far beyond Latin America by Jose de Carvalho in his Presidential address to the IUSSP at the *Beijing General Conference (*1997). A colleague of his and a critical contributor to this model has been Laura Rodriguez Wong who is at the present seminar. Implicit in their paradigm is the notion of choice: that an

[1] With only six percent of the World's population being aged at this time. In contrast, apart from their sexuality which received a lot of attention, youth (aged 15-24 yrs) and who constituted almost 20 percent of the globe's population received little acknowledgement. In the part of the document titled "Actions" only one para (6.11) referred to them: "Countries should aim to meet the needs and aspirations of youth, ensuring their integration and participation in all spheres of society".

opportunity exists, but is one that can be realised on only if policy- makers exploit it effectively[2].

Fourthly, the IUSSP Committee on Age-structure and Policy of which I am a member, formed in 1998, has brought together a range of scholars with interests in age-structure, economic, sociological, anthropological and demographic, in work at both the macro- and micro-levels. Its mandate has been wide, but with a focus on "age-structural transitions" which the committee has attempted to conceptualise and map. It has also married practical concerns of mine with theoretical and empirical analyses of Shripad Tuljapurkar relating to the construction and use of projections in a wide range of settings, and the application of these to public policy issues. My own interests date back to the 1980s to a global evaluation by UNFPA (1989)[3] of population and development planning which highlighted the relative lack of success of endogenising population into planning.

In the work linked to presentations to the IUSSP committee I have developed a transition model that has some of the elements of the one noted above, but goes further by introducing cohort and momentum dimensions. It posits
Stage I: Simple momentum, with sub-phases of Constant Momentum, and Accelerating momentum, characterised by almost a tidal wave effect. A number of African countries are at this phase at present.
Stage II: Population Waves, with sub-phases of simple oscillation, linked to decelerating momentum, double and multiple oscillations, both sub-phases likely to be typified by disordered cohort flows.
Stage III: Ageing, with a first sub-phase when the total population is still growing, a second when it is stationary, and a third when it is decreasing (Pool 2000)[4].

This overview of developments would be incomplete without referring to interactions between the demographic transition and age structures. A major contributor to this research has been Jean-Claude Chesnais, although his prime emphasis has been on the determinants of that transition. Nevertheless, he has given precision to the interactions by formulating "a synthetic index [a population multiplier]… [by] which the population is multiplied during the transition". He then recognised that during a transition "the increase in population is not evenly distributed by age" (1990: *passim*). The faster the transition the higher the multipliers, as this comparison between France and Kenya shows:

Transitional multipliers per country for the following ages:	France	Kenya
Total population	2	20
Ages 0-14	1.5	10
Ages 65+	10	200

[2] My own work in New Zealand, shows that increased birth cohort sizes of the 'baby-blip" of around 1990 will produce large flows of young workers into the labour market around 2010. This is thus a "window of opportunity", but will have positive outcomes only if there is investment in human capital. If this population wave is not responded to in this way this will be not merely an opportunity lost but will result in increased fiscal burdens and dis-investment in welfare necessary to sustain young un- or under-employed (Pool 2003). Opportunities are thus also potential risks.
[3] I was involved in both the regional (Africa, and Asia-Pacific) fieldwork and the global synthesis. See Pool 1994a.
[4] The terms population wave and disordered cohort effects come from Keyfitz (see also Rowland 1996). The term momentum as used here differs a little from the way it is defined by, say, Frejka (1982) to accord more closely with the definitions employed in physics to mean simply "impetus gained from movement" (*New Shorter OED*: vol A-M, 1810). Frejka's definition is "a property whereby populations change their growth rates in a relatively smooth fashion".

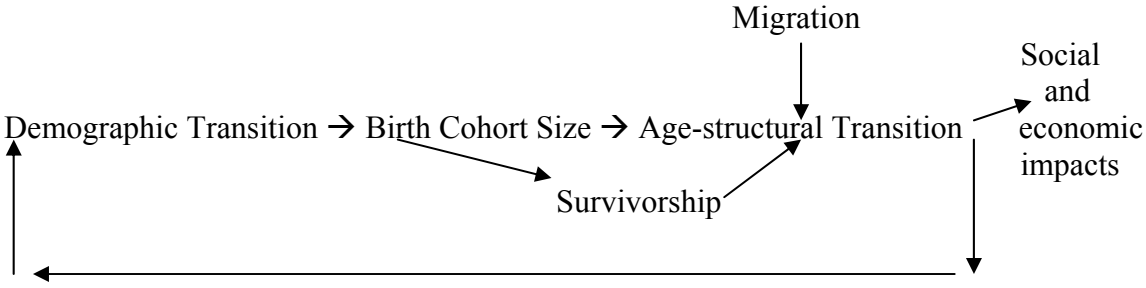
In many senses the term demographic transition is misleading. It only covers part of the way population dynamics and structures change, in terms of natural increase, but not structural changes. For this paper I will retain the conventional terminology.

Age-structural Transitions: Some Theoretical Questions

Over much of the world today age-structural transitions are being produced primarily by changes in fertility resulting from the demographic transition, as is shown in Figure 1, and thus in the sizes of birth cohorts. These are then mediated by shifts in patterns of survivorship, and in many populations by migration flows (albeit that migration will normally be a less significant determinant of change). Earlier in the demographic transition when fertility levels remained high a key factor was a decrease in mortality that disproportionately affected younger ages where the force of preventable mortality was highest. Then fertility declines became the factor that most affected age-structures. Recently in developed countries improved survivorship at oldest ages is an emerging force, but even there ageing is still mainly a result of low fertility. Finally, and a major issue for this seminar, is another point indicated in Figure 1: that age-structural transitions have an impact on sustainable social and economic development. They also have feedback effects on the demographic transition through the effects of age compositional effects on fertility and mortality.

The linkages between these different factors is shown in Figure 1:

Figure One: From Demographic Transition to Age-structural Transition



A central problem, particularly for planning for sustainable development, is that the birth cohort sizes, and/or shifts in patterns of survivorship, and/or migration flows that modify birth cohort sizes are not likely to be regular, and, to make this more complicated, will be age-specific. In some countries and in some eras either may play a major role: the very perturbed structures seen for the Russian Federation or China come from a mix of fertility and survivorship effects, that were irregular both from a temporal standpont and the degree to which they affected structures. Migration effects will normally be more marked at a sub-national level than at a national level.

Beyond this, fluctuations in past cohort birth sizes have produced the waves and disordered cohort flows that characterise some Western Developed Countries (eg United States and New Zealand). Elsewhere, as in Italy or Japan, rapid decreases in fertility will produce highly skewed age distributions, in Italy's case, for example, with higher proportions at some older age-groups than at younger ones. But in other countries, such as India and France, shifts in fertility have been less marked and thus perturbations less severe, so that in future France will

have a remarkably even composition across age-groups, with a bit lower proportion at the older age-groups (Pool under editorial review, a and b).

This raises three important points. Firstly, in studying age-structural transitions it is essential to recognise and build into models the effects of the demographic transition (as defined in this paper). Equally well, however, when loking at the age-structural transition *per se* it is essential to analyse both broader age-compositional changes over time and the cohort flows.

The dynamics of both of these are described by Bloom *et al* (2003: 30-31; see also Pool 2000 and under editorial review a), who show how cohorts emanating from periods of high fertility may see their numbers being maintained, relative to previous generations, by improved survivorship, and even declining levels of reproduction being offset to a degree by decreases in infant and childhood mortality[5]. This wave produces momentum as the cohorts concerned pass through the age-pyramid. When each of these waves "itself reaches the prime reproductive years, it creates its own echo…", as larger parenting cohorts produce a higher number of births, occuuring even if fertility rates have declined. A useful term for this is "secondary momentum" (see the outline I sent out with the call for papers).

The picture is more complex, however, than this description might suggest. Cohort flows may take the form of one or more relatively regular wave(s) moving across the age-pyramid, but they are more likely to be disordered flows than simple oscillations, with both volumes and durations for waves and trouhs varying irregularly. The broader changes may provide "windows of opportunity" or produce "demographic dividends" over longer terms, or equally well place burdens on fiscality, and the delivery of services across a decade or so. But disordered cohort flows will produce complex age-structural fluctuations over short-term periods thereby posing problems for the realising of dividends, or the planning of responses to burdens induced by the changes. Essentially, the yield for dividends may vary rapidly over short durations while the policy-maker will need to plan for on/off-again demands. In short, to fully appreciate the social and economic impacts of age-structural changes it will be necessary to move to more refined models that permit the analysis of cohort flows as well as broader ae-structures.

Secondly, the degree of perturbation of structures is a determinant of the social and economic impacts of an age-structural transition. This can be both in a positive direction, producing "dividends", or in a negative direction by increasing fiscal, service, resource and other economic demands, or on the analogues of these, positive and negative, at the level of the family. Conversely, the degree of perturbation an age-structure is subject to also affects social and economic capacities across these same factors.

Bloom *et al* (2003: 39-42) identify the three most important mechanisms that "deliver" the demographic dividend: (1) Labour supply, the volume, age-distribution and spatial spread of which are demographic questions but the quality and skills of which are due to education and other factors; (2) savings; and (3) human capital, the quantum of which is essentially also a demographic factor, but the exploitation of which is a function of social and cultural norms and the way public and private sector enterprises, and small/family businesses/farms are

[5] Bloom *et al* (2003: 30) call this a "Baby-Boom" even when it is merely the continuation of high levels of fertility, a usage that I am unhappy about. A Baby-Boom is rather more an upsurge in rates and numbers of births, associated with a shift to younger and younger ages for child-bearing, and typifying the Neo-European Western Developed Countries. It is arguable whether it applies even to the countries of Western Europe (Pool and Sceats 2003).

organised. They go on to say that "the demographic transition has significant effects on investments in human capital, effects of which are the least tangible, but may be the significant and far-reaching". Finally they point out that "All these mechanisms are heavily dependent on the policy environment" (Bloom *et al* 2003: 41, 42).

Thirdly, the waves continue on into the older age-groups. The net effect are shifts in the balance between the older elderly and the younger, and this has major implications for health and welfare policies and services (Pool 2003 for New Zealand). The waves also fashion the long-term relative weighting of the age-structure, as the comparisons of France and Italy above show.

The emphasis in this seminar is on the developing countries. Most of these, indeed some developed countries as well, are at the second stage of an age-structural transition the framework for which was outlined earlier. A limited number of developed countries in Europe, especially in the Mediterranean Basin, plus Japan seem to have entered the last stage (see Pool under editorial review a and b; Bloom et al 2003).

Some Sub-saharan African countries are at the first stage of a transition, in the later sub-phase of accelerating momentum coming from declines in infant and childhood mortality in the face of the maintenance of high fertility (see Pool under editorial review a and b; Bloom et al 2003). Or, perhaps one should say, were in this first stage – the HIV/AIDS epidemic may significantly alter their transitional path, perhaps causing them to deviate markedly from what has been seen in the past. This epidemic will have two impacts on the sizes and survivorship chances of birth cohorts in the countries most affected. The death of men and women at prime reproductive ages could well reduce the reproductive potential and thus fertility rates, and there also is the effects on children born alive of infant and childhood mortality from secondary infection.

In sum, then, in reviewing age-structural transitions three elements must be covered. Firstly, there is the question of determinants, the demographic transition and migration as affected in turn by age-compositional effects coming from the age-structural transition itself. Secondly, there are the processes by which age-structural transitions unfold. Thirdly, and most importantly perhaps, there are the consequences of these for sustainable development. The first of these issues is arguably better understood than the other two. The second requires new and improved mthodologies to which I will turn in the next section of my paper, and must be elaborated through detailed case-studies, some examples of which I will present after I have dealt with some methodological questions. The third question will then be addressed.

Age-Structural Transitions: Methodological Issues

There are four major methodological questions that need addressing if this domain is to progress. Developments here, I would argue, should be treated with the same degree of priority that was accorded indirect estimation of vital rates in the 1960s to 1980s. Then the Princeton Africa project and other work carried out there assembled a team of scholars whose work built on methodological advances coming from the United Nations Population Division. This spawned a range of new techniques that were collated by Ansley Coale and Paul Demeny in United Nations *Manual IV* (1967) (and subsequently in *Manual X*).

My citing of this important precedent is because, as Bloom *et al* (2003) have signaled, the architecture of the world's population is undergoing a mutation, from trends driven by natural

increase and migration to composition being the dominant factor. The emerging architecture has implications for development and policy in general that are as urgent as unprecedented accelerating growth was three decades ago. To draw an analogy, demography must shift from an "epidemiological" to a "morphological" focus. Yet it is a sobering thought that, by comparison with the sophisticated techniques available to analyse the way populations grow and move, the methodologies of population morphology are very basic. Moreover, they occupy a minor part of demography's liturgy as a review of any methodological text will show (eg Shryock and Siegel 1976)[6].

A first point is that cohort analysis is central to much of the work in morphology. This is particularly true for that component dealing with issues that have policy implications. The reason is rather simple: the intersection of (a) cohort flows across a given life-cycle stage, with (b) a focus in most policy sectors on the needs of particular age-groups (as against the population as a whole), requires analyses that take a cohort approach. This permits assessments to be made of fluctuations in levels of need, as cohorts of varying sizes arrive at different life cycle stages. Although this branch of demographic analysis has again been directed to more "epidemiological" ends, it has a major role in the area of population "morphology", as Norman Ryder has demonstrated over the years (eg 1965).

This becomes significant in the second question to be raised here: The measurement of wave effects, especially when cohort flows create situations of turbulence. Below when this paper looks at case studies it firstly uses conventional indices of age-structure based around a time-series analysis of period observations (Figure 2). Then in the case studies an attempt to capture wave-effects employs as a denominator the total population at time "t", and then computes the proportionate significance of age-specific changes, the numerator statistic, over the period t to t+n. This captures, to a degree, the impact of cohort flows and also is suggestive of momentum effects (see below), but it is a true measure neither of cohort flows nor of momentum.

A third issue is the measurement of the contribution of momentum to total growth. A literature review in the domain of regional population change, where momentum (as against net migration) can be a very important factor, suggests that few models exist in this area of analysis. In attempting to disaggregate "ageing in place" from migration Rogers and Woodward (1988) employ an age-specific variant of standard component methods where, $Pt = P_0 + B - D + I - E$ (see Shryock and Siegel 1976: 410, 413-14). At each age-group 5-9 years and over the equivalent of "births" are the "new entrants" to the age-group (called NE here), and the effects of deaths and net migration are then subtracted to isolate out the pure effects of momentum. They show that, at the state level, "ageing in place" makes a very significant contribution to regional change in the United States, less so in "sun-belt" regions subject to retirement migration inflows, more so in others. This finding is of real significance in terms of planning for ageing[7].

In this present paper, however, the focus is on the national level, and for questions such as labour supply and human capital. To illustrate this for the period 1995-2000, two case-studies were chosen, China which has a very perturbed age-structure, and Nigeria that is at a first

[6] A partial exception is the work of Roland Pressat (eg 1978: Chapt 3) that has exploited the analytical utility of cohorts and of the Lexis Diagram for both epidemiological and morphological ends. His plenary paper in a session on the Demography of China at the *Manila IUSSP Conference*, 1982, was a fascinating exposition of the implications for that society of "morphological" changes.

[7] Work underway at our Centre on New Zealand confirms this finding.

stage of an Age-Structural Transition with accelerating momentum. The choice of these two countries, which have population structures that, *grosso modo*, are closed to migration, permits one to skirt around the practical issue of obtaining reasonable estimates of external migration movements. Thus the age-specific equation was simply,

Momentum (x), t to t+5 = NE(x) – D(x),t to t+5
where x = age-group,
and NE = P(x),t+5 – P(x),t.

The numbers involved and the direction of the momentum effects are shown in Table 1 for each quinquennial age-group five years and over. More refined computations are required at age-group 0-4 years where natural increase (actual B – D,0-4yrs) will far outweigh migration and momentum effects, and thus this age-group is excluded here.

The results in this table show several things. Firstly, momentum is important. In the case of China gross momentum (positive momentum growth plus negative combined) is at a level far above that for net momentum (positive minus negative), whereas in Nigeria, facing a "tidal wave" effect, the two are close. Thus in China gross momentum at ages 5+ years, that is all the gains and losses due to successive waves, is 2.45 times the growth at these ages in this period; and the net figure, the increments due purely to "primary momentum" was far lower but still 38%. Some of the births, excluded from this computation, would have been from "secondary momentum", a birth cohort size effect produced in the face of severe constraints on reproduction, by the fact that the three largest age-groups in 1995 were at the prime reproductive age-groups (20-34 years). In Nigeria, gross momentum constituted 75% of the total change, but net momentum was still 70%. Again "secondary momentum" would have played a major role as "primary momentum" had seen the prime reproductive age-groups increase in size by 32% over the decade 1985-1995; not surprisingly this translated more or less directly into replacement and thus age-group 0-4 years had grown by 28% over the same period.

These comments here have drawn a distinction between gross and net momentum. This is more than merely an academic distinction but has policy implications. The figure for gross momentum is an indicator of the degree of total turbulence in the age-structural transition: it is the sum of the way waves mount and then drop off into troughs. The more turbulent the system, the more complex the policy and planning models necessary to respond to the trends. The net figure also carries policy implications for it provides an approximation of change due to positive momentum, an impetus that is carrying the population size upward. The relationship between these, then, shows the relative importance of the two trends. In China's case the ratio between the net and gross figure is only 16%, but in Nigeria is 94%.

The fourth methodological question relates to projections. A major problem arises from the fact that traditionally a deterministic set of parameters has been posited, typically involving changes in rates up until some future date and then constant rates thereafter. A net effect is that the potential for fluctuations and waves is artefactually dampened, as can be seen at older ages in the data presented in Figures 2 and 3. For that reason these figures end at 2030 even though the projection period runs to 2050.

Recently, to attempt to overcome this weakness, a family of stochastic projection methodologies has been proposed (eg see Lutz *et al* 2001; Tuljapurkar *et al* 2000). This development has, however, left unsolved several problems. Firstly, stochastic methodologies

produce a plethora of trajectories and parameters; selecting the more likely patterns from among these, and certainly avoiding doing so arbitrarily becomes an inherent problem. Secondly, much of the work to date has been directed towards projecting two variables, mortality and fertility. Very little has been done on migration, a very difficult parameter to project for "open" populations. Thirdly, little has been achieved in inter-relating these different factors, or on their interactions with co-variates. Finally, there is a need to review the implications of these problems for the projecting of age-structural changes. In a sense, an age-structural transition, and its component waves and cohort flows, is a descriptor that synthesises, as it were, the effects of the different population dynamics (fertility, mortality, migration as these affect the age-structure existing in a base year). The trajectory of the age-structural transition is determined by the dynamics.

The computation above excludes the effects of deaths, seeing them a determinant of momentum but not one of its components. An alternative way to measure momentum might be to argue that negative momentum at age x in any year t already comprises the impacts of deaths over the period immediately prior to this, during the year(s) t-n to t.
Thus, in this case
Momentum (x), t to t+5 = P(x),t+5 – P(x),t,t to t+5
where x = age-group,

The numbers involved and the direction of the momentum effects are shown in Table 1b for each quinquennial age-group five years and over. As noted earlier, more refined computations are required at age-group 0-4 years where natural increase (actual B – D,0-4yrs) will far outweigh migration and momentum effects, and thus this age-group is excluded here.

The results in this table show several things. Firstly, once again momentum is important. In the case of China gross momentum (positive momentum growth plus negative combined) is at a level far above that for net momentum (positive minus negative), whereas in Nigeria, of course, the two are the same. But more interestingly for China is the fact that the gross figure, all the gains and losses due to successive waves, is 2.57 times the growth at these ages in this period. Nigeria on the other hand had quasi-stable structure and population waves that took the form of a mounting surge, so that all age groups had positive growth therefore the gross momentum was 100% of growth at these ages.

Comparing the results back to the first set of measures, the results are not that dissimilar where the ratio between the net and gross figure is only 16% for China, but in Nigeria is 94%. With the second measure the percentages are 39% and 100% for China and Nigeria respectively. Nigeria then shows what happens to a population at the end of Stage I of an age-structural transition, but China of a country not merely at the second stage, but one that has been subject to multiple oscillatory effects an to very disordered cohort flows..

Table 1b: Momentum Effects, Numbers (000s) Nigeria and China 1995-2000, Ages 5+ Years

	Nigeria	China
5 – 9	1,964	-15,585
10 – 14	1,887	16,560
15 – 19	1,938	1,865
20 – 24	1,781	-23,704
25 – 29	1,223	-6,486
30 – 34	815	20,829
35 – 39	581	19,780
40 – 44	509	-3,305
45 – 49	709	21,794
50 – 54	249	13,533
55 – 59	289	2,212
60 – 64	238	1,995
65 – 69	178	4,484
70 – 74	135	3,291
75 – 79	99	2,709
80 – 84	72	1,625
85+	28	763

Calculated: (Population 2000 - Population 1995)
Source: United Nations Projections, 2000 revision.

Age-Structural Transitions: Case Studies

To illustrate the earlier discussion in Figures 2 and 3 data are presented on a number of case-study countries. The countries chosen and the comments are drawn in the main from an earlier paper (Pool under editorial review a, source data United Nations series, 2000 Revision), but three more African countries, Kenya, Nigeria and South Africa, plus Brazil in Latin America, have been added here in this paper.

Figure 2 uses conventional percentage age-distributions. Here childhood is represented here by age-group 0-14 years; youth by 15-29 years; early middle age by 30-44 years; late middle-age by 45-59 years; early retirement ages by 60-74 years; and old age by 75+ years. Figure 3 then standardises the impacts of waves and cohort flows on different life-cycle stages by relating each change back to the base population (all ages) at the start of each quinquennium[8] In both sets of figures the graphs relate to functional age-groups, that are proxies for life-cycle stages, that in turn are seen as being characterised by distinct sets of social and economic needs, and behaviours. Needs and demands will relate to both the public and private sectors, and behaviours can be social, economic, cultural and consumer in form. The distinction between needs and demands is often very difficult to draw. Even the so-called "basic needs" can have a discretionary element. Housing is a very good example of this, as shelter is a basic

[8] A more direct indicator (the contribution of changes at each age-group, negative or positive) to total change over any quinquennium encounters arithmetic problems with some countries undergoing negative total growth, and produces grossly distorted figures in those countries with very slow positive growth.

need, yet for the majority of the world's families probably takes the form of demands met by the market or the wider family.

Some life-cycle stages, such as youth, are subject to high level of "demographic density" (to use the phrase of Rindfuss 1991), that is they consitute periods in which a range of different bio-social events are acted out. In the youth years, for example, a number of key reference points are reached or passed, some of which involve life-time statuses (eg completion of highest educational qualification). One can identify as examples the following:

(a) biological maturation is attained;
(b) typically, formal education is completed and first entry to the labour market occurs;
(c) these are ages at which the incidence and prevalence of geographic mobility are likely to be highest;
(d) sexual maturity is also reached, the young leave their families of origin and their parents become "empty-nesters" (or at least they used to – this is changing in some developed countries with the phenomena of "boomerang kids" and "cluttered nests");
(e) and, normally, entry into a first union will take place, and, frequently, young people will also be forming their own families of reproduction.

A similar list built around increasing frailty, retirement, material dependency and grand-parenting could be constructed for age-groups 60-74 years.

In Figures 2 and 3 results for the world and two slow growth countries are graphed. The "world" averages out all the different models, and as a result, at least by comparison with a country like Russia, appears to be subject to a relatively un-turbulent progression through its age-structural transition (see especially Figure 3a). That said, a modest surge had occurred at the youth ages around the time of the Cairo ICPD, as was noted earlier, and this age group will be the second most important for decades to come. This last comment underlines the point that the "window of opportunity" is not just about a gross reduction in dependency as the world's population shifts from a youthful to a more elderly structure, but the passage through a phase during which the percent at working ages is higher. But it also points to the fact that the labour force itself can go through a more localised age-structural transition that changes the distribution within the working ages. While juvenation of the labour force is often seen as desirable, as a sort of side-product of the demographic dividend because it brings in workers with newly acquired skills, there may also be an obverse side to this that has implications for fiscal policy. That is, if labour supply is to become human capital, investments will be necessary, and these may compete with the need for increased savings for the long-term impacts of ageing.

Countries that are at advanced stages of age-structural transition

The Russian Federation and France represent two slow growth populations (in fact over the period 1990-95 negative (-0.02% p.a.) for the Federation; but +0.5% for France). Yet the case of the Russia Federation shows that slow growth is not the end-point for population "problems" and that these constitute far more than ageing. The perturbed nature of the Russia age-pyramid comes not from the passage through it of one wave, but of a number representing different cohorts that sequentially and irregularly affect different life-cycle stages. These stages may also be affected more than once by different birth cohorts (see especially Figure 3a).

In both graphs France contrasts markedly with Russia (cf figures 3a and 3b). Whether by lucky accident or by design through policy interventions, France has in front of it a

remarkably "calm" age-structural future. Its trajectory, that has positive implications for policy development as shifts, are gradual and of limited volume. That said, and as is true for numerous other developed countries, France may well see rapid inflows of migrants that could distort its age-structure.

Parenthetically, it is worth noting that across slow growth countries, not just Western Developed Countries, migration has been posited as a response to ageing, and advocacy for this will most likely arise when troughs occur at key working ages. In a major recent study the United Nations (2000) has addressed this phenomenon, noting the fact that the inflows would have to be very large. It is clear that these might be beyond what would be acceptable politically, particularly where cultural factors are concerned (eg for Japan, Teitelbaum 2003). The demographic and social impacts of migration on the countries of origin are oft-ignored questions, the significance of which must also be recognised (the paper by Gultiano and Xenos to this seminar is a case-study of a sending country). But as Dittgen adds, there is yet another dimension to this: Immigration will be advocated "not for demographic imperatives but for economic [needs] and these will fluctuate… These [migratory] movements will only serve to accentuate the chaotic trends in the age-pyramids" (Dittgen 2002 :*passim*; translation present author).

The United States is the third "slow-growth" case-study population meaning the end of stage two of its age-structural transition or entering the third.. In terms of proportions by functional age-group (Figure 2b) it bridges between European countries and developing countries, For the impacts of cohort flows in Figure 3b the United States fits somewhere between France and the Russian Federation. But these are attribute it shares with the other English-speaking neo-Europes, especially New Zealand. All four of these countries are, of course, immigrant receiving populations, and these streams have a significant impact on population growth and size as well as well as age- and ethnic-structures. It is worth stressing that this holds true even in Australasia, where most of the inflows are of documented migrants. In New Zealand, for example, 14% of the entire population in 2001 comprised documented immigrants or their children from the Pacific and Asia.

The United States and Russian examples also demonstrate another point: the fact that several cohorts may be bringing pressures on resources and services simultaneously. If one takes the period 2000-05, two life-cycle stages, young adults and the pre-retirement ages (45-59 years) that have totally different needs and behaviours, are both affected by inflated cohorts. Having geared up policy interventions and markets to cater for the passage of these two cohorts, these initiatives will have to be ratcheted back to cater for lessened needs of deflated cohorts reaching the same ages. At the same time the focus for policy and for markets will have had to shift to the needs of generations at childhood, early adult ages (30-44 years) and early retirees.

The Russian Federation, France and the United States are at different sub-phases of the ageing stage of an age-structural transition. I now turn to countries that are less advanced in their age-structural transitions: Mexico, Brazil (Figure 2b), China, India, Thailand (Figure 2c), Kenya and South Africa (2d).

Countries that are at intermediate stages of age-structural transition

The next seven countries are representative of the majority of populations across the world, and thus cluster around the world as a whole (discussed above). That said, they also differ

markedly between themselves both in terms of proportions at different life-cycle stages, and the degree to which they are subject to one, or multiple waves, and disordered cohort flows. But they share in common a relatively recent starting point for their transitions, at which juncture more than 40% of the population was aged less than 15 years.

India stands out as the member of this group with the most gradual and least disordered transition to date and into the future (Figures 2c and 3c). South Africa falls somewhere between India and the next group: a bit more accelerated than India, and a little more disordered, but not notably so (Figures 2d and 3c). The comments about South Africa, of course, must be tempered, as a very large question mark hangs over this case-study because of HIV/AIDS. Its age-specific incidence of infection, if carried over to mortality will have major impacts on survivorship patterns at adult ages, and as explained earlier perhaps also at childhood.

The most rapid changes come in the two Latin American examples, for Thailand (Figures 2b and 2c), and for Kenya, although it has only recently started its transition (Figure 2d). These countries vary, however, in terms of the effects of waves on life-cycle stages. Thailand, and to a lesser degree Mexico, and even more muted Brazil, show the effects of the passage of one wave as it progresses from life-cycle stage to the next (Figures 3d and 3e), although Thailand has multiple wave effects, but of limited significance.

Of all the case-studies, it is Kenya that starts from the highest point with over 50% of its population under 15 years at the outset (Figure 2d). Parenthetically, the reasons for the slight rise for it, and for Congo and Nigeria, to be dealt with below, have been explained by Dyson and Murphy (1985) and are not an artefact of poor data.

Turning to the effects of cohort flows on Kenya's structures (Figure 3f), this case-study is remarkable for the velocity with which waves move from one life-cycle stage to another. It also has multiple waves passing through key life cycle stages, undoubtedly due to secondary momentum, to an echo effect as large birth cohorts become inflated parenting cohorts and produce larger birth cohorts, even though their fertility rates will fall below those of their parents. Kenya's case, by comparison to India's, is a reminder, then, that a very rapid decline in fertility will produce some degree of disordering, particularly in societies with a young average age at marriage. Very large birth cohorts are suddenly followed by much smaller ones, but, as just noted, despite fertility declines may go on to produce larger cohorts, all over a very short time frame. The last section of this paper returns to the implications of this for medium term policy analyses. Again the spectre of HIV/AIDS hangs over this country and could significantly change the path just outlined.

Finally in the intermediate group comes China, the most complex and disordered. It starts of from a high point in 1970, but not from an exceptionally high one. The changes in Figure 2c appear reasonable, but when one turns to Figure 3c the perturbations coming from disordered cohort flows become evident.

These case-studies show, with the possible exception of India, that even with relatively well ordered fertility declines, as seems to have been the case in Latin America or Thailand the states concerned will be faced with rapid shifts in the distributions across life-cycle stages. In some cases, this will come from the passage of only one wave; in other cases because of multiple waves.

These countries very definitely fit the dividends/windows of opportunity models. That said, the wave effects shown here will often put great strains on the resources and investments required if the states concerned are to exploit these bonuses. A corollary of this is that, until the end of the projection period used here, the major changes and pressures will come at the childhood, youth and early adult ages, not at ages above these. This point will be picked up in the next section of the paper.

Countries that are at an early stage of age-structural transition

Data from the remaining two countries are graphed in Figures 2d and 2e, and 3f and 3g. Looking at proportions at key life-cycle stages, they start from, and still have, very high percents at childhood. It can be assumed that they will follow the trajectory shown by Kenya, and perhaps Mexico, but once again the possible effects of HIV/AIDS makes forecasting difficult. In this case the rapid but relatively smooth transitions they show to date will continue, but perhaps mediated because of the caveat relating to secondary momentum effects already suggested for Kenya.

Towards a Synthesis: Policy Implications of Age-Structural Transitions

The issues raised in this paper are highly applied not just for economic development, but for all areas of public policy and for market sectors. The results support very strongly more generic arguments relating to "demographic divdends" and "windows of opportunity". But in this paper the waves and cohort flows that generate these bonuses for some countries were shown often to be complex, and for some populations produce severe levels of turbulence (perturbations).

Age-structural transitions are underway, but much of the world is still at an intermediate stage. It is this temporal factor that has produced the demographic dividends, the windows of opportunity. The world is not, in fact, ageing at present, but is "middle ageing". In 1995, 32% of its population were aged less than 15 years, 46% were at 15-44 years, and only 22% above this: and in 2015 almost three-quarters will still be below 45 years, although by then the percent above 45 will have passed the proportion aged less than 15 years. In this paper these broad age-groups have been disaggregated further and also the implications of cohort flows indicated. Whether broader or more specific age-ranges are used one point is clear: that age-structural changes have major implications for policy and planning.

This also support another argument that Bloom et al (2003) underline in their analysis: that it is only when age-structural changes are endogenised in planning models that the links between population and development become highlighted. In a case-study on the OECD, Lindh and Malmberg (1999) demonstrate this point empirically. From personal experience working with and evaluating planning ministries/units across Anglophone and Francophone Africa, Asia and the Pacific, the observation can be made that there is another dimension to this "Traditionally, planning has had a relatively short-term horizon, say 3-5 years, while the processes of demographic change are generally of a gradual and long-term character, although certain processes, such as migration, have sectoral impacts over the short- to medium-term…" More pragmactically, a constraint has been that much of "economic planning" has really been confined to the financial and fiscal aspects of public sector management; more cynically often what was seen as "planning" was little more than a "wish-list" of capital projects put up for funding (Pool 1994a: 283; my translation).

But the arguments that Lindh and Malmberg (1999) sustain raise another related operationally important question. As was noted earlier, needs and behaviours vary between life-cycle stages, as do financial and other capacities. But sectoral policies also are directed at different stages, for example health at the young and old, education at the young, housing and employment at youth and the middle-aged, and income support at the elderly (Pool 1994b: 66; elaborated in Pool under editorial review a). This thus holds true for those that deal with two of the "mechanisms" that "deliver" the dividend labour supply and human capital. But it also is the case for the third mechanism "savings" (Bloom et al 2003: 39-42). It is the working-age populations that save, and it is also that group who pay the taxes that support the dependent populations. Recent research on Asian economies strongly supports the links between age-structural changes, and savings and investment, and thus fiscal capacity (eg Higgins and Williamson 1997). Therefore, age-structural changes are not just important for those sectors that deal with social policy, including employment and other human capital questions, but also with those that deal with the more financial and fiscal aspects of planning and policy, and that have traditionally abjured any interest in population concerns. Curiously, in developed countries it has been the fiscal and actuarial implications of population ageing that has been the trigger that has produced an interest in age-structures among Treasury or Ministry of Finance officials.

With growing interest in age-structural matters and the recognition that a window of opportunity exists, it is important to signal that the changes involved are very complex, as the data presented here show. There are waves, disordered cohort flows, and coterminous changes at different life-cycle stages. The last phenomenon is clearly a source for inter-generational competition for resources. For policy-makers and planners the message is simple: modeling will be more complex regardless of whether or not the age-structural changes imply favourable or unfavourable social and economic consequences. Moreover, waves, regular or irregular, are followed by troughs, and this means planning for peak demand, and then pulling back and directing attention to another life-cycle stage with a different sets of needs and behaviours. The more disordered the flows, the more intense the wave and trough patterns and the shorter the durations involved for formulating and implementing planning strategies. Even countries that are going through seemingly smooth and rapid demographic transitions through a fertility decline, may still be subject to multiple wave effects at short intervals as the parents drawn from large birth cohorts produce large birth cohorts. Kenya was shown to be an example of this.

Policies and planning are primarily concerned with responding to short to medium term needs, during which time, as has been noted, wave activity could be fairly marked[9]. Thus an analysis is made here of changes that will occur over the period to 2015.

In Table 2, data are presented on the world's age structure and its transition to 2015. Two key age-groups for labour supply and human capital, 15-24 and 25-44 years comprise virtually the same proportion of the total over the 20 years from 1995 to 2015. This is strong evidence at a global level of the dividend/windows of opportunity effects. But the profile either side of these ages goes through more significant changes, with late middle and retirement ages gaining at the expense of childhood ones. Yet throughout the period, age-group 0-4 remains the largest single quinquennial age-group, and the aged/child ratios remain low. There are,

[9] The next part of this paper is a response to comments of Kourtoum Nacro, to whom grateful acknowledgement is made

however, significant differences in numerical and percentage increases by age, and in age-specific contributions to overall change.

Turning to case-studies in Table 3, for the key age for labour supply and for human resource policies, 15-24 years, very significant differences are seen. Slow growth countries, with the exception of the United States, show percentage and numerical declines at these ages, dramatically so in the case of the Russian Federation. But so too do some recently high growth countries, Brazil, China and Thailand. As in the case of Taiwan[10], a labour surplus at these ages will rapidly translate into a deficit. It also means, of course, that these countries will be less likely to export migrant workers.

The remaining countries show increases in the sizes of the new entrant age-group, at levels in Congo, Kenya and Nigeria that will be very difficult to accommodate. Lower increases are seen in particular in Mexico and South Africa. In passing, it is worth noting that three of the case-study countries, India, Congo and Nigeria will contribute 42% of the net growth of 123,976,000 new entrants over that period, and the United States another 5%.

The right hand side of Table 3 shows the percent of the total population at ages 15-24 years in 1990, 2000 and 2015. Almost a fifth of the entire population worldwide will fall into these two quinquennial age-ranges, although the percent is going down gradually. For the case-studies three patterns are seen. There are those countries in which the proportions at new entrant ages remain more or less constant, normally at around 20%, but only 15% in the case of the United States. There are those for which the percent declines gradually but steadily, France being an example. But so too, and more significantly, are Mexico, China and Thailand. Then the Russian Federation sees a wave and then a trough. Each of these patterns will require totally different labour market policies.

To sum, then, there are windows of opportunity, but they do not exist for all countries, and their details vary considerably. Moreover, variability will be seen not only in the longer-run, but also over the short- to medium-term This may be a case, in fact, where the "devil is in the detail". Exploitation of windows of opportunity so as to realise the potential dividend will, therefore, require the pro-active policy mangement of wave and trough effects that will vary from country to country.

But beyond this, as noted,major and rapid changes will be occurring rapidly over the next few years. During that time, moreover, the balance around the middle ages, between younger and older will also be altering. This raises an important question: whether or not the window of opportunity is slipping away very quickly. It certainly existed around 1995; it may still exist; but it is not clear that after 2015 it will still exist.

In the decade of the 1990s, the broad parameters were very clear in, say, the projection series of the United Nations. Yet this era was one in which opportunities were frittered away by a lack of appreciation by the international community about the seriousness of age-structural

[10] Verbal intervention, Dr Tsay, Academia Sinica, *International Meeting on Age-structural Transitions and Policy Dynamics, IUSSP/Academia Sinica*, Dec. 2001. Cited in IUSSP Policy Paper (on web) prepared by the present author.

issues[11]. On the basis of past experience, therefore, one can only remain somewhat pessimistic. Thus, I finish then by citing the 17th century English poet, Andrew Marvell:

> "**But at my back I always hear**
> **Time's winged chariot hurrying near;**
> **And yonder all before us lie**
> **Deserts of vast eternity."**

[11] Unfortunately the ICPD in 1994 chose to concentrate largely on issues of reproductive choice, and not on other social and economic factors, as they affected the key new entrant age-group, then just under 20% of the total population. A real window of opportunity was thus missed (See also fn.1).

REFERENCES

Bloom, D., Canning, D. and Sevilla, J (2003) *The Demographic Dividend: A New Perspective on the Economic Conseuquences of Population Change,* RAND, Santa Monica, Calif.

Chesnais, J-C (19901) "Demographic Transition Patterns and Their Impact on Age-Structures", *Population and Development Review*, 16,2:327-54

Coale, A., and Hoover, E (1958) *Population Growth and Economic Development in Low-Income Countries.* Princeton Univ. Press, Princeton, NJ.

Dittgen, A (2002) "Apres la transition demographique: L'equilibre ou les turbulences?" in AIDELF (eds) *Vivre plus longtemps, avoir moins d'enfants : Quelles implications ? Colloque international de Byblos-Jbeil.* (Liban), Presses Universitaires de France, Paris : 547-555.

Dyson, T. and Murphy, M (1985) "The Onset of Fertility Transition", *Population and Development Review* 11,3:399-440.

Frejka, T (1982) "Momentum" in Ross, J (ed) *International Encyclopaedia of Population,* Free Press, NY: Vol 2:450-51.

Higgins, M and Williamson J (1997) "Age-Structure and Dependence on Foreign Capital" *Population and Development Review*, 23:261-93.

Keyfitz, N (1968) *Introduction to the Mathematics of Population*. Addison-Wesley, Reading, Mass.

Lindh, T and Malmberg, B (1999) "Age-structure Effects and Growth in the OECD, 1950-1990" *Population Economics* 12,3: 431-50.

Lutz, W., Sanderson, W., and Scherbov, S (2001) "The End of World Population Growth", *Nature,* 412: 543-45.

New Shorter Oxford English Dictionary, 2 Vols. Clarendon, Oxford.

Pool, I (1994a) « Problemes operationnels de la population and planification du developpement; experience practique dans le Tiers Monde » in Inst. De demographie –UCL, CIDEP, CEPED (eds) *Integrer Population et developpement : Chaire Quetelet 1990.* Academia/Harmattan, Louvain-la-Neuve/Paris :275-88.

Pool, I (1994b) *The World's Caring Capacity: Population Compositional Aspects*. Independent Commission, Population and Quality of Life, Paris.

Pool, I (2000) "Vers un Modele de la 'transition age-structurelle': Une Consequence, mais aussi une composante de la transition demographique », Paper, *Conference of Association canadienne-francaise pour l'avancement de science,* Montreal, May.

Pool, I (2003) "Ageing, Population Waves, Disordered Cohorts and Policy" *New Zealand Population Review.* "Special Issue: Population and Social Policy" 29,1:19-40.

Pool, I (Under editorial review a) "Age-structural Transitions and Policy: Towards Frameworks", Paper seminar IUSSP/Asian Meta-Centre, "Age-Structural Transitions and Policy", Phuket, Dec 2000

Pool, I (Under editorial review b) "Age-Structural Transitions in Industrialised Countries", Paper IUSSP/Nihon University Population Research Institute "Age-structural Transitions in Industrialised Countries" Challenges and Responses", Tokyo, March 2001

Pool, I and Sceats, J (2003) "Low Fertility of the English-Speaking Countries", Paper International Workshop/Seminar on Low Fertility and Family policies, Tokyo, Nov 2002 (*http://www.ipss.go.jp/English/WebJournal.files/WebPopulation.html*)

Pressat, R (1978) *Statistical Demography*, Methuen, London

Rindfuss, R (1991) "The Young Adult Years: Diversity, Structural change and Fertility", *Demography,* 28,4: 493-512

Rogers, A and Woodward, J (1988)"The Sources of Regional Elderly population Growth", *Professional Geographer*, 40: 450-59

Rowland, D (1996) "Population Momentum as a Measure of Ageing", *European Journal of Population,* 12: 41-61

Ryder, N (1965) "The Cohort as a Concept in the Study of Social Change", *American Sociological Review*, 30: 843-61

Shryock, H and Siegel, J, and Associates (1976) *The Methods and Materials of Demography*, Academic Press, NY

Teitelbaum, M (2003) Oral Presentation, Annual Welfare Seminar, National Institute for population and Social Security (Japan), "Population Decline and Immigration Policies: Japan's Choice", Tokyo Dec 16th

Tuljapurkar, S, Li, N and Boe, C (2000) "A Universal pattern of Mortality in the G-7 Countries", *Nature*, 405: 789-92

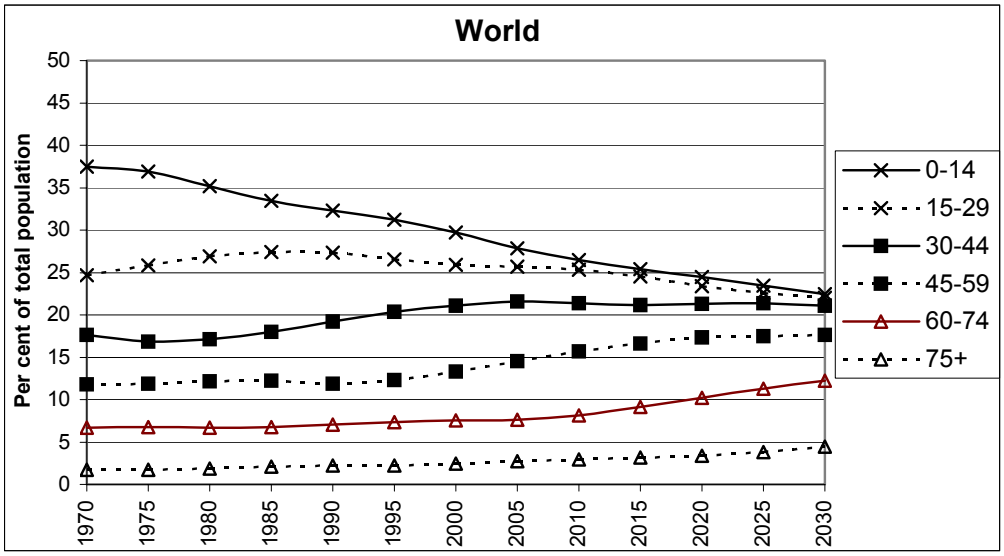
United nations, !967) *Manual IV: Methods of Estimating Basic Demographic Measures from Incomplete Data*, Population Division, NY

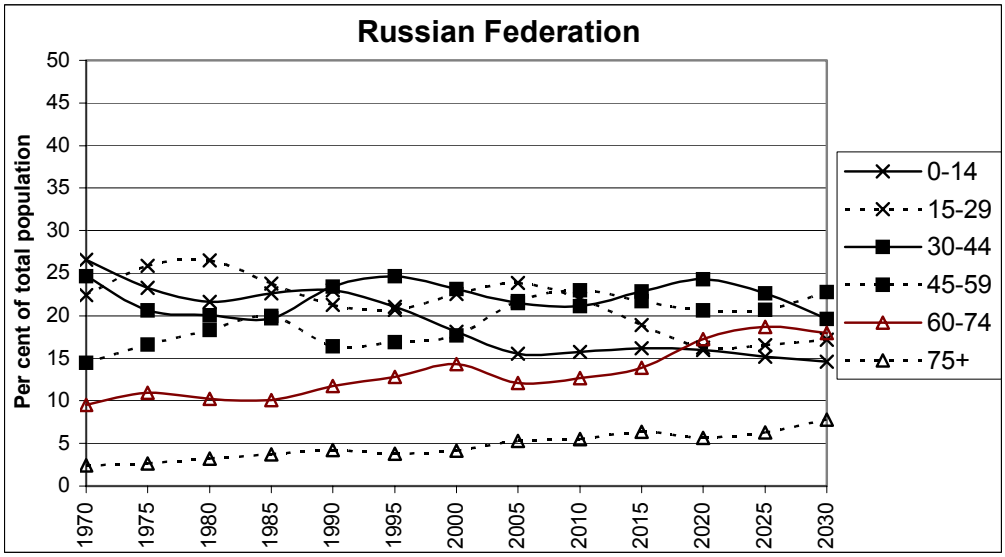
United Nations (2000) *Replacement Migration: Is it a Solution to Declining or Ageing Populations?*, Population Division, NY

United Nations Population Fund (1989) *Comparative Evaluation of UNFPA Support to Population and Development Planning: Global Report*, UNFPA, NY

Figure 2: Percentage Age-Distribution, Functional Ages, 1970-2030

Figure 2a





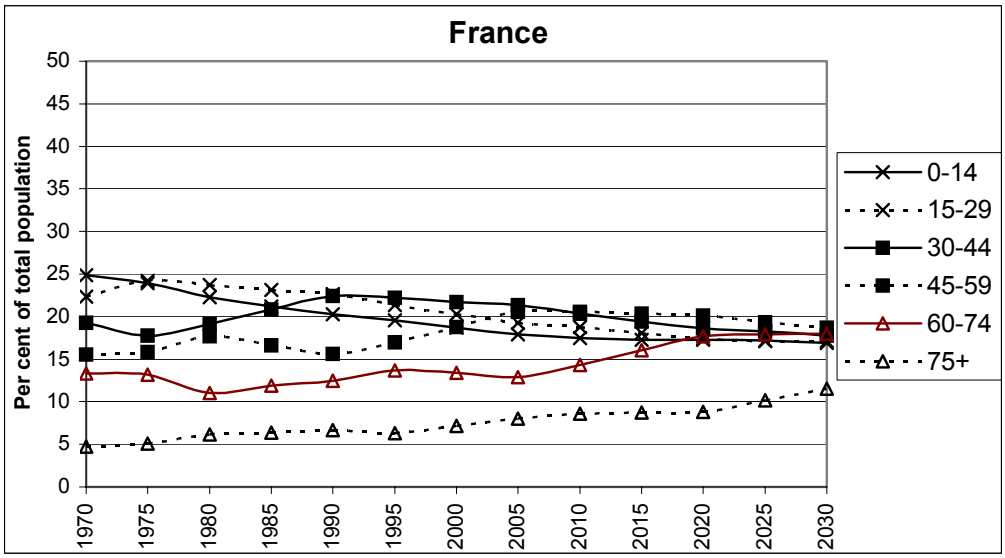
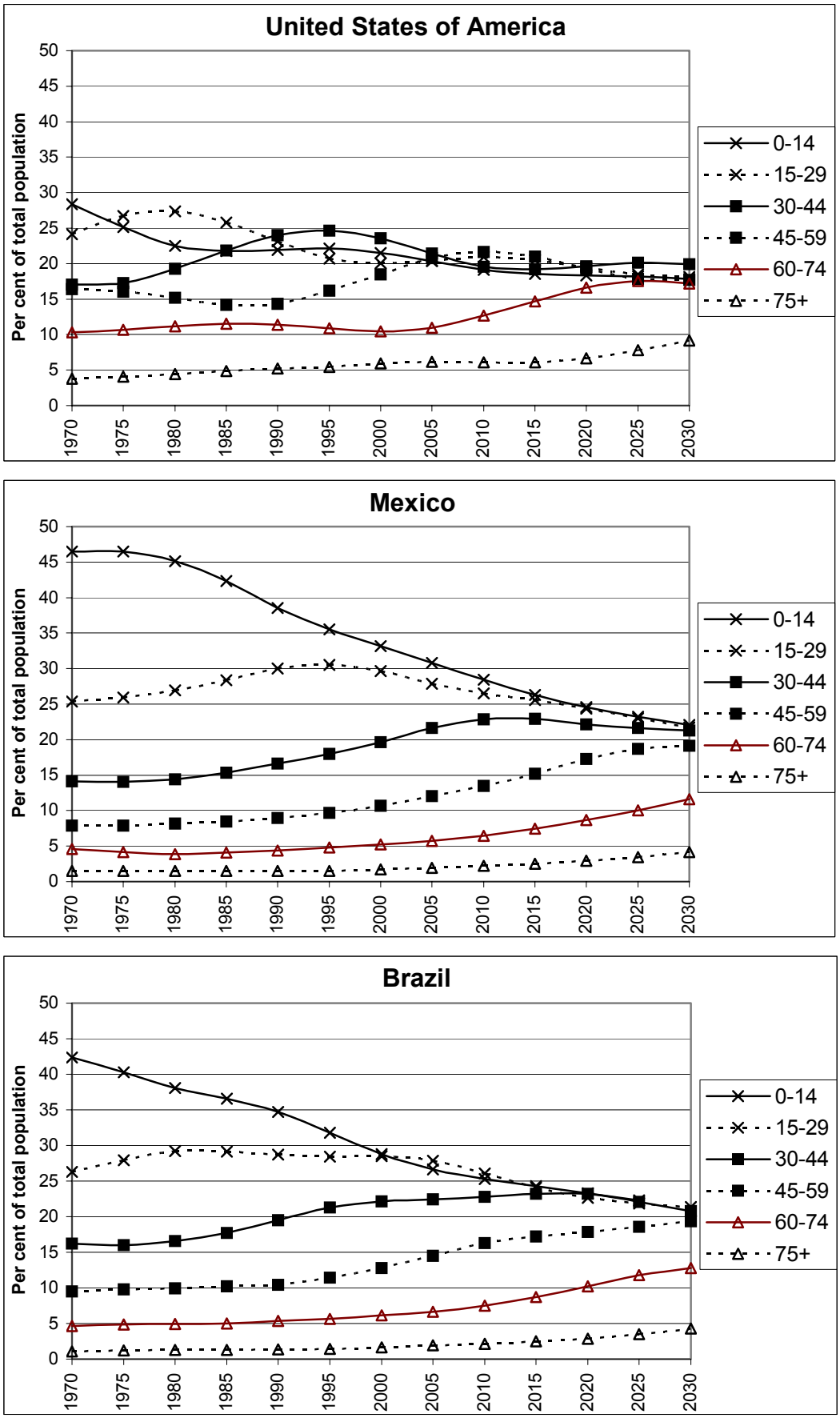


Figure 2b


United States of America
Per cent of total population
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45
50
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
0-14
15-29
30-44
45-59
60-74
75+
Mexico
Per cent of total population
0
5
10
15
20
25
30
35
40
45
50
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
0-14
15-29
30-44
45-59
60-74
75+
Brazil
Per cent of total population
0
5
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15
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45
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1970
1975
1980
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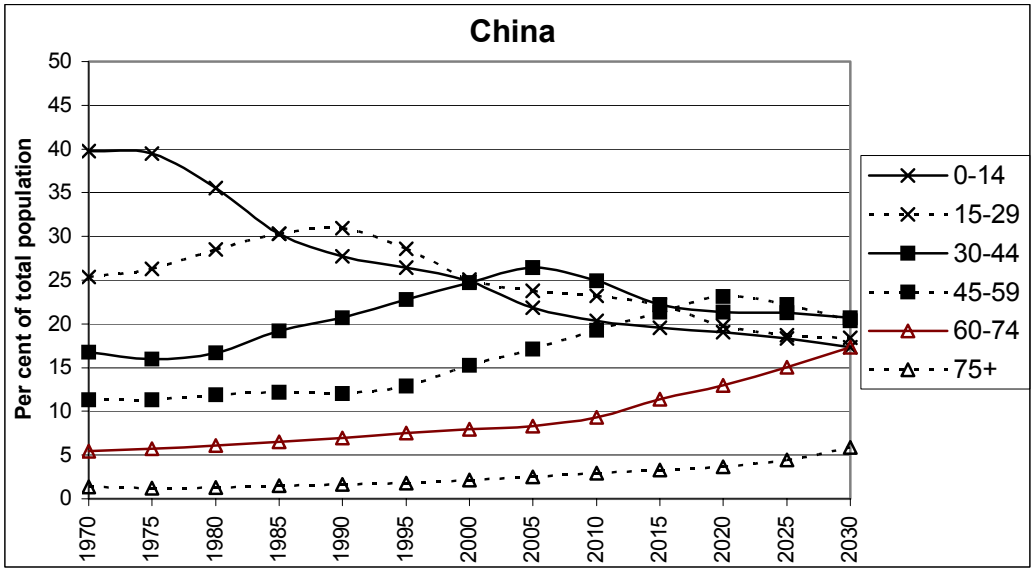
75+

Figure 2c


China
Per cent of total population
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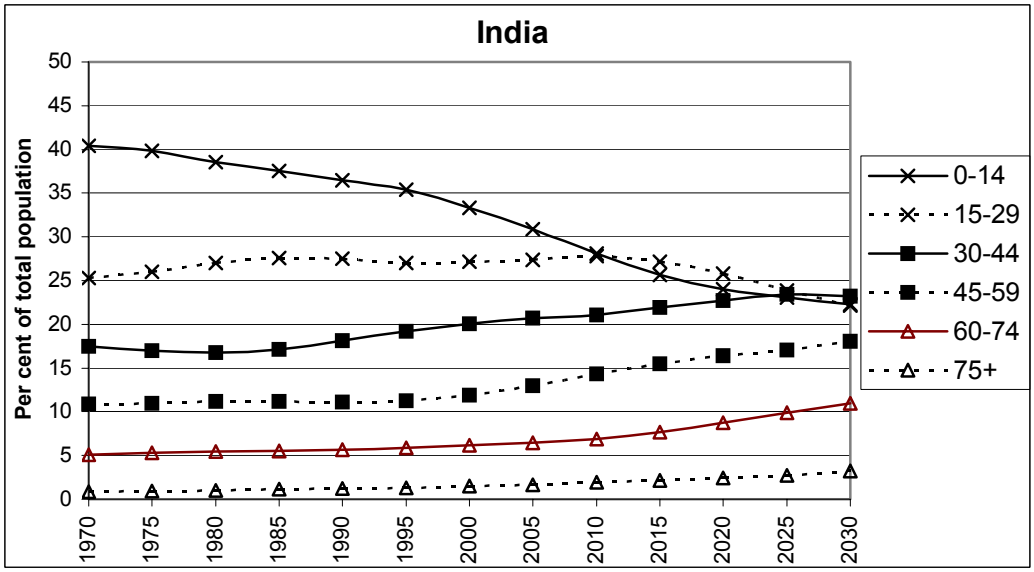
0-14
15-29
30-44
45-59
60-74
75+


India
Per cent of total population
0
5
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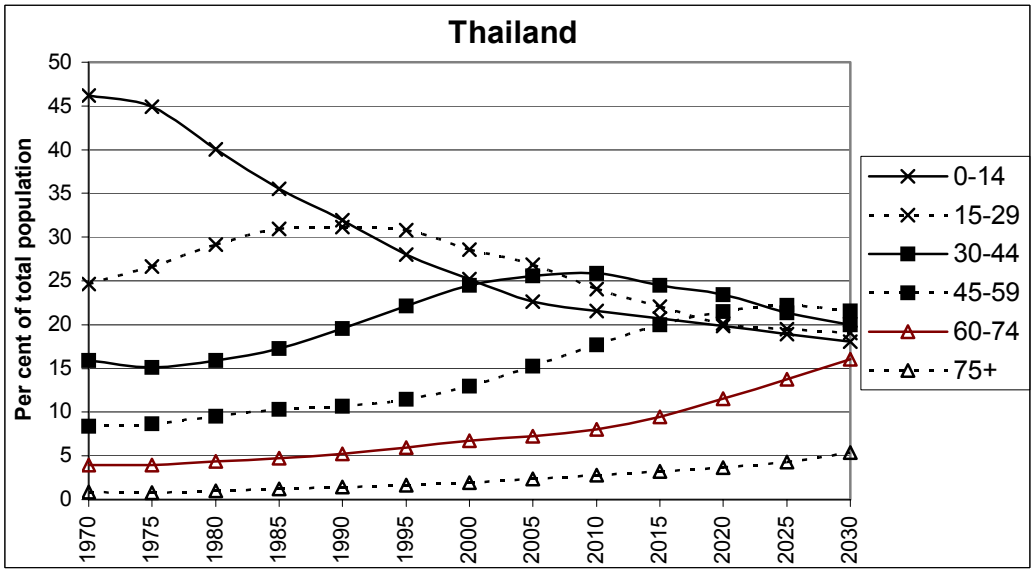
45-59
60-74
75+


Thailand
Per cent of total population
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1970
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1980
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2015
2020
2025
2030
0-14
15-29
30-44
45-59
60-74
75+

Figure 2d

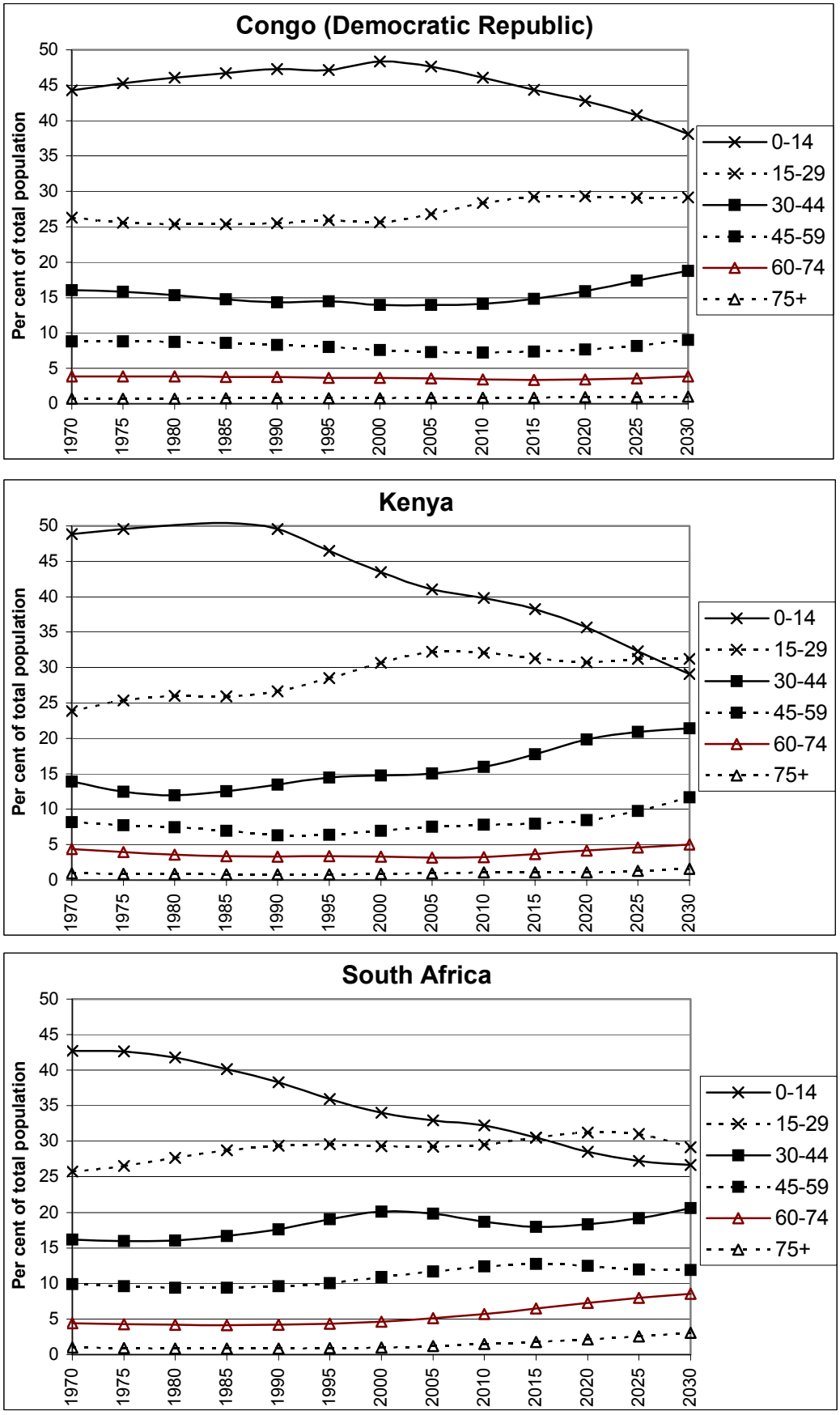
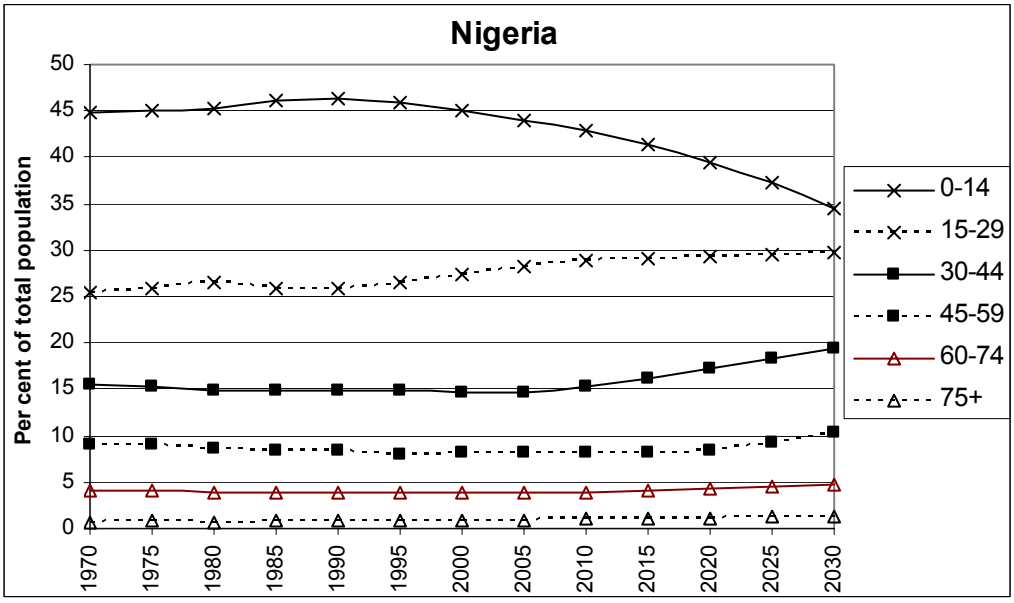

Congo (Democratic Republic)
Per cent of total population
0-14
15-29
30-44
45-59
60-74
75+
Kenya
Per cent of total population
0-14
15-29
30-44
45-59
60-74
75+
South Africa
Per cent of total population
0-14
15-29
30-44
45-59
60-74
75+

Figure 2e


Nigeria
Per cent of total population
50
45
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20
15
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0
1970
1975
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2015
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45-59
60-74
75+

Figure 3: Impacts of Cohort Flows on Functional Age-Groups, 1970-2030

Figure 3A

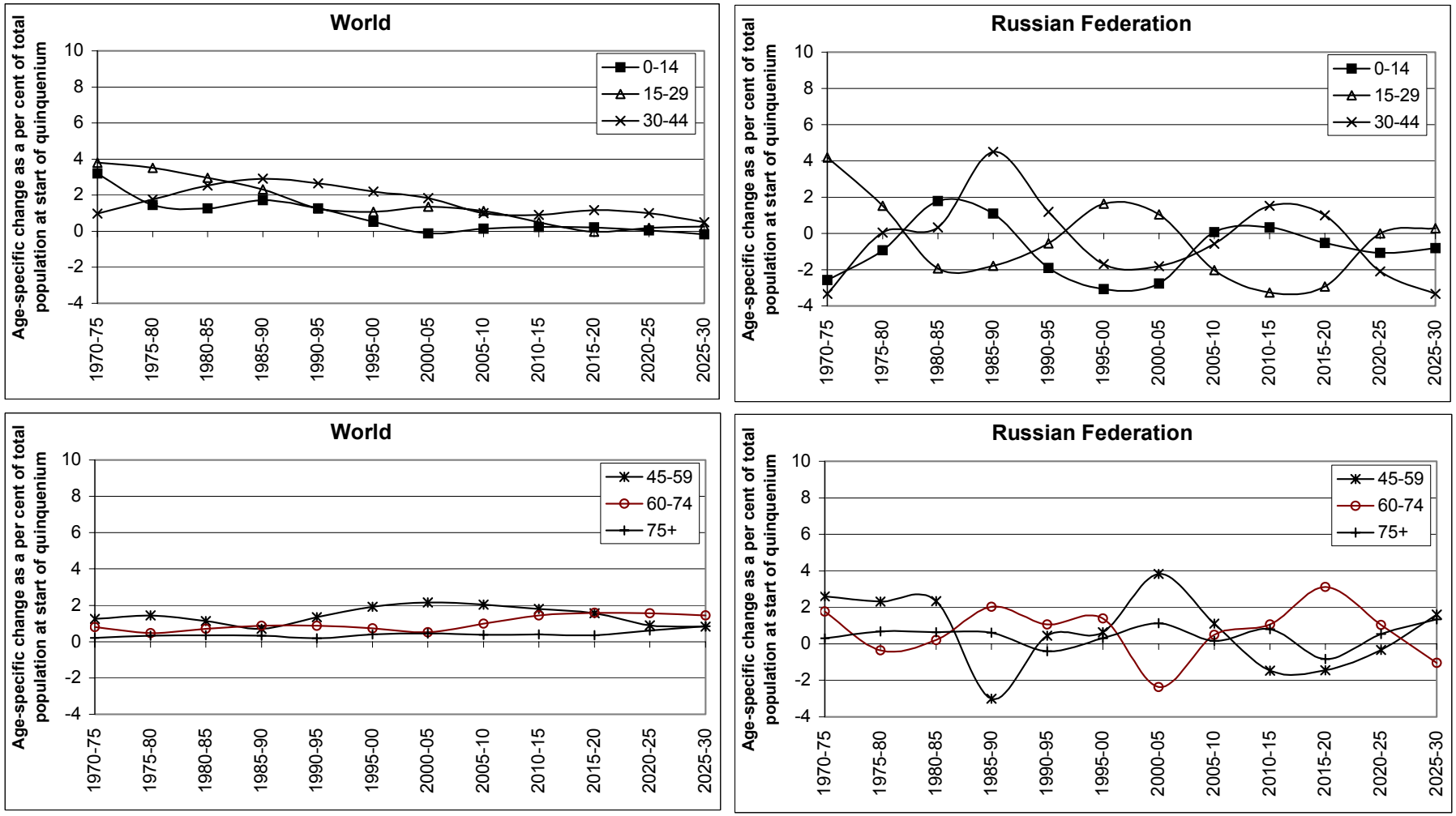


Figure 3b

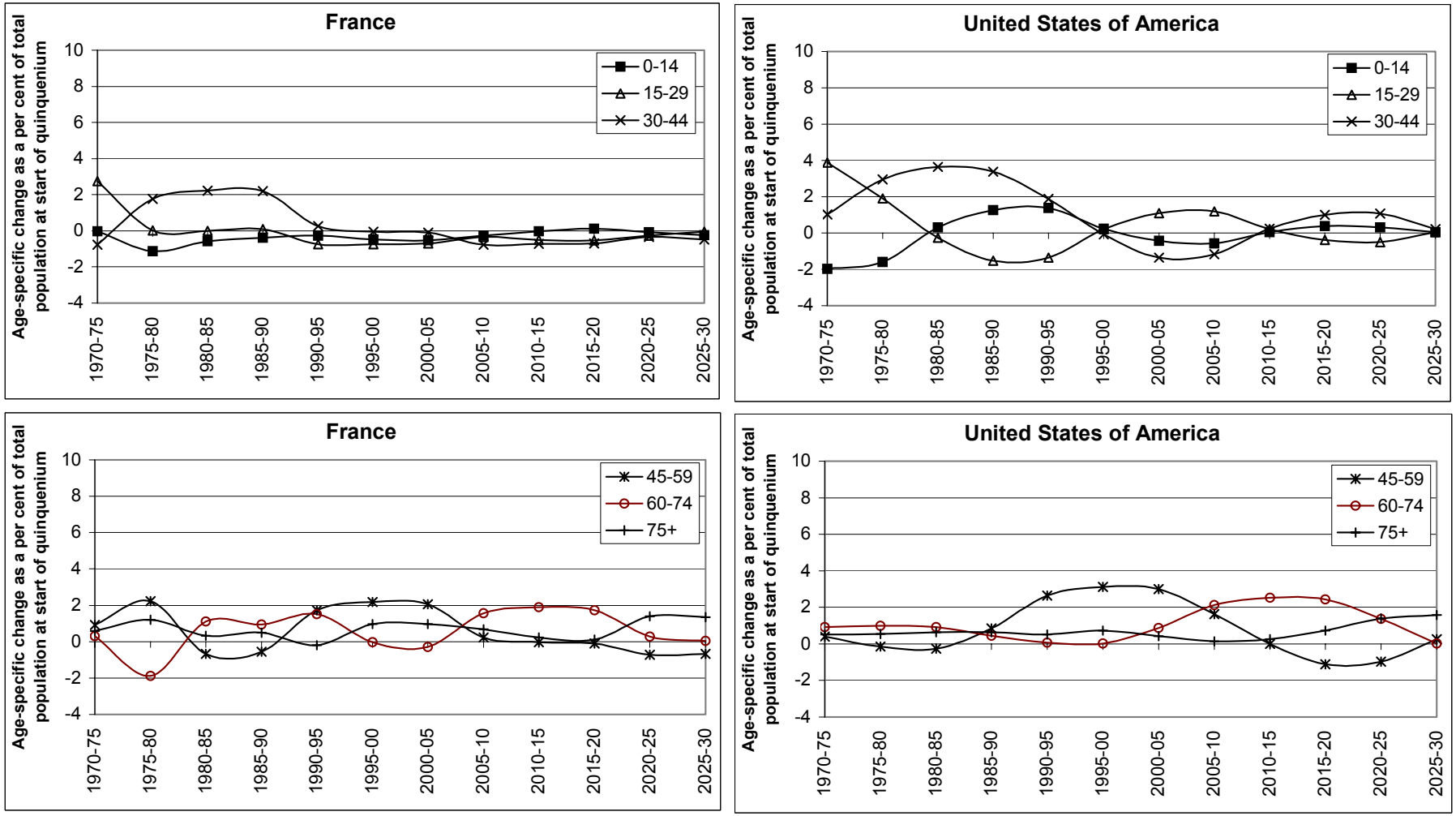

France
Age-specific change as a per cent of total population at start of quinquenium
0-14
15-29
30-44
United States of America
45-59
60-74
75+
1970-75
1975-80
1980-85
1985-90
1990-95
1995-00
2000-05
2005-10
2010-15
2015-20
2020-25
2025-30

Figure 3c

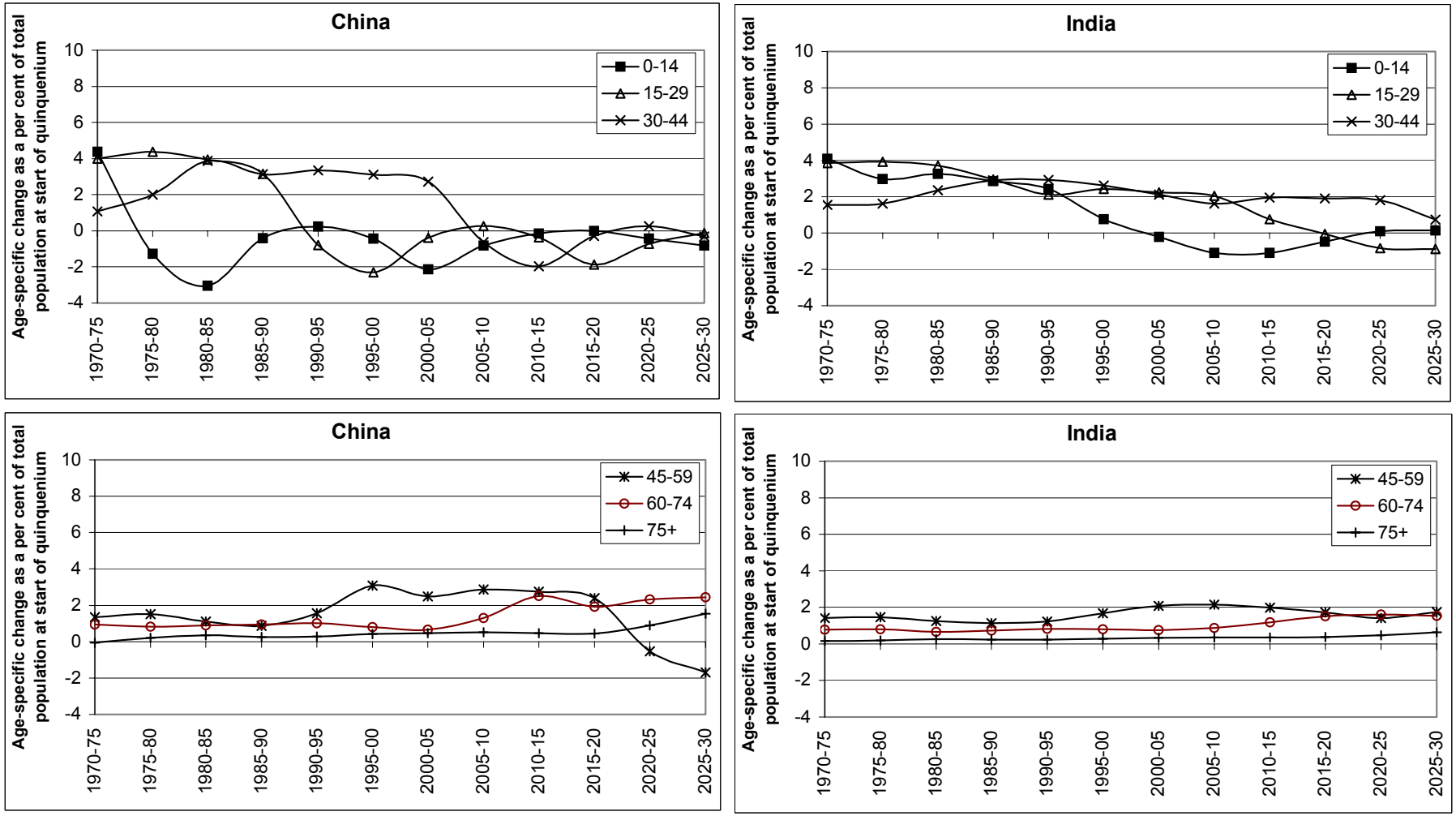

China
India
Age-specific change as a per cent of total population at start of quinquenium
0-14
15-29
30-44
45-59
60-74
75+
10
8
6
4
2
0
-2
-4
1970-75
1975-80
1980-85
1985-90
1990-95
1995-00
2000-05
2005-10
2010-15
2015-20
2020-25
2025-30

Figure 3d

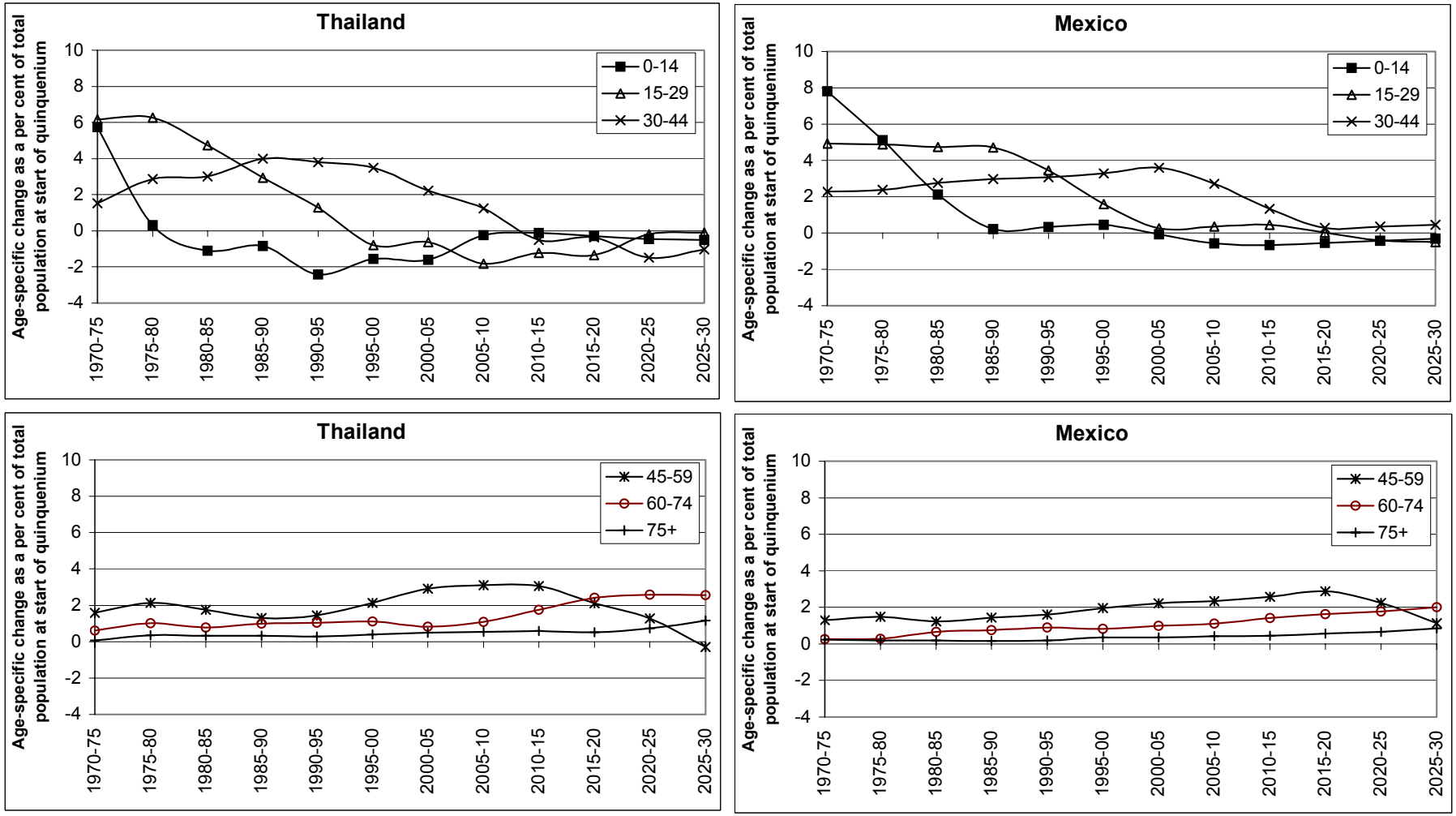

Thailand
Mexico
Thailand
Mexico
Age-specific change as a per cent of total population at start of quinquenium
0-14
15-29
30-44
45-59
60-74
75+
10
8
6
4
2
0
-2
-4
1970-75
1975-80
1980-85
1985-90
1990-95
1995-00
2000-05
2005-10
2010-15
2015-20
2020-25
2025-30

Figure 3e

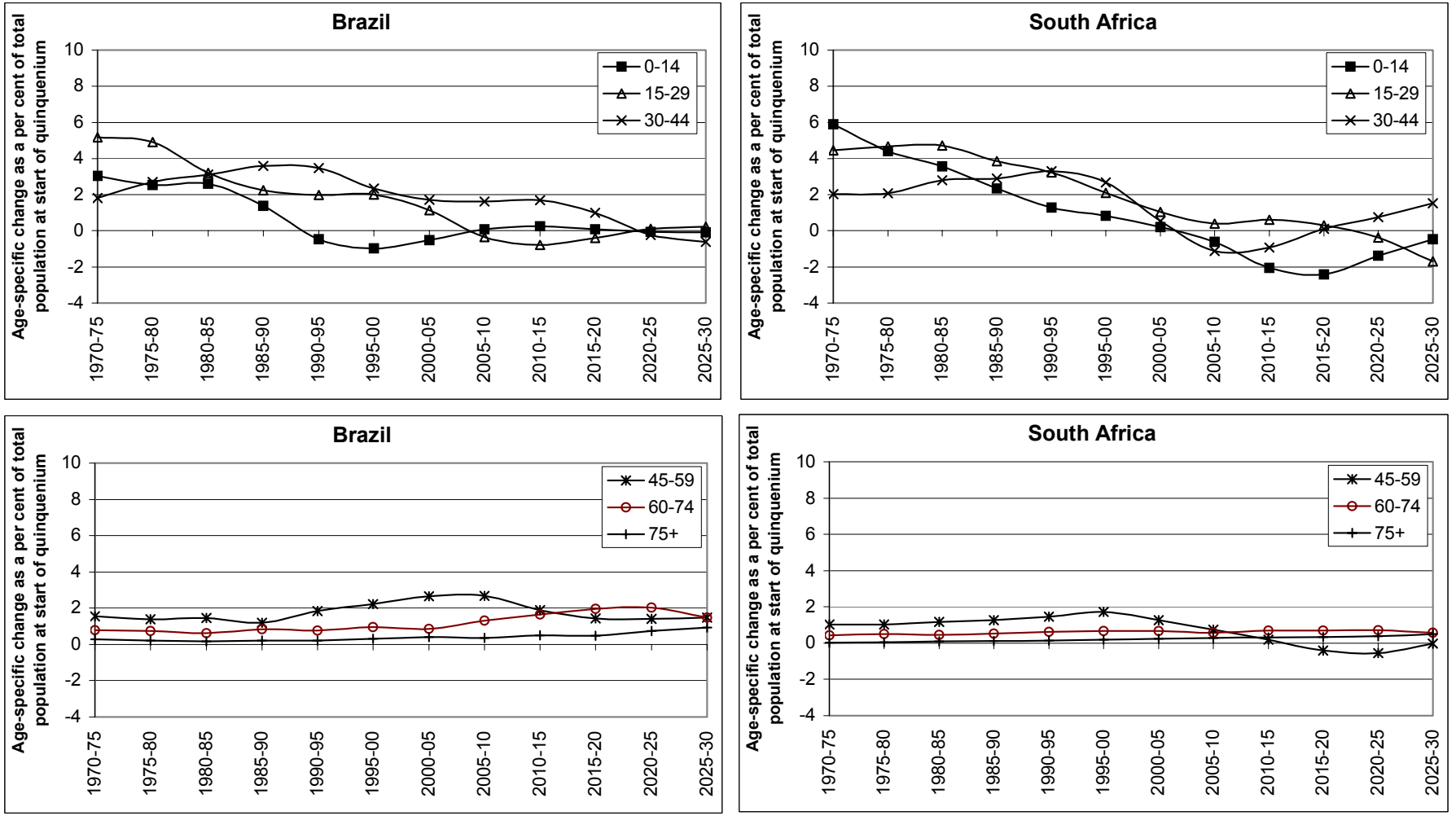

Brazil
South Africa
Age-specific change as a per cent of total population at start of quinquenium
0-14
15-29
30-44
45-59
60-74
75+
10
8
6
4
2
0
-2
-4
1970-75
1975-80
1980-85
1985-90
1990-95
1995-00
2000-05
2005-10
2010-15
2015-20
2020-25
2025-30

Figure 3f

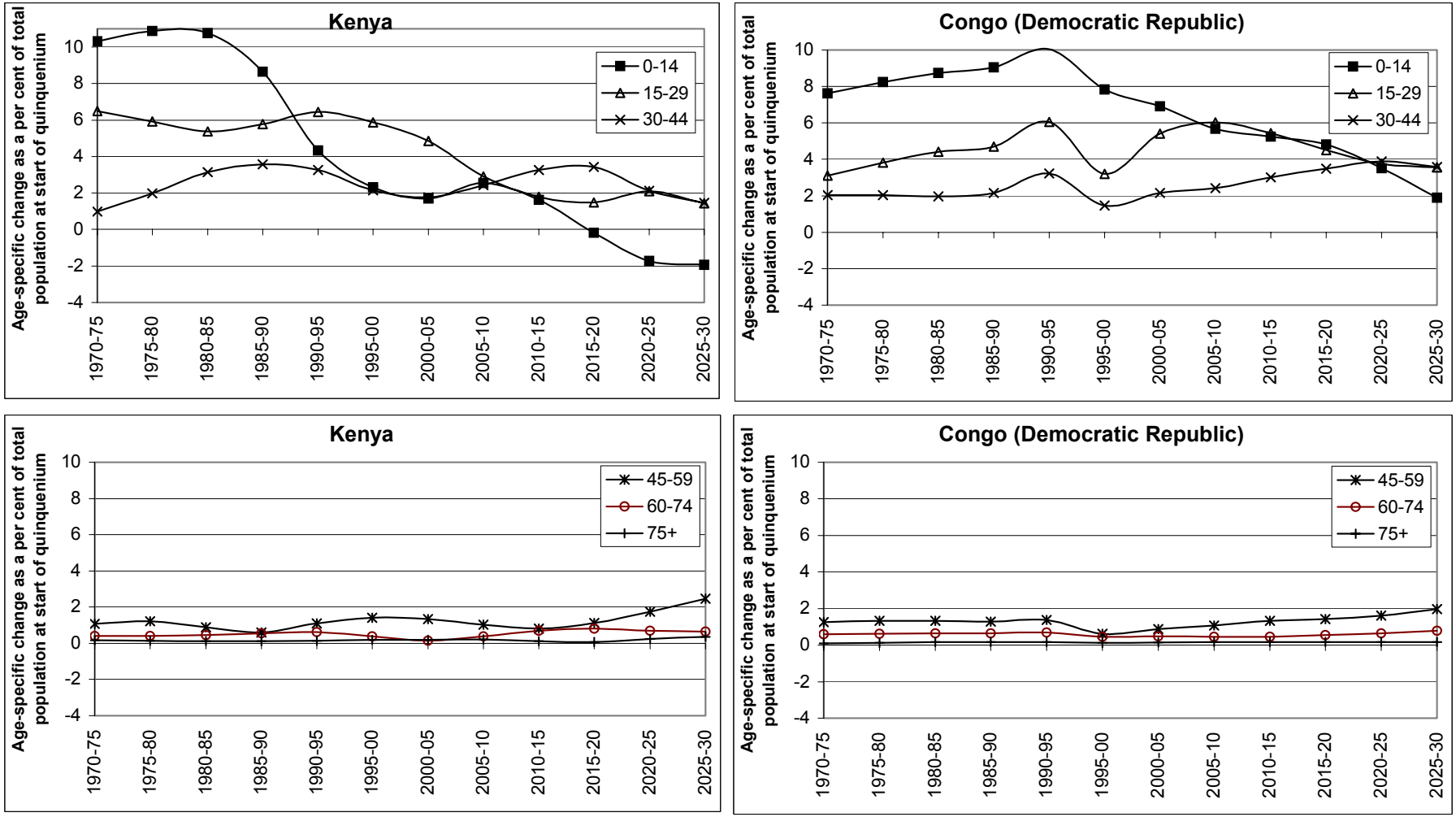
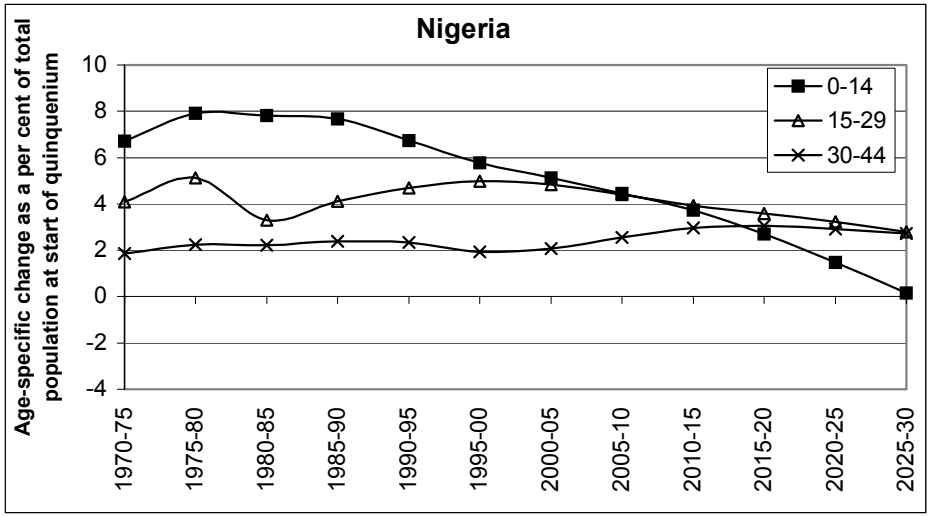

Kenya
Age-specific change as a per cent of total population at start of quinquenium
0-14
15-29
30-44
45-59
60-74
75+
1970-75
1975-80
1980-85
1985-90
1990-95
1995-00
2000-05
2005-10
2010-15
2015-20
2020-25
2025-30
Congo (Democratic Republic)

Figure 3g


Nigeria
Age-specific change as a per cent of total population at start of quinquenium
10
8
6
4
2
0
-2
-4
0-14
15-29
30-44
1970-75
1975-80
1980-85
1985-90
1990-95
1995-00
2000-05
2005-10
2010-15
2015-20
2020-25
2025-30

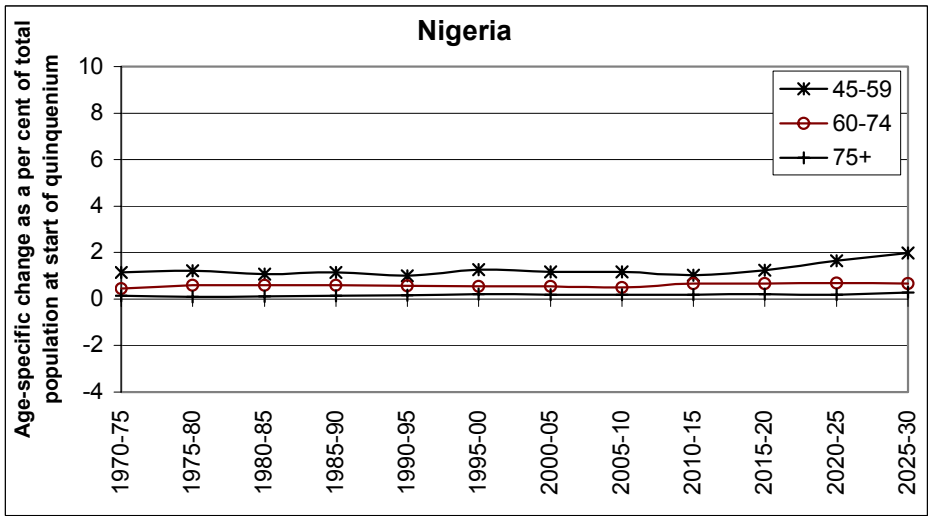

Nigeria
Age-specific change as a per cent of total population at start of quinquenium
10
8
6
4
2
0
-2
-4
45-59
60-74
75+
1970-75
1975-80
1980-85
1985-90
1990-95
1995-00
2000-05
2005-10
2010-15
2015-20
2020-25
2025-30

Table 1: Momentum Effects, Numbers (000s) Nigeria and China 1995-2000, Ages 5+ Years

	Nigeria	China
5 - 9	1,645	-15,858
10 - 14	1,668	16,292
15 - 19	1,721	1,512
20 - 24	1,478	-24,218
25 - 29	855	-7,140
30 - 34	464	20,113
35 - 39	280	19,010
40 - 44	248	-4,335
45 - 49	482	20,382
50 - 54	38	11,802
55 - 59	70	-229
60 - 64	1	-1,665
65 - 69	-83	-482
70 - 74	-139	-2,583
75 - 79	-155	-3,095
80 - 84	-107	-2,807
85+	-85	-2,797

Calculated: (Population 2000 - Population 1995) - Deaths 1995-2000
Under 5: Births – Deaths

Source: United Nations Projections, 2000 revision.

Table 2: The World, 2000-2015: Some Age-Structural Indices

		0-4	5-14	15-24	20-44	45-64	65+	Total
Percent by age	**1995**	11	21	18	29	15	7	101
	2000	10	20	18	29	16	7	100
	2015	9	17	17	29	20	8	100
Increase by Age	**Numbers (mills)**	31	29	124	314	447	178	1150
	%	5	2	12	18	45	43	19
Percent of Total Change	**(all ages)**	3	3	11	27	39	16	99
Largest quinquennial age-group	**2000**	X						
	2015	X						
Age/Child ratio (65+/0-14)	**2000**	.23						
	2015	.31						

Source: UN Estimates, 2000 Revision

Table 3: Growth in Size of Cohorts Representing New Entrants (NE) to Labour Force (15-24) 2000-2015

	Growth 2000-2015		% at NE Ages of All Ages		
	Percent	**Number (000's)**	**1990**	**2000**	**2015**
WORLD	12	123,976	19	18	17
France	-5	-420	15	13	12
Russia Fed.	-37	-8,446	13	16	11
United States	15	5,815	14	14	15
Mexico	4	820	22	20	17
Brazil	-8	-2,594	20	20	16
China	-1	-1,924	22	16	14
India	18	33,471	19	19	19
Thailand	-5	-641	22	19	15
South Africa	7	633	21	21	21
Congo (Dem rep.)	78	7,531	19	19	20
Nigeria	49	11,297	19	20	21
Kenya	23	1,662	20	23	22

Source: UN Estimates, 2000 Revision