THE USE OF MODEL SYSTEMS TO LINK CHILD AND ADULT MORTALITY LEVELS: PERU DATA

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ABSTRACT:

New age patterns of mortality have been constructed for Peru. The two principal methods of estimation (child survivorship and orphanhood) are investigated to discover how sensitive they are to assumptions about the age patterns of mortality. The indirect approaches depend heavily on Model Life Tables.

Two aspects of age patterns are examined: (1) The use of Brass's two parameter logit system where it is assumed that the mortality pattern has varied over time and (ii) the use of Kamara's three parameter logit system, where it is assumed that the mortality pattern has remained fixed over time.

In each case we recommend a procedure for examining a characteristic of the age pattern, apply the method to the 1981 census/survey data of Peru, and attempt to evaluate the extent to which the results are reasonable.

Great caution must be taken, however, in using these models and, above all, in interpreting the results, particularly in an uncertain field of mortality, in developing countries. The Peru demographic data are by no means representative of all developing countries.

INTRODUCTION

The Problem (The Choice of the Model)

The construction of conventional life tables for less developed countries is not always a straightforward procedure. Most often, there are limitations in the mortality and fertility data. In such circumstances where there are doubts about the quality of reports on a population, it has been customary for analysts to use indirect methods.

The most reliable information (e.g. q(5) = child mortality rate/level, at age 5) collected from the actual population is used to locate a Model Life Table/Stable population with approximately the same value of q(5). The characteristics of this stable population are then taken as estimates of the corresponding parameters of the actual population. A major problem with this simple approach is that these Model Life Tables have only one quantitative parameter, α (alpha), which governs the level of mortality and, therefore, cannot adequately describe the variety of shapes of observed survivorship curves. Another problem with the tables is their dependence upon the database, that generated the, which may have causes of death, disease patterns and age patterns of mortality probably substantially different from those in the developing countries whose population is under investigation. It is probable, that any two populations with identical infant or child mortality levels may well have very different age patterns of mortality. Perhaps in one, adult mortality is high relative to childhood mortality while in the other it is relatively low. In fact demographic research has repeatedly established that the relative levels of childhood and adult mortality vary markedly between populations (e.g. Ledermann and Breas 1959). Such differences can extent to neighbouring populations and even to different ethnic groups living in the same area (Blacker et. al, 1985). For these reasons, it may be dangerous to use empirical Model Life Tables for deriving estimates of the level of adult mortality merely by extrapolating from information on infant or child mortality.

There is the need for relational models which provide great flexibility and degrees of freedom (by incorporating two extra parameters β and δ), in the indirect estimation of mortality based on more representative patterns. The parameter β governs the relationship between childhood and adult mortality, whilst the parameter δ allows the standard table to be twisted so that deviations in infancy and old age are in the opposite directions.

The usefulness of relational Model Life Tables for indirect estimation of child and adult mortality, however, depends on whether the model standard can be chosen judiciously. If the model standard is chosen correctly, the derived estimates of childhood and adult mortality are less likely to be in error. If on the other hand, the true mortality experience in no way resembles that implied by the choice of the model standard, the estimates will be in error. Extensive illustrations of this idea has been done with child survival data from less developed countries, using Brass (General and African) standards on the one hand, and other model standards on the other hand. For example (in Kamara 1988, 1989), the 1972 census data of Kenya has been used to investigate the effects of variations from the standard pattern (β = 1.0) on indirect estimates of child and adult mortality. The illustrations show that if the wrong model standard is chosen, the derived estimates are very much in error. The estimates of trends in the infant mortality rate with standard notation q(1) obtained from the child survival data, are more sensitive to the assumed age pattern of mortality than the corresponding estimates of child mortality q(2), q(3) and q(5) at ages 2, 3 and 5 respectively. The examination of mortality trends for developing countries (Brass 1985, Kamara 1988, 1989) also show that in order to satisfy the assumption of a fixed age pattern of mortality over time, the patterns of childhood and adult mortality would have to differ markedly from the standard values found in most model life table systems. It is preferable to use sets of Model Life Tables which allow for variations in mortality pattern, making maximum use of whatever information is available about the age pattern of mortality for the study population.

METHODOLOGY

The New Model: Kamara's Three Parameter Logit System

We present an adaptive three parameter logit system (a reduced form of the Zaba four parameter logit system) which uses Brass's General (or African) standard and which can be collapsed into Brass's two parameter logit system when the data are not sufficiently adequate to support the use of three parameter.

The aim is to examine the effects of varying the standard pattern of mortality on indirect estimates by use of β and the extra two parameters γ and δ in the Zaba system (see for example Zaba 1979) as opposed to the one parameter system obtained by varying the level of mortality, α, only.

Preliminary investigations have been made by Brass and Kamara about the effects of adjusting Brass's General Standard $l_s(x)$, through the extra three parameters of Zaba's logit system.

**** Table 1 about here ****

The results of Table 1 show that the effects of adjusting Brass's General Standards $l_s(x)$, through $\beta < 1.0$ [for example, $\beta Y_s(x) = 0.8\ Y_s(x)$] and negative values of Zaba's third parameter, γ [to give $l_N(\gamma, x) = l_s(x) + \gamma\ K(x)$], have rather similar effects at ages under 50 (the survivorship values of the new standards are quite close and are less than those of Brass's General Standard); and at ages over 50 their effects are in opposite directions but negligible in magnitude between ages 50 and 60.

Table 2 shows that the same effects (observed in Table 1) are true for positive values of γ and values of $\beta > 1.0$ (the survivorship values of the new standards are again quite close but are greater than those of Brass's General Standard).

**** Table 2 about here ****

It is only at late ages that the two parameters modify the standard in distinctly different ways (cf. Tables 1 and 2). Since we normally have little information on mortality at late ages, and whatever data there are remain suspect, it appears that there would be little gain by incorporating γ into a model for indirect estimation at ages under 60.

The results of Table 3 show that the adjustment of the General Standard through t(x) to give a new standard $L_N(\delta, x) = l_s(x) + \delta t(x)$, however, has a quite different effect from variation of β.

**** Table 3 about here ****

Adjustments through $\beta > 1.0$ and the negative coefficients of t(x) i.e. negative values of δ] have rather similar effects on $l_s(x)$ both at ages 25 and over 65; between ages 25 and 60 their effects are in opposite directions. The same is true for positive values of δ and the values of $\beta < 1.0$.

In certain cases, the effect of δ on the gradient of the l(x) function is much sharper up to age 25 than that of β (and vice versa), after this age, its effect is, more or less, the opposite of β (cf. Tables 1, 2, and 3). In principle then the addition of the t(x) modification to the standard $l_s(x)$, can provide a model for the examination of pattern effects which are apparent up to middle age mortality. Although the fourth parameter, δ, acts at the extreme ages we can ignore its effects on old age mortality, in so far as indirect methods cannot measure this accurately.

We can show that models produced by varying γ can be effectively described by setting γ equal to zero and adjusting β and δ (Kamara 1988, 1989). Thus, the Zaba four parameter logit system can be reduced to a three parameter logit system (with parameters α, β and γ) as long as the life table functions are computed to age 60.

It would be useful to give some illustrations of the effects of adjusting the General Standard by γ k(x) as opposed to a combination of β and δ t(x).

For known values of β, δ and γ parameters, the logit (obtained by using γ alone) $Y(x, \gamma) = \text{logit}\ (l_s(x) + \gamma\ k(x))$ can be compared with the logit (obtained by using β and δ combined), $\beta Y(x) = \beta\ \text{logit}\ (l_N(\delta, x))$ where $l_N(\delta, x) = l_s(x) + \delta\ t(x)$.

To show that β, and the twist parameter δ give an optimum representation, we demonstrate in graph 1.1 that for a given value of γ, we can find a combination of β and δ such that the fits $\beta Y(x, \delta)$ to $Y(x, \gamma)$ are close or fair (i.e. most of the points lie on the fitted line).

**** Graph 1.1. about here ****

Graph 1.2 however shows that for a certain β and δ combination we cannot necessarily, find a γ such that fits $Y(x, \gamma)$ to $\beta(x, \delta)$ are close or fair. In this case the fit is said to be poor as most of the points do not lie on the fitted line.

**** Graph 1.2 about here ****

The parameter ranges considered are ($0.6 < \beta < 1.4$) and ($-0.8 < \delta < 0.8$). Fair fits can be obtained when ($0.75 < \beta < 1.0$) and ($-0.4 < \delta < 0.4$). Outside of these range only poor fits, are possible, when γ is the fitting parameter.

Relatively better fits are possible when low values of β are combined with negative values of δ, than with combinations of low β and positive δ, or high β and negative δ.

DERIVING AN EXPRESSION FOR THE ALPHA DIFFERENCES IN THE ADJUSTED STANDARD

This section gives an illustration of the use of the two and three parameter logit systems, to link estimates of life table measures based on child survival data and maternal orphanhood data to derive complete life tables for developing countries. We avoid estimating our model parameters by the direct fitting procedures outlined by Brass (1975) and Zaba (1979). Instead, we adopt a trial and error method to obtain values of β in the two parameter system, or combinations of β and δ in the three parameter system, which lead to the most consistent set of α estimates. In the first approach, it will be assumed that the age pattern of mortality in the population under study has been changing. We pick a value of the second parameter, β, of Brass's two parameter logit system which leads to the most consistent set of mortality level estimates α over time from both child and adult survival estimates.

In the alternative approach, it is assumed that the age pattern of mortality in the population under study has been fixed. In this case we pick a combination of the second and third parameters β and δ respectively (in Kamara's three parameter logit system) which lead to most consistent set of α - estimates over time.

It is convenient to express the adjustment of the standard in terms of α rather than the survivorship $l_s(x)$, since the magnitude of the difference in alpha does not depend on age.

Assuming that $\delta t(x)$ is small compared with $l_s(x)$, logit $(l_N(x)) = Y_N(x)$, can be expressed as the first two terms of a Taylor's series expansion about $l_s(x)$ giving:

$$logit\ (l_N(x)) = \frac{1}{2}\ log\ \left\{\frac{(1.0 - l_s(x) - \delta t(t))}{l_s(x) - \delta t(x)}\right\}$$

$$= logit\ (l_s(x)) - \left[\frac{\delta t(x)}{2\, l_s(x)(1.0 - l_s(x)}\right] \qquad \text{……… (1)}$$

i.e.

$$Y_N(x) = Y_s(x) - \left[\frac{\delta t(x)}{2 l_s(x)(1.0 - l_s(x)}\right] \qquad \text{……….(2)}$$

where Y_s (x) is obtained with the original standard $l_s(x)$ and $Y_N(x)$ with the modified standard, $l_N(x) = l_s(x) + \delta t\ (x)$.

Then for the child mortality estimates, expressing a model logit in terms of the new standard logits $Y(x) = \alpha + \beta\ Y_N(x)$ so that

$$Y_N(x) = \alpha + Y_s(x) + (\beta - 1)\, Y_s(x) - \left[\frac{\beta\ \delta t(t)}{2\, l_s(x)\,(1.0 - l_s(x))}\right] \qquad \text{……. (3)}$$

and $Y(x) = a + Y_s(x)$ ………(4)

where a is obtained with the original standard and α with the modified one.

The difference in the α - estimate is then

$$(\alpha - a) = -\,(\beta - 1)\, Y_s(x) - \left[\frac{\beta\ \delta t(t)}{2\, l_s(x)\,(1.0 - l_s(x))}\right] \qquad \text{……. (5)}$$

The charge in α caused by the modified standard can then be calculated. However, the estimates of adult mortality α's are made from rates of the form l(b + n)/l(b) the probability of surviving from age b to (b + n), and the effects of changing the standard are more complicated.* However, it is possible to obtain approximate algebraic expressions for small adjustments. Technical details are given elsewhere in the Mathematical section B (Kamara 1989).

* The maternal orphanhood estimate l(b + n)/l(b) are not sensitive to variations in the β (Beta) parameter [except at central ages 40, 45 and 50]. Brass and Hill 1973, Brass 1975, K. Hill 1973, Kamara 1988, 1989].

The final expression obtained for adults is summarised in equation 6 below:

$$(\alpha - a)\, E(b, n) = F(b)\, G(b + n) - F(b + n)\, G(b) \qquad \text{...... (6)}$$

where $E(b, n) = l_s(b) - l_s(b + n)$, ... (7)

$$F(b) = (1.0 - l_s(b))\left((\beta - 1)Y_s(b) - \left[\frac{\beta\,\delta t(x)}{2\,l_s(b)\,(1.0 - l_s(b))}\right]\right) \qquad \text{.....(8)}$$

$$\text{and } G(b) = \left(e^{2a} + l_s(b)\left[1.0 - e^{2a}\right]\right) \qquad \text{...... (9)}$$

Each category of child and adult mortality has a time location (Brass and Bamgboye 1981). The mortality levels can, therefore, be plotted against the calendar time points in graph. Most frequently, the mortality levels of children and adults at the same time points will fail to agree. A small disagreement is of no importance but often the gap is large. The question in these circumstances is whether an age pattern of mortality to achieve consistency can be found. Because of the shape of the t(x) vector the adjustments through δ, do not affect significantly the estimates of α at the upper ends of the range of values (20 – 25) years for children and (50 – 60) years for adults. However, at younger ages which correspond to the more recent time location points the effects of the δ adjustments are in opposite directions for child and adult α. Thus the δ parameter can be used to modify underlying mortality patterns to bring children and adult estimates more closely into line. If the discrepancy is fairly small β and δ adjustments to bring the α for children and adults together can be found easily by trial and error. Kamara has explored this idea for several African Populations (Kamara 1988, 1989). The best consistency is often obtained with unlikely or implausible life-table models. It is possible that as data quality improves, this approach will yield more plausible returns. At present, it seems practicable to use it to derive measures of the broad level of mortality at different stages of life, but no refinement by age.

RESULTS

Application of Kamara's New Model to Peru Data.

The Peru census data 1981 turns out to be an interesting illustration. The data quality is of a more improved nature than that of most African populations. The techniques introduced in this paper are new in their applications to Peru retrospective data.

The child and adult measures from the reports on surviving female children and mothers are used to examine a method for arriving at a consistent mortality pattern. Two procedures for representing age patterns of mortality are examined. In the first approach it will be assumed that the age patterns of mortality in the population under study has been changing. In this case we pick a value of the second parameter β, of Brass's two parameter logit system which leads to the most consistent set of mortality level estimates (α) from both child and adult survival estimates. Unlike Brass's two parameter technique where the second parameter β is fixed, this study allows both α and β parameters to vary over time, and the evidence for mortality trends in Peru is then interpreted in terms of a shift from a fixed to variable pattern.

In the alternative approach, the age pattern of mortality will be assumed fixed. We pick a combination of the second and third parameters, β and δ respectively (in the new three parameter logit system developed by the author) which leads to the most consistent set of α - estimates for both child and adult survival estimates. The evidence for mortality trends in Peru is then interpreted in terms of a general improvement on the mortality level parameter, α, which is allowed to vary (whilst all other parameters are kept fixed). The α - measures of mortality level with the General Standard $\beta = 1.0$ is given in table 4 and plotted in graph 2.1

******* Table 4 and Graph 2.1 about here *****

Obviously, the standard gives incompatible results for adults and children. Changes in the β coefficient to 0.6 gives the results in table 4 and plotted in graph 2.2.

**** Graph 2.2 about here ****

Graph 2.3 has also been illustrated for values of β (beta) equal to 0.7.

**** Graph 2.3 about here ****

Again the α - measures for adults and children are closer together than for the standard pattern ($\beta = 1.0$), but because the trends are different $\beta = 0.7$ gives good agreement around the year 1972, and $\beta = 0.6$ gives good agreement around the year 1977.

The introduction of the third parameter δ, illustrated in Table 4 and graph 2.4 for Peru reduces the disagreement in the trends.

**** Graph 2.4 about here ****

The child and adult α - measures for 1981 can best be brought into coincidence by using $\beta = 0.70$ and $\delta = 0.40$ to fix the pattern of mortality. The illustration seems to be fairly satisfactory. New age patterns of mortality have thus been constructed which fit the hypothesis that over the years the only change has been in the mortality level parameter α.

The life tables for any of the years under consideration can be derived by combining the new standard age pattern with the α - level estimates. These level estimates can be made from graph 6. We now have the standard given by

$$L_N(x) = l_s(x) + 0.4\ t(x)$$

and $\text{logit}(l(x)) = \alpha + 0.7\ \text{logit}(l_N(x))$ ….. (10)

Freehand curves were fitted approximately to the time series of α (alpha) jointly for children and adults and values of $\alpha = -0.38$ for 1967, $\alpha = -0.48$ for 1972 and $\alpha = -0.59$ for 1977 were read off. In one of the resulting life tables (cf. Table 5).

**** Table 5 about here ****

Values for ages over sixty are not shown since, as noted previously, extrapolation to late ages without some knowledge of the effects captured by the neglected fourth parameter, the coefficient of k(x) is not justified.

CONCLUSION

The above results for Peru show that life tables constructed using a combination of fixed β and δ and linearly changing α can fit observed orphanhood and child survival data better than two parameter tables with fixed β.

However in some circumstances, even closer fits to the observation can be obtained using the two parameter system, but allowing both α (alpha) and β to vary. In the example analysed here, the required variation in the β parameter over time was non-linear, so that a model incorporating this variation would have to have more parameters than the fixed δ and β model.

Great caution must be taken, however, in using these models and, above all, in interpreting the results, particularly in an uncertain field of mortality, in developing countries. The Peru demographic data are by no means representative of all developing countries. A model that may work well for one country may not necessarily translate to another. It is encouraging of course, that the three parameter logit system has produced favourable results with the 1981 census data of Peru.

Table 1. The Kamara's New Standards l_N (β, x) and l_N (γ, x) obtained by modifying the General Standard, $l_s(x)$, with parameters β and γ respectively.

General Standard		**New Standards**			
β = 1.0		l_N (β, x)	l_N (γ, x)	l_N (β, x)	l_N (γ, x)
Age (x)	l_s (x)	β = 0.8	γ = - 0.6	β = 0.9	γ = - 0.3
1	0.8499	0.8001	0.7937	0.8264	0.8218
2	0.8070	0.7585	0.7541	0.7837	0.7806
3	0.7876	0.7405	0.7378	0.7649	0.7627
5	0.7691	0.7236	0.7228	0.7470	0.7460
10	0.7502	0.7068	0.7080	0.7290	0.7291
15	0.7363	0.6945	0.6972	0.7158	0.7167
20	0.7130	0.6744	0.6796	0.6940	0.6963
25	0.6826	0.6485	0.6566	0.6658	0.6696
30	0.6525	0.6234	0.6335	0.6381	0.6430
35	0.6223	0.5986	0.6096	0.6105	0.6159
40	0.5898	0.5721	0.5727	0.5810	0.5563
45	0.5535	0.5429	0.5506	0.5482	0.5521
50	0.5106	0.5085	0.5105	0.5095	0.5106
55	0.4585	0.4668	0.4570	0.4626	0.4578
60	0.3965	0.4168	0.3873	0.4066	0.3919
65	0.3210	0.3545	0.2959	0.3375	0.3084
70	0.2380	0.2827	0.1932	0.2597	0.2156
75	0.1516	0.2014	0.0954	0.1751	0.1235
80	0.0768	0.1203	0.0311	0.0964	0.0539

Source: Kamara 1989: (Unpublished Ph.D. Thesis).

Table 2. The Kamara's New Standards l_N (β, x) and l_N (γ, x) obtained by modifying the General Standard, $l_s(x)$, with parameters β and γ respectively.

General Standard		**New Standards**			
		l_N (β, x)	l_N (γ, x)	l_N (β, x)	l_N (γ, x)
Age (x)	l_s (x)	β = 1.1	γ = - 0.3	β = 1.2	γ = - 0.6
1	0.8499	0.8707	0.8780	0.8890	0.9061
2	0.8070	0.8283	0.8334	0.8477	0.8599
3	0.7876	0.8087	0.8125	0.8282	0.8374
5	0.7691	0.7898	0.7922	0.8091	0.8154
10	0.7502	0.7702	0.7713	0.7891	0.7924
15	0.7363	0.7556	0.7557	0.7741	0.7752
20	0.7130	0.7313	0.7297	0.7488	0.7464
25	0.6826	0.6990	0.6956	0.7148	0.7086
30	0.6525	0.6666	0.6620	0.6805	0.6715
35	0.6223	0.6340	0.6287	0.6455	0.6350
40	0.5898	0.5986	0.6233	0.6072	0.6569
45	0.5535	0.5588	0.5549	0.5641	0.5564
50	0.5106	0.5117	0.5106	0.5127	0.5107
55	0.4585	0.4544	0.4593	0.4503	0.4600
60	0.3965	0.3865	0.4011	0.3766	0.4057
65	0.3210	0.3049	0.3336	0.2893	0.3461
70	0.2380	0.2175	0.2604	0.1984	0.2828
75	0.1516	0.1308	0.1797	0.1124	0.2078
80	0.0768	0.0609	0.0997	0.0482	0.1225

Source: Kamara 1989: (Unpublished Ph.D. Thesis).

Table 3. The Kamara's New Standards, I_N (δ, x) and I_N (γ, x) obtained by modifying the General Standard, I_s(x), with parameters δ.

General Standard		New Standards			
		I_N (δ, x)	I_N (δ, x)	I_N (δ, x)	I_N (δ, x)
Age (x)	I_s (x)	$\delta = -0.4$	$\delta = -0.1$	$\delta = 0.1$	$\delta = 0.4$
1	0.8499	0.8881	0.8594	0.8404	0.8117
2	0.8070	0.8350	0.8140	0.8000	0.7790
3	0.7876	0.8104	0.7933	0.7819	0.7648
5	0.7691	0.7871	0.7736	0.7646	0.7511
10	0.7502	0.7634	0.7535	0.7469	0.7370
15	0.7363	0.7461	0.7388	0.7338	0.7265
20	0.7130	0.7181	0.7143	0.7117	0.7079
25	0.6826	0.6825	0.6826	0.6826	0.6827
30	0.6525	0.6491	0.6517	0.6553	0.6559
35	0.6223	0.6173	0.6210	0.6236	0.6273
40	0.5898	0.5845	0.5885	0.5911	0.5951
45	0.5535	0.5496	0.5525	0.5450	0.5574
50	0.5106	0.5098	0.5104	0.5108	0.5114
55	0.4585	0.4616	0.4593	0.4577	0.4554
60	0.3965	0.4019	0.3978	0.3952	0.3911
65	0.3210	0.3215	0.3211	0.3209	0.3205
70	0.2380	0.2219	0.2340	0.2420	0.2541
75	0.1516	0.1137	0.1421	0.1611	0.1895
80	0.0768	0.0348	0.0663	0.0873	0.1188

Source: Kamara 1989: (Unpublished Ph.D. Thesis).

Table 4: Female Mortality levels of children and Adults (alpha) at Calendar dates (using Brass's General Standard) Peru 1981 census.

Age (x) Children	**Time (t)**	**α (β = 1.0)**	**α (β = 0.60)**	**α (β = 0.70, δ = 0.40)**
1	80.4	– 0.2844	– 0.6312	– 0.6400
2	79.0	– 0.3234	– 0.6096	– 0.5877
3	77.2	– 0.3376	– 0.5898	– 0.5801
5	75.0	– 0.3471	– 0.5877	– 0.5621
10	72.6	– 0.2856	– 0.5056	– 0.4748
15	70.0	– 0.2730	– 0.4784	– 0.4448
20	66.8	– 0.2562	– 0.4382	– 0.4013

Age (x) Adults	**α (β = 1.0)**	**Time (t)**	**α (β = 0.6)**	**Time (t)**	**α (β = 0.7, δ = 0.4)**	**Time (t)**
35	– 0.7358	76.7	– 0.5636	76.6	– 0.5714	76.6
40	– 0.7063	74.8	– 0.5133	74.6	– 0.5425	74.7
45	– 0.6722	72.9	– 0.4547	72.7	– 0.5080	72.8
50	– 0.6332	71.4	– 0.3850	70.9	– 0.4649	70.9
55	– 0.6115	70.0	– 0.3266	69.1	– 0.4322	69.3
60	– 0.5762	68.6	– 0.2406	67.4	– 0.3682	67.7
65	– 0.5560	67.6	– 0.1524	65.8	– 0.2847	66.3

Table 5: Life Tables for Peru (1977)

Age (x)	Two parameter system $\alpha = -0.53, \beta = 0.6 \quad \delta = 0$ l (x)	q (x)	Three parameter system $\alpha = -0.59, \beta = 0.7 \quad \delta = 0.4$ l (x)	q (x)
0	10000	0.1091	10000	0.0996
1	8909	0.0213	9004	0.0148
2	8719	0.0095	8871	0.0065
3	8636	0.0089	8813	0.0062
5	8559	0.0091	8758	0.0066
10	8481	0.0068	8700	0.0049
15	8423	0.0113	8657	0.0088
20	8328	0.0149	8581	0.0122
25	8204	0.0150	8476	0.0133
30	8081	0.0155	8363	0.0146
35	7966	0.0171	8241	0.0172
40	7820	0.0198	8099	0.0212
45	7665	0.0248	7927	0.0279
50	7400	0.0326	7706	0.0376
55	7231	0.0436	7416	0.0498
60	6916	0.0630	7047	0.0666

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