RESEARCH NOTE

CONTRIBUTION OF MORTALITY DECLINE TO LONGER WORKING LIFE: THE CASE OF INDONESIAN MALES 1980–1995

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The length of working life of Indonesian males has been estimated for 1980 and 1995. Data on age specific labour force participation rates are obtained from the 1980 census and the 1995 intercensal population survey. Data on age-specific mortality have been adopted from appropriate model life tables based on indirect estimates of child mortality in the absence of any direct information about mortality. The contribution of declining mortality to the lengthening of working life has been greater than the contribution of higher labour force participation rates. Reductions in mortality at ages before entry into the labour force have increased the potential for added and improved education and training needed for the work force, which is also a contribution of reduced mortality to human capital development. The findings have implications for policy and future employment plans.

In conventional terms working life starts at 15 years and ends at 65 years. Under this convention, the potential working span of a person is 50 years. In an economy like that of Indonesia, where the majority of the population lives in the rural areas, people enter the labour force before the age of 15 and continue to participate in the labour force beyond the age of 65 years, giving a potential working life of more than 50 years. The actual length of working life is a function of labour force participation rates (LFPRs) and mortality rates in the working ages. The working life of a person can be interrupted by illness or by death. Therefore, strictly speaking, one should use data on morbidity, disability and mortality, but because morbidity and disability statistics are not available with the required degree of detail and accuracy, mortality data are used instead to indicate the health factor. The LFPR is primarily determined by the prevailing economic forces and the health status of the working-age population. The reduction of mortality and the increase in labour force participation in Indonesia during the past three decades has increased the potential productive years of the Indonesian population.

A detailed study of any demographic aspect of the Indonesian population in the

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past is hampered by limitations of data. Indonesia conducted its first post-Independence population census in 1961. However, most of the data collected at this census were lost owing to the civil disturbances of the mid-1960s. The next population census was conducted in 1971 and although all the data from this census were processed and published, the labour force data are not directly comparable to those of the later censuses because of definitional and conceptual differences.

The present note is focused on the period between the 1980 population census and the 1995 intercensal population survey. These fifteen years have seen significant growth in the Indonesian economy, much structural change in the Indonesian labour force and considerable reductions in mortality. The per capita income increased from US$580 in 1982 (World Bank 1984: 218) to US$980 in 1995 (World Bank 1997: 214), an increase of almost 70 per cent in 15 years.[1] In 1980, the main sectors of the Indonesian labour force comprised 59 per cent agriculture, 12 per cent manufacturing and 29 per cent services; in 1990 these percentages were respectively 57, 14 and 29 (World Bank 1997: 220). In 1995, agriculture employed 46 per cent, manufacturing 17 per cent and services 37 per cent of the Indonesian labour force.[2] The crude labour force participation rate at ages 10 years and above increased from 68.4 per cent for males and 32.6 per cent for females in 1980 (Abdurochim 1986: 46) to 72.7 per cent for males and 41.0 per cent for females in 1995 (BPS 1996: 262–263). Life expectancy at birth increased from an estimated 52.2 years in 1976 to an estimated 64.4 years in 1991[3] (BPS 1997: 59). The increased labour force participation and the improved longevity imply an increased length of working life of the Indonesian population, with implications for the availability of human resources and their productivity.

The aim of this research note is to estimate the contribution of mortality decline to human capital formation in Indonesia, by estimating the length of the working life of Indonesian males in 1980 and 1995; and to calculate the changes in the length of working life due to changes in labour force participation rate and changes in mortality. It will be shown that reductions in mortality have made a greater contribution to the lengthening of working life of Indonesian males than have increases in labour force participation rates. The analysis is useful in showing the effect of reductions in mortality, through improvements in health and nutrition, on the availability of human capital.

Method and data

No estimate of the length of working life of Indonesian males is currently available, primarily because of the paucity of data on mortality. The length of working life is estimated in this analysis by the method of constructing 'tables of working life' or 'labour force life tables' (United Nations 1968). This method is based on the technique of a double-decrement life table, in which a given number of male births, say 100,000 at a given time, a proportion of whom would survive the prevailing mortality rates from birth to the exact age of entry into the labour force at the conventional start of working life (here taken to be 10 years); pass through the working years according to the prevailing LFPRs, rates of entry into the labour force and mortality; and leave the labour force at given ages according to the prevailing rates of retirement and mortality. The LFPRs by five-year age groups from 10 to 65 were obtained from publications of the Indonesian population census of 1980 (Republic

of Indonesia 1993: 46) and the 1995 Intercensal Population Survey (BPS 1996). Because complete and reliable mortality data for Indonesia are not available, age-specific death rates were derived from the West Model Life Tables (Coale and Demeny 1983) based on the mortality levels estimated from child survivorship data collected at the 1980 population census and the 1995 intercensal population survey (BPS 1997: 58). The Coale–Demeny tables have been used in preference to the model life tables prepared by the United Nations (1982) mainly because the former were used for estimating mortality in Indonesia.

A number of assumptions are used in the construction of working life tables. These assumptions are as follows (United Nations 1968: 26):

1. all persons who enter the labour force at any time in their lives do so prior to the age at which the activity rate reaches its maximum, and no survivors retire into inactive status prior to that age;
2. ages at which individuals retire are independent of the ages at which they enter the labour force; and
3. mortality at each age is the same for the economically active and inactive populations.

The validity of the estimates of the length of working life depends on the extent to which the above assumptions are satisfied. The first assumption is generally met for males. However, it is not usually met for females because many women enter the labour force before marriage, withdraw after marriage to have children and rejoin the labour force after some time. Thus the construction of working life tables for females is seldom attempted, unless other data are available, such as rates of entry to, withdrawal from, re-entry to and retirement from the labour force. The second assumption may not be fully satisfied for either the male or the female population of any country. Compared to the urban population, persons in rural areas enter the labour force at earlier ages and retire from the labour force at later ages. Where such rural–urban differences are very large and where neither the rural nor the urban population forms a dominant majority of the total population, estimates of the length of working life for the entire population may not be representative of the length of working life for rural and urban areas separately. In Indonesia the rural population makes up more than 70 per cent of the total population, and no attempt is made to estimate the length of working life separately for rural and urban areas. The third assumption of equal mortality of the economically active and non-active populations is not satisfied in most cases, because a major factor for not participating in the labour force may be ill-health and consequently higher mortality. However, labour force participation usually occurs in the age range where mortality is at its lowest, and any difference between the mortality of the labour force and the non-labour force populations is not likely to make a large difference in the estimates of the length of working life. In any case, such a difference would at most produce a somewhat underestimated length of the working life of the economically active population.

In addition to producing estimates of the expected length of working life, the working life tables also provide a number of related measures such as the rate at which persons enter the labour force at each age (accession), or the rate at which persons leave the labour force through death or retirement. Other applications of the working life table, which are not attempted here, include the estimation of expected earnings per person at each age, given data on average annual earnings of econom-

ically active persons by sex and age; and expected values of consumption per person by sex and age, given data on annual values of consumption by sex and age.

Age patterns of working life

LFPRs are shown in column 2 of Tables 1 and 2. Between 1980 and 1995, except for the age group 10–14 years, the LFPR of Indonesian males has increased in every age group. The observed increases are no doubt largely real, owing to better overall work opportunities in 1995 than in 1980, but may also be partly artificial owing to the high proportion of males enumerated in the 'other' (*lain-lain*) category in 1980, especially at the younger ages, many of whom were probably really available for work, even if not looking very hard. The reduction in the LFPR at ages 10–14 is probably due to the increased length of time spent in school. About one half of the young men aged 15–19 were either working or looking for work. The LFPR rises sharply to a peak at age 35–39 in both 1980 and 1995, declines gradually between the ages of 40 and 50 years and drops sharply after age 50.

Column 3 of Tables 1 and 2 shows the LFPR at the exact year of age at the beginning of each age interval. This column is analogous to the life table survivor column (l_x) and is approximated by averaging the LFPRs in an age group and its immediately preceding group. According to this measure, just under a third of the males aged exactly 15 years were working or looking for work in 1980 and in 1995. Column 4 shows the economically active (or labour force) stationary population in each age group.

The next column, 5, shows the death rates per 1,000 economically active males in each age group, and indicates the rates at which Indonesian males leave the labour force through mortality; these death rates increase with age as expected. The death rate estimated for the highest age group (65+) is a gross underestimate of the probable actual death rate; such underestimation occurs because of the interaction between the rates of attrition due to mortality and due to retirement (United Nations 1968: 31). A more realistic estimate of the death rate in this age group could have been made if data for the higher ages were available in more detail for Indonesia, such as in 5-year age groups to, say, age 85 years.

Column 6 shows the accession rate into the labour force (i.e., from not economically active to economically active status) per 1,000 males of each age group. The accession rate rises sharply to a peak at age 20–24 years and drops thereafter until there are no more entrants to the labour force at ages 35 and over. One interesting contrast between the two dates is that the accession rate at age 10–14 is slightly smaller in 1995 than in 1980. Again, this probably reflects the longer time spent in school in 1995 to prepare for entry to the labour force. However, the accession rate for ages 15–34 is much higher in 1995 than in 1980, because of greater opportunities for participating in the labour force due to the improving economic conditions, better reporting of labour force status in 1995, or both.

Column 7 shows rates of exit from the labour force due to retirement. In 1980, retirements, due either to age or to withdrawal from the labour force through permanent disability, started occurring at a low rate in the age group 40–44, and the rate increased by age. In 1995, retirements started occurring in the age group 35–39, at a very low rate. Overall, the retirement rates were slightly lower in 1995 than in 1980, again perhaps because of the better economic situation in 1995, better data

coverage in 1995 or both. A better picture of entry to and retirement from the labour force could have been obtained if the data were available by single years of age, particularly in the age-range 30–44 years.

Column 8 shows the expectation of life of all males (in the labour force and not in the labour force): a comparison of the two tables indicates better longevity in 1995. The higher life expectancy at age 5 than at birth in 1980 is due to high child mortality. By 1995, child mortality had been considerably reduced such that life expectancy at each age shows a smooth downward trend. Column 9 shows the expectation of working life. A newborn male could expect to spend about 33 years in the labour force if he experienced the age-specific labour force participation and mortality rates prevailing in 1980, and about 44 years if he was subjected to the rates prevailing in 1995. The increase in the length of working life is the result of increased labour force participation and reduced mortality. As the overall life expectancy has increased at every age between 1980 and 1995, so too have the expected years of life in the labour force, rendering the length of inactive years at each age (column 10) much the same for the two dates.

Changes in the length of working life 1980–1995

Column 11 of Tables 1 and 2 shows the expected number of years of active life remaining per economically active male surviving to ages 10, 15 etc. An economically active male at age 10 in 1980 could expect to spend about 49 years in the labour force, while his counterpart in 1995 could expect to spend about 55 years in the labour force. This pattern of increase in the expected length of working life is true for all ages. The greater proportion of this increase can be attributed to reduced mortality between the two periods and the relative mortality advantage of two cohorts born 15 years apart, particularly at the younger ages (age 30 and below). To a lesser extent, the observed increase can also be attributed to the higher LFPRs in 1995. A comparison of columns 9 and 11 indicates that beginning with age 10, the expectation of economically active life per economically active survivor is much greater than that of a (general) survivor, but this difference declines with increasing age, to age 45 in 1980 and to age 40 in 1995; this reflects not only the reduced labour force participation at older ages, but also, to some extent at least, the increased mortality at older ages. After age 45 in 1980 and age 40 in 1995, when there is no accession to the labour force, the difference between the two expectations of economically active life starts increasing again.

Effect of mortality on the economically active life of Indonesian males

If all men were in the labour force and none died, the potential length of working life would be 55 years in the age range 10 to 64 and 70 years in the age range 10 to 79 years (where 80 is the assumed upper limit). Gross years of economically active life are an index of the aggregate effects of the age pattern of labour force participation, which considers the actual labour force participation rates and no mortality. Gross years of economically active life are shown in Table 3 in 1980 to be 51 years and 43 years respectively for ages 10 years and above and for ages 10–64. These constitute 73 and 78 per cent of the respective potential length of working life of Indonesian males. The corresponding figures for 1995 are 53 years and 45 years,

Table 1 Economically active life, Indonesian males 1980[a]

Age interval (x to x + 4)	LFPR (x,x + 4) (%)	w_x (%)	$(Lw)_x$	$(mw)_x$	a_x	r_x	e_x	$(ew)_x$	Inactive years 8 – 9	$(ew)_x^*$
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
0–4	0	0	0	–	–	–	53.3	33.2	20.1	–
5–9	0	0	0	–	–	–	57.2	38.9	18.3	–
10–14	12.9	0	54,083	3.04	69.63	–	53.0	39.4	13.6	49.1
15–19	47.7	30.3	197,288	3.32	127.35	–	48.6	39.2	9.4	44.6
20–24	79.4	63.6	321,932	4.73	217.54	–	44.3	37.5	6.8	40.3
25–29	92.4	85.9	365,582	5.16	210.24	–	40.3	34.3	6.0	36.2
30–34	95.1	93.8	366,162	5.30	55.60	–	36.3	30.5	5.8	32.0
35–39	95.6	95.4	356,490	7.03	0	–	32.3	26.6	5.7	27.9
40–44	95.1	95.4	340,774	8.99	–	1.68	28.4	22.7	5.7	23.8
45–49	94.1	94.6	320,263	11.69	–	5.28	24.6	18.9	5.7	19.9
50–54	90.0	92.1	285,752	16.29	–	10.63	20.9	15.2	5.7	16.5
55–59	84.6	87.3	243,717	22.69	–	15.53	17.4	11.8	5.6	13.5
60–64	76.7	80.7	192,548	32.63	–	39.68	14.2	8.7	5.5	10.8
65+	53.4	65.1	278,455	28.41[b]	–	78.76	11.4	6.1	5.3	9.3

a **x** = Age in years; **LFPR** = Activity rate (labour force participation rate) in age interval; $\mathbf{w_x}$ = Activity rate at beginning of age interval; $\mathbf{(Lw)_x}$ = Stationary population in the work force between exact ages x and x+5; $\mathbf{(Lw_x) = L_x.w_{x'}}$ where $\mathbf{L_x}$ is the life table population; $\mathbf{(mw)_x}$ = Death rate in age-interval x to x+5 (per 1,000 males in the work force); $\mathbf{a_x}$ = rate of entry into the work force between ages x and x+5 (per 1,000 males not in the work force); $\mathbf{r_x}$ = rate of retirement from the work force between ages x and x+5 (per 1,000 males in the work force); $\mathbf{e_x}$ = expectation of life at exact age x (from the model life table); $\mathbf{(ew)_x}$ = average number of remaining years in the work force at exact age x years (per survivor); $\mathbf{(ew)_x^*}$ = average number of remaining years in the work force at exact age x (per economically active survivor)

b The death rate of active males aged 65+ calculated here is an underestimate of the probable actual death rate.

Source: Working Life Tables constructed by the author from data from the 1980 Indonesian Population Census and West Model Life Tables.

Table 2 Economically active life, Indonesian males 1995[a]

Age interval (x to x + 4)	LFPR (x,x + 4) (%)	w_x (%)	$(Lw)_x$	$(mw)_x$	a_x	r_x	e_x	$(ew)_x$	Inactive years 8 – 9	$(ew)_x^*$
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
0–4	0	0	0	–	–	–	66.4	43.9	22.5	–
5–9	0	0	0	–	–	–	64.8	46.1	18.7	–
10–14	10.3	0	48,686	0.74	66.40	–	60.1	46.3	13.6	54.7
15–19	49.2	29.8	231,370	1.33	149.60	–	55.3	46.0	9.3	49.9
20–24	86.4	67.8	403,098	1.88	346.52	–	50.6	43.8	6.8	45.2
25–29	96.1	91.3	444,151	1.92	308.87	–	46.1	39.9	6.2	40.6
30–34	98.4	97.3	450,200	2.24	155.87	–	41.5	35.5	6.0	36.0
35–39	98.5	98.5	445,194	2.75	–	0.40	36.9	30.9	6.0	31.4
40–44	98.1	98.3	436,082	3.95	–	1.02	32.4	26.4	6.0	26.8
45–49	97.4	97.8	422,320	6.10	–	3.48	28.0	21.9	6.1	22.4
50–54	94.8	96.1	395,432	9.50	–	10.48	23.8	17.7	6.1	18.4
55–59	87.3	91.1	342,657	15.11	–	17.84	19.8	13.7	6.1	15.0
60–64	79.3	83.3	283,006	23.13	–	38.09	16.2	10.2	6.0	12.3
65+	56.5	67.9	487,148	22.83[b]	–	70.56	12.9	7.3	5.6	10.7

a See Table 1, note a.
b The death rate of active males aged 65+ calculated here is an underestimate of the probable actual death rate.

Source: Working Life Tables constructed by the author from data from the 1995 Indonesian Intercensal Population Survey and West Model Life Tables.

Table 3 Effect of mortality on the economically active life of Indonesian males 1980 and 1995

Measure	1980 Active years:		1995 Active years:	
	10+	10–64	10+	10–64
1	*2*	*3*	*4*	*5*
(a) Gross years of active life[a]	51.2	43.2	53.3	44.8
(b) Expectation of active life at birth	33.2	30.5	43.9	39.0
(c) Loss of active years through mortality from birth to the end of active ages = (a) – (b)	18.0	12.7	9.4	5.8
(d) Expectation of active life at age 10	39.4	36.1	46.3	41.2
(e) Loss of active years through mortality after age 10 = (a) – (d)	11.8	7.1	7.0	3.6
(f) Loss of active life through mortality between birth and age 10 = (c) – (e)	6.2	5.6	2.4	2.2

a Gross years of active life are calculated by summing the products of the LFPR in each age group and the width of the age group. For the age group 65+, the upper age limit is taken to be 80 years. This measure shows the expected length of working life assuming no loss due to mortality.

and 76 per cent and 82 per cent, showing the effect of increased labour force participation during 1980–1995.

As mentioned, the expected length of economically active life depends on the prevailing mortality as well as the prevailing labour force participation. To account for the losses caused by mortality, the expectation of working life at a particular age is subtracted from the gross average length of working life. Loss of active years due to mortality is estimated at birth and at age 10. These measures are shown in Table 3. In 1995, out of a potential length of working life of 70 years at age 10, 9.4 years were lost due to mortality between birth and the end of active life, and 7.0 years were lost owing to mortality between age 10 and the end of active life. Mortality between birth and age 10 thus accounted for 2.4 years or about 26 per cent of the loss of potential working life of Indonesian males in 1995. For the age range 10 to 64 years, the years of active life lost through mortality between birth and age 65 was 5.8 years and that between ages 10 and 65 was 3.6 years, giving a net loss of 2.2 years (38 per cent) due to mortality between birth and age 10.

In comparison with the situation of 1980, losses in economically active life due

to deaths had been much reduced by 1995. In 1980, out of the gross years of working life of between 43 and 51 years, a total of between 13 and 18 years respectively were lost through deaths, consisting of around 6 years between birth and age 10 and between 7 and 12 years respectively between age 10 and the end of active life. The average number of active years expected to be lived by a newborn male in Indonesia, if labour force participation was spread between 10 and 80 years, increased by about 32 per cent from 33.2 years in 1980 to 43.9 years in 1995. The corresponding increase in work life expectancy at birth, if labour force participation was confined to the ages 10 to 64 years, was 8.5 years or 28 per cent. These increases were achieved largely by improved chances of survival, both before entry into the labour force and during the time spent in the labour force.

Conclusion

In this analysis, an estimate has been made of the effects of reductions in mortality on the length of working life of Indonesian males in 1980 and 1995. Problems of data have prevented any previous work in this area. This paper uses the labour force data collected at the Indonesian census of 1980 and the Intercensal Population Survey of 1995. While the increase in LFPRs is probably partly due to improved reporting, this does not detract from the estimated effect of improved mortality. Mortality rates have been adopted from an appropriate model life table selected on the basis of the indirectly estimated child mortality. It is hoped that with improvements of data, particularly on mortality, better estimates of the average length working life can be made.

Human capital development for males in Indonesia has been measured by the increase in the average number of years an Indonesian male can expect to participate in the labour force. This increase is the result of two factors: an increase in the labour force participation rates, and a reduction in the mortality of working-age males. It has been shown that, although the labour force participation rate of Indonesian males has increased in every age group (except 10–14) between 1980 and 1995, the lengthening of the average number of years an Indonesian male can expect to participate in the labour force has been largely caused by the reduction in mortality during this period. Further, reduced mortality before entry into the labour force has increased the potential for added and improved education and training needed for the work force, which is also a contribution of mortality decline to human capital development.

The changes in the expected length of working life discussed above do not reveal any qualitative change in the pattern of labour force participation at different ages. For example, they do not show to what extent the Indonesian males reported to be in the labour force work only part-time or are paid less salary than that commensurate with their qualifications (i.e., under-employed), nor do they show what proportion of the men in the labour force are only looking for work.

Implications for the future

The analysis presented above has several implications for the future. Indonesian mortality is still in transition. The high level of mortality in Indonesia, as implied by the most recent estimates of infant mortality of 52 per 1,000 live births (CBS 1998:

132) indicates that there is scope for further reduction, thereby further increasing the potential working life of its population. The increased number of years spent in the labour force because of reduced mortality and, to a lesser extent, increased labour force participation, has increased the potential for better productivity of Indonesian males. This potential increase in productivity can be better realized with advanced technology, given that the share of the manufacturing and services sectors in the labour force has been increasing over time. Finally, the availability of greater human capital through reduced mortality and increased labour force participation has to be matched by a corresponding increase in the availability of jobs in order to satisfy the increasing supply of human capital.

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Notes

1 Indonesian per capita income, measured in US dollars at current prices, would give a misleading picture of most people's local purchasing power because they do not spend much on imported goods.
2 Author's calculations based on data collected in the 1995 Indonesian Intercensal Population Survey (BPS 1996: Table 37.9).
3 The estimate referring to 1976 is derived from data collected in the 1980 population census and the estimate referring to 1991 is derived from the 1995 Intercensal Population Survey.

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