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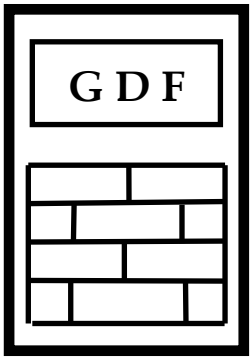

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Australian population:

life, cancer and death

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Australian population: life, cancer and death

Abstract

Data about population, cancer and death reported by authorized Australian institutions are reviewed according to the linear and Universal representations thoroughly studied for a large number and category of transforming systems. Basic data are expressed as age-specific number of persons on each calendar year normalized to 100,000 persons of population, separated by sex and in particular case of death by state. This normalization is one of basic conditions in obtaining data banks on transforming systems according to the topoenergetic representation. These raw data allow evidencing the kinetic of these basic processes as a function of age and as a function of calendar time (series of data on 10 – 105 calendar years). The obtained results are mainly presented in graphics in view to suggestively reveal at least the following conclusions: (i) the difference between age year and calendar year; (ii) the kinetics of Australian population shows a clear origin at the calendar year of 1859 ± 3.2 (95%) which is in good agreement with historical facts; (iii) kinetics of the three processes show a clear coupling between male and female population.

Abbreviations used and their assignments:

Population

p	number of persons in a specified population
cyr	calendar year (at which the population is considered)
ayr	age year (of a group of population)
SD	standard deviation (CF =68%)
CF	confidence level associated to a uncertainty
u(A)(CF)	uncertainty of quantity A with specified CF
slope, intercept, correl see Excel (Windows®) functions	
MP	males population (age-specific if it is not specified otherwise)
FP	females population (age-specific if it is not specified otherwise)
OMP	overall males population (all ages)
OFP	overall females population (all ages)
L(A,B)	linear representation of values (A,B): A = n1*B + m1
U(A,B)	Universal representation of basic experimental values: A = potential, B = eigenvalue, log(B) = N*log(abs(A-Ao)) + M, (log = natural logarithm)
(n1, m1)	first phylogenic parameters derived from L(A,B)
(n2, m2)	second phylogenic parameters derived from the first phylogenic parameters: m1 = n2*n1 + m2
(ni, mi)	phylogenic parameters of order i : m(i-1) = ni*n(i-1) + mi
Ctr	transforming component
Cin	inert component
ctr	kinetic entity
CS	coupling strength between Ctr and Cin

L((MP, FP), cyr) in the period of 1901 - 2005	
n1	annual rate of population (p/cyr)
m1	population extrapolated at 0 cyr (p)
Yo=-m1/n1	the calendar year at which the considered group of population is zero (cyr)
n2	calendar year for which the group of population is zero (cyr)
m2	population extrapolated at n2 = 0 cyr (p)

P(X, Y): Y = a*(X-b)^2 + c, parabolic variation	
for X = ayr , Y = n1(L(p , cyr)) , where p: MP, FP, or MP&FP	
a	rate variation of n1 (p/(cyr*ayr))
b	the age at which n1 has maximum value (ayr)
c	the maximum value of n1 (p/cyr)
n1o	the value of n1 at age zero (p/cyr)

Death

ASDRAM	Age Specific Death Rates of Australian Males, all causes by state and territory of usual residence in 2004, or by sex in the period of 1921 to 2004 (per 100,000 population)
ASDRAF	Age Specific Death Rates of Australian Females, all causes by state and territory of usual residence in 2004, or by sex in the period of 1921 to 2004 (per 100,000 population)

Cancer

ASIBCAF	Age-Specific Incidence of Breast Cancer in Australian Females (number per 100,000 population standardized to the 2001 Australian standard population); 1992-2002 (11 cyr).
<ASIBCAF>age	variation on two successive age groups of ASIBCAF cases averaged on the period of 1992-2002 (11 cyr).
<ASIBCAF/age>	average on the period 1992-2002 (11 cyr) of variation of ASIBCAF cases between two successive groups of age.
ASIPCAM	Age-Specific Incidence of Prostate Cancer in Australian Males (number per 100,000 population standardized to the 2001 Australian standard population); 1982-2003 (22 cyr).

Institutions

ABS	Australian Bureau of Statistics (Central Office: 45 Benjamin Way, Belconnen ACT 2617 Canberra, Australia, www.abs.gov.au)
AIHW	Australian Institute of Health and Welfare (26 Thynne St., Fern Hill Park, Bruce ACT 2601 Canberra, Australia, www.aihw.gov.au)

Australian population: life, cancer and death

Introduction

Recent studies on cancer diseases in NSW (Australia) [1] and United Kingdom [2] were revealed some specific aspects of kinetics of each type by considering the Universal topoenergetic principles [3] in retrieving the normalized data on age-specific new cases registered on a calendar year. Breast and prostate cancers appeared to be the most significant types for human society as a clear result of actual lifestyle. Furthermore, all aspects of human activity defining this lifestyle, as science, technology, climate change, space programs, sources and resources of energy and raw materials, space and time kinetics of population, etc. are driven by human mentality [4].

Australia is a huge space with practically unlimited resources and its population is based on birth, death and immigration. Population density is still far from a critical value that could trigger specific social events with irreversible results. However, there are some places with high population density and diverse ethnic structure which could suffer local changes. Interethnic confrontations on Cronulla beach (Sydney) in 2005 and increase rate of violent incidents in high dense populated areas are good examples for further considerations.

Study of Australian population and its lifestyle can reveal important aspects of actual human mentality, so that this study takes into account official records on population (see the sources in the Reference section), death and cancer (breast and prostate) incidence reported on a periods of 10 – 105 calendar years. Age-specific and sex separated data allow to evidence the effect of life style and sex on these processes (phenomena).

Population

Raw data on Australian population in age-specific groups cover the period of calendar years 1901 – 2005 in equidistant manner, namely for 1901, 1921, 1941, 1961, 1981, 2001 and 2005. These data allow to evidence good linear increases of all these groups with calendar time (correlation coefficients greater than 0.96).
Figure 1 shows the results of L(MP and FP, cyr) evidencing their second phylogeny expressed by the parameters (n2, m2).
Taking into account their significances we can estimate the calendar year as origin of each age group of population or of overall population at which their values are zero (Yo). Figure 2 shows a good linear behavior of Yo(age) for both MP and FP groups and the resulted Yo values for different groups of population are given in Table 1.

Table 1.

source	Yo	Yo , cyr	u(Yo)(95%)
L(MP, cyr)	-m1/n1	1859	3.6
L(FP, cyr)		1858	5.6
L(MP&FP, cyr)		1859	3.2
L(cyr, OMP)	m1	1889	13.4
L(cyr, OFP)		1891	13.0
L(cyr, OMP&OFP)		1891	8.6

These values are in good agreement with historical facts showing that Australian society as federal and unitary state has begun at approximately 1850 cyr with first massive settlements of immigrants arrived in the gold rush [5].
Parameter n1(L(MP or FP, cyr) represents the time-rate of specific population in the considered period of calendar time. Figure 3 shows the spectrum of this parameter as a function of age which has a parabolic shape with maximum at the age of approximately 40 ayr. Table 2 gives the parameters defining this behavior for each group and all population. All associated uncertainties are estimated for CF of 95%.

Table 2.

P(X, ayr)	a, (p/(cyr*ayr)	b, (ayr)	c , (p)	n1o, (p/cyr)
MP	- (4.9 ± 1.2)	40.5 ± 2.9	(12.3 ± 1)*1000	20,311
FP	- (4.7 ± 1.2)	42.6 ± 2.6	(12.3 ± 1)*1000	20,806
MP&FP	- (4.8 ± 0.7)	41.5 ± 1.7	(12.3 ± 1)*1000	20,544

It is important to reveal this increase rate in relative units between MP and FP. Figure 4 shows the age spectrum of the ratio n1(L(MP, cyr))/n1(L(FP, cyr)). This spectrum has three distinct behaviors:

(i) in the range of 0 - 24 ayr MP rate is significantly greater than FP rate,
(ii) in the range of 24 - 64 ayr this ratio slightly decreases under 1;
(iii) over 64 ayr drastically decreases.

This spectrum can be correlated with the other processes considered below.

Death

Death appears as natural process in all kind of living population and can be defined in topoenergetic terms as the final equilibrium state of each living individual as system in transformation [3].Data on death in Australian population used in this study are expressed as ASDRAM and ASDRAF values reported for each state for 2004 cyr for entire Australia for 1901, 1941, 1961, 1981, 2001 and 2004 cyr.

We have to observe first the child mortality (0 – 4 ayr) as a function of state (Figure 5) and calendar year (Figure 6). This process has a different nature than the death process at higher ages and will be studied in more detail in a separate work.

Secondly, is important to observe the age variation of death process expressed by the ratio ASDRAM/ASDRAF as a function of age in al states (Figure 7) and for entire Australia in the above mentioned calendar years (Figure 8). All values are greater than 1 which means that deaths in MP are greater than in FP for all ages and two maxima can be observed in both graphics, namely a more prominent one at approximately 30 ayr and another more flat at approximately 70 ayr. Table 3 and 4 give the age and values of first maximum for both cases and it can see the difference between state and calendar year, respectively.

We have also to observe that death amplitude vs age shows a Universal representation, i.e. an exponential increase towards a limit value of age, Ao, so that the ontogenic parameters (N, M, Ao) from U(ASDRAM/F, age) can be estimated by non-linear regression and by removing the values in the range 0 – 4 ayr. These parameters and further phylogenic ones define the death process caused by ageing, or as we mentioned in the previous studies [1, 2] by exposure to a lifestyle. The obtained results and higher phylogenies show that all populations considered in the study have the same nature of this death process, or in the other words are exposed to the same lifestyle.

Table 5 shows these parameters for each sex group and for each state in 2004. Taking into account the structural and kinetic significances of these parameters, we may observe that the global amplitude of death process is represented by Ao and also in relative units by Ao(MP)/Ao(FP) which slightly differ from the maximum values in Table 3. We can observe again higher global death rate for MP (excepting for WA) and high values for ACT, SA and especially NT.

Figure 9 shows the Ao values as a function of calendar year and the most significant topoenergetic kinetic quantities.

Tables 6 – 8 give the higher phylogenic parameters derived from this Universal representation of death kinetics U(ASDRAM/F, age). The values in Table 7 have lower uncertainties for FP than for MP and this means that death process in FP is more uniform than in MP. On the contrary, phylogeny on the states shows slight greater uncertainties values for FP than MP (Table 6).

In conclusion, death behavior is more uniform in space for MP than in calendar time, while FP shows the practically the same uniformity in space and calendar time as well.
Furthermore, states greatly influence kinetic entity of the death process for both MP and FP, so that L(M, -M/N) is poor (correl < 0.6).

Table 8. Second phylogenic parameters defined on the first phylogenic parameters derived from all L(M, X) regressions (X: -N, Ao, -M/N, N^2/M).

	state (Table 6)	sex (Table 7)	overall
n2	- (5.33 ± 0.04)	- (8.33 ± 1.5)	- (5.34 ± 0.05)
m2	25.4 ± 15	31.4 ± 19	34.8 ± 13
correl	0.9998	0.93	0.9995
	MP(state &sex)	FP(state&sex)	
n2	43.5 ± 2.4	46.9 ± 3.4	
m2	- (1.3 ± 2.3)	- (6.1 ± 2.6)	
correl	0.992	0.992	

Breast cancer

Specific-age data on breast cancer in FP in the period of 1992 – 2002 (11 cyr) were considered.
Figure 10 presents the incidence rate in 1992 as typical and average values vs age. Behavior on each calendar year shows some local steps which disappear at averaged behavior. However, the behavior up to approximately 55 ayr seems to be very uniform on the overall calendar period. On this age range of 20 – 55 ayr the incidence rate has a maximum value. Figure 11 presents the incidence rate vs age in two differential modes by the variation of incidence for two successive 5 ayr intervals. It clearly appears the maximum incidence rate at 44 ayr.
Universal representation U(ASDRAF, age) allows to evidence kinetics of breast cancer by ageing and calendar time.
Figure 12 presents the variation of limit age Ao on calendar time considered. We may observe first the big difference between these values and the similar ones defining death process (Figure 9).On the other hand, breast cancer process in FP is much more uniform than death process with small exceptions (1993 and 2000).
Table 9 gives the first phylogenic parameters of this breast cancer process. These values show again the uniformity of breast cancer process in FP in comparison with death process (Table 7).

Table 9.

	n1	m1	correl	SD(n1)	SD(m1)
L(M, N)	-8.884	-165.6	0.99995	0.031	5.4
L(M, Ao)	1.791	292	0.9993	0.022	31
L(M, -M/N)	6.603E-4	7.019	0.996	1.8E-5	0.025
L(M, N^2/M)	1.247E-2	4.71	0.9997	1E-4	0.14
L(-M/N, Ao)	2702	-18660	0.999	47	369
n2	161 ± 2				
m2	3.4 ± 2				
correl	0.9998				

Parameters (n2, m2) are estimated for all L(M, X) (X: -N, Ao, -M/N, N^2/M). For X= Ao and L(-M/N, Ao) data for 1993 cyr were removed being outside the fit of the other values, so that the point Ao(1993 cyr) in Figure 12 is not confident. This leads to the conclusion that breast cancer in FP on this period of calendar time appears to be very uniform.

Prostate cancer

Age-specific data on prostate cancer (MP) in the period of 1982 – 2003 (22 cyr) were considered.
Figure 13 presents the average values on this calendar period of time as a function of age. Significant cases of prostate cancer appear over 40 ayr and the increase of incidence function is smooth without particular points. Figure 14 presents the incidence rate vs age in two differential modes by the variation of incidence on two successive 5 ayr intervals (similar to Figure 11 for breast cancer). We may observe a perfect superposition of the two series of values and a slight maximum at 64 ayr after that the increase rate (new cases/age) remains practically constant.
It is important to notice that the maximum increase rate for breast cancer at FP is very close to the age when appears prostate cancer at MP.
Figure 15 presents the variation of Ao from U(ASIPCAM, age) as a global amplitude of prostate cancer over all age range, vs calendar time on the considered period. This period shows three different behaviors of Australian MP, namely: (i) below 1993 cyr when the prostate cancer had low amplitude; (ii) in the period of 1993 – 2000 cyr when this process had the highest amplitude, but constant (the same period considered for FP breast cancer), and (iii) over 2000 cyr prostate cancer shows a slight decrease.
These facts substantiate (if it was necessary) the assumption that processes of transformation affecting MP and FP are strongly interconnected.
Figure 16 shows the increase of MP prostate incidence reported to FP breast cancer as a function of age by taking into account the same period of calendar time (1992-2002). It is important to observe that these values continuously increase, so that these are less than 1 below 64 ayr and greater than 1 for over 64 ayr.
Table 10 presents the most important phylogenic parameters resulted in similar manner as for breast cancer.

Table 10.

	n1	m1	correl	SD(n1)	SD(m1)
L(M, N)	-9.0274	-257	0.9995	0.067	14
L(M, Ao)	1.581	-135	0.98	0.067	109
L(M, -M/N)	6.84E-4	6.677	0.996	3.2E-5	0.053
L(M, N^2/M)	1.19E-2	7.385	0.997	2.1E-4	0.34
L(-M/N, Ao)	2298	-15469	0.9994	19	144
n2	-95.7 ± 14				
m2	17.7 ± 11				
correl	0.98				

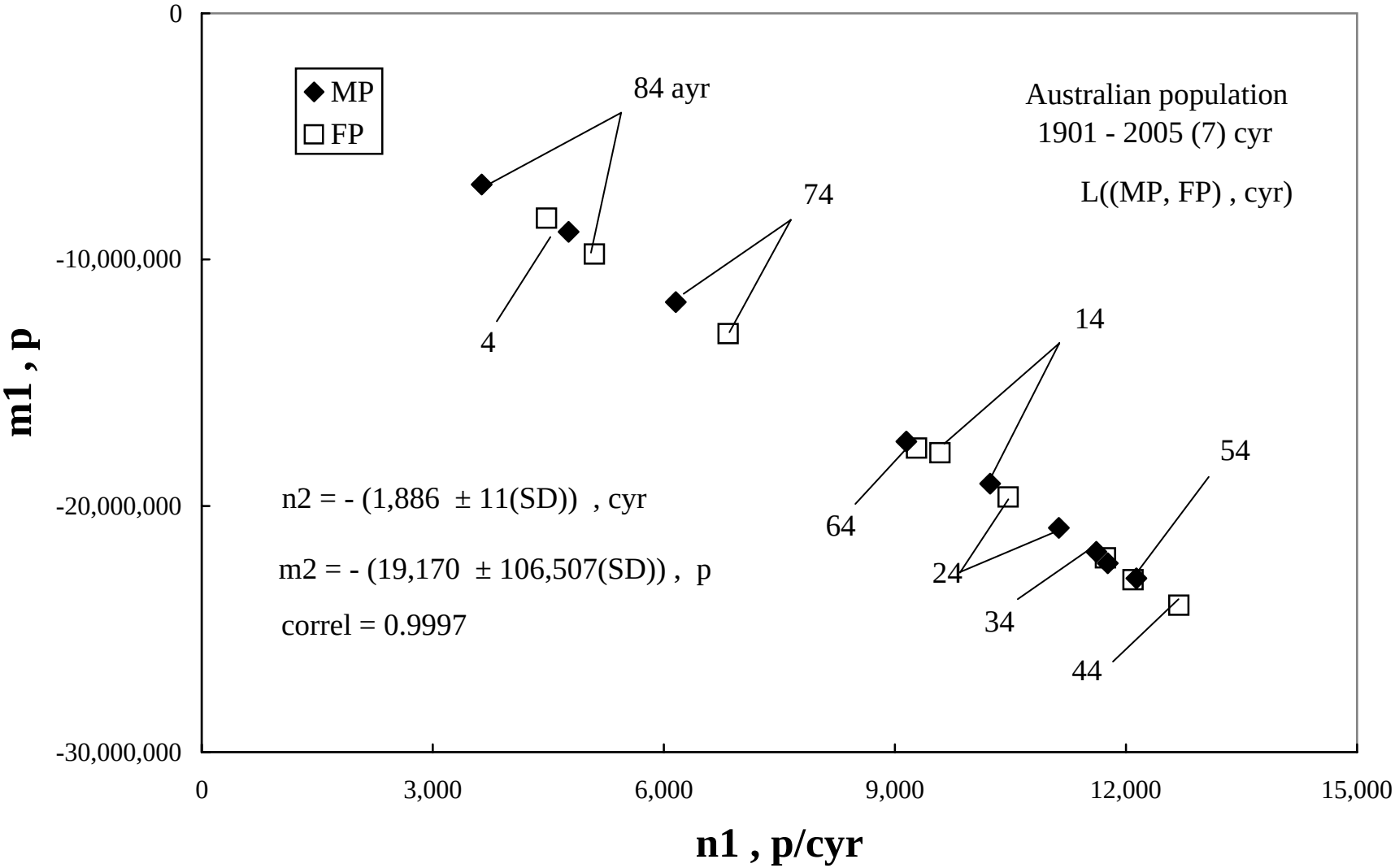

Figure 1. The 2nd phylogeny in the representations L((MP,FP), age).

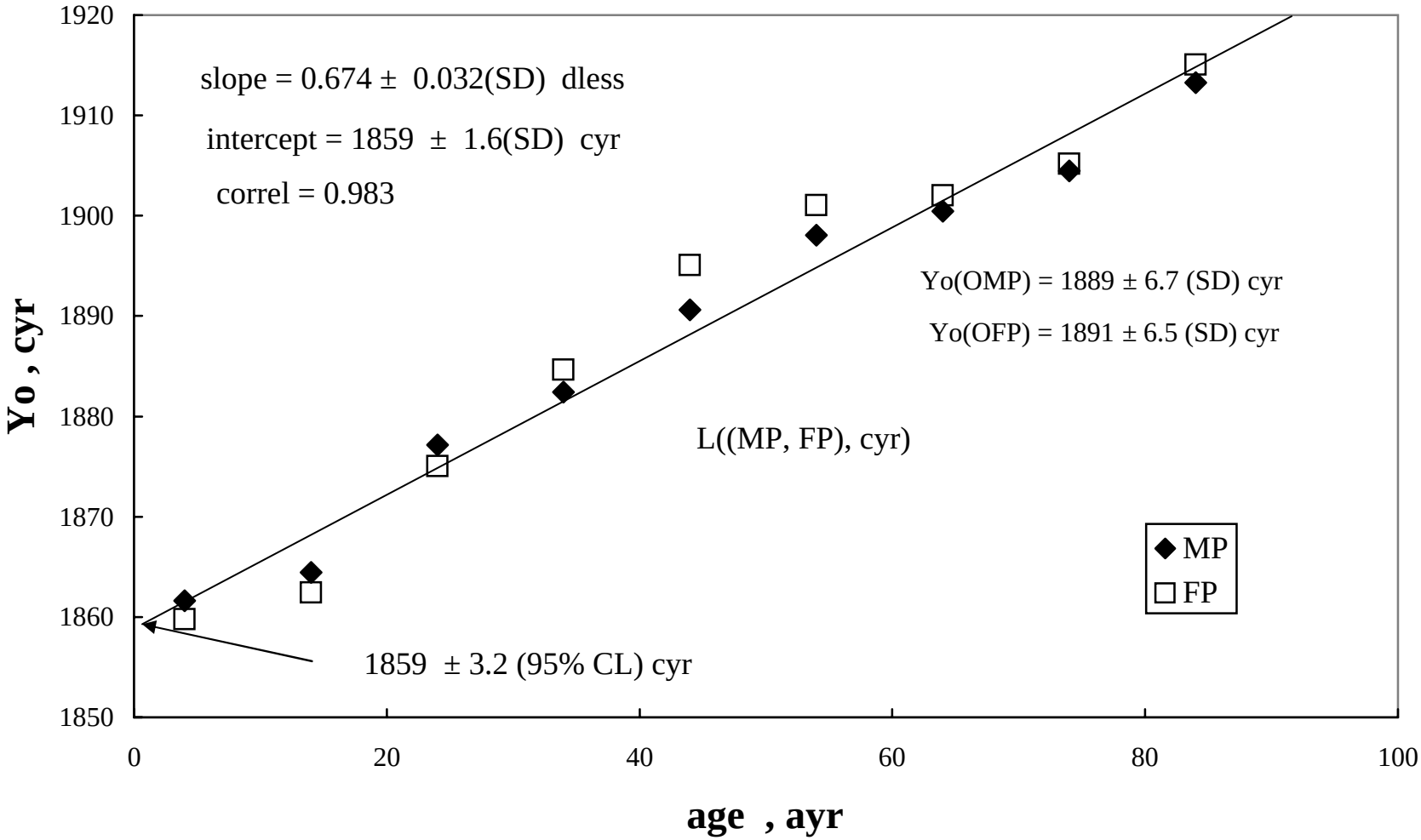

Figure 2. Variation of origin calendar year of each MP and FP age-group with its age.

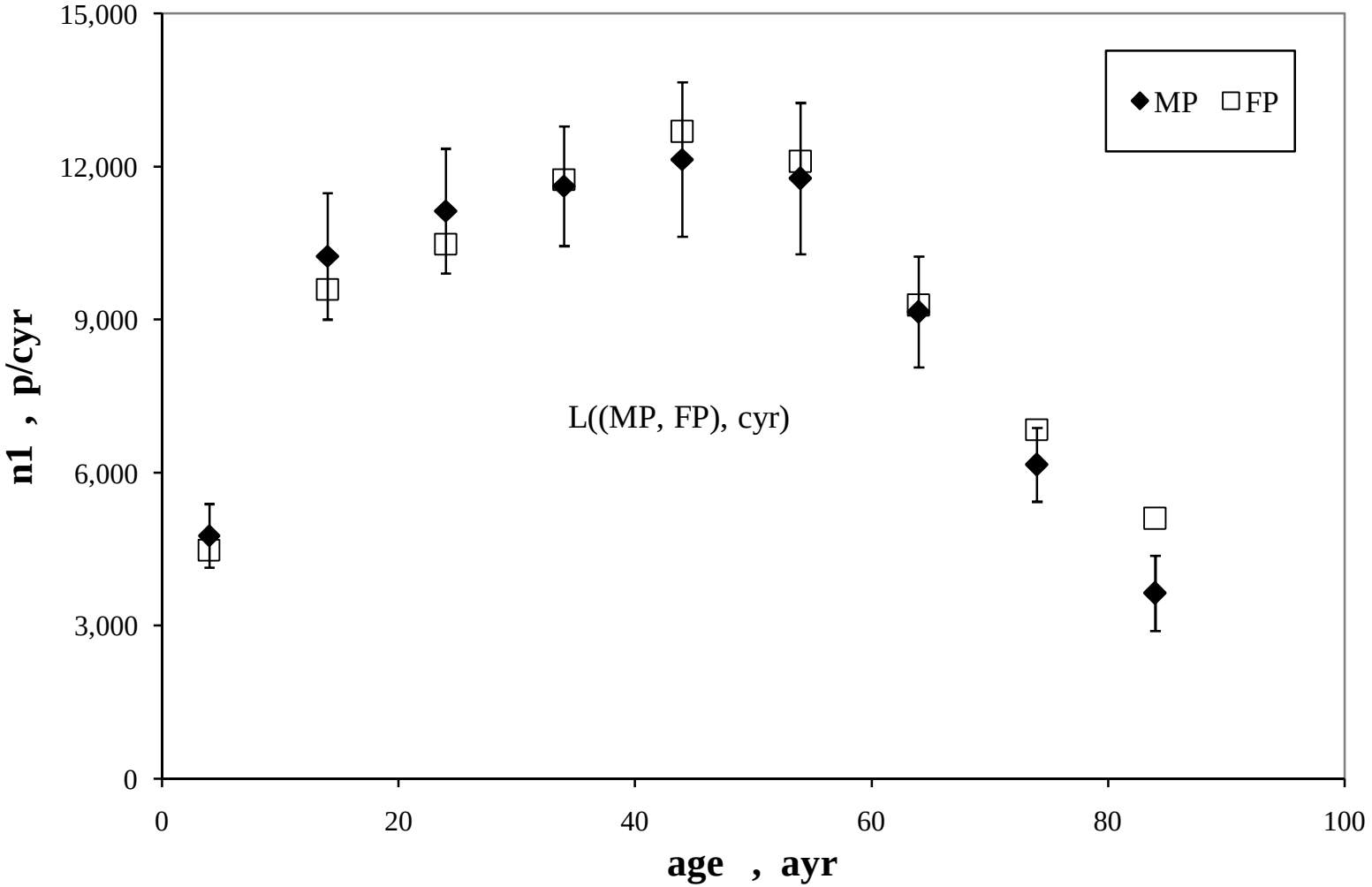

Figure 3. Variation of MP and FP time-rate on age averaged on the period 1901 - 2005 (7 cyr).

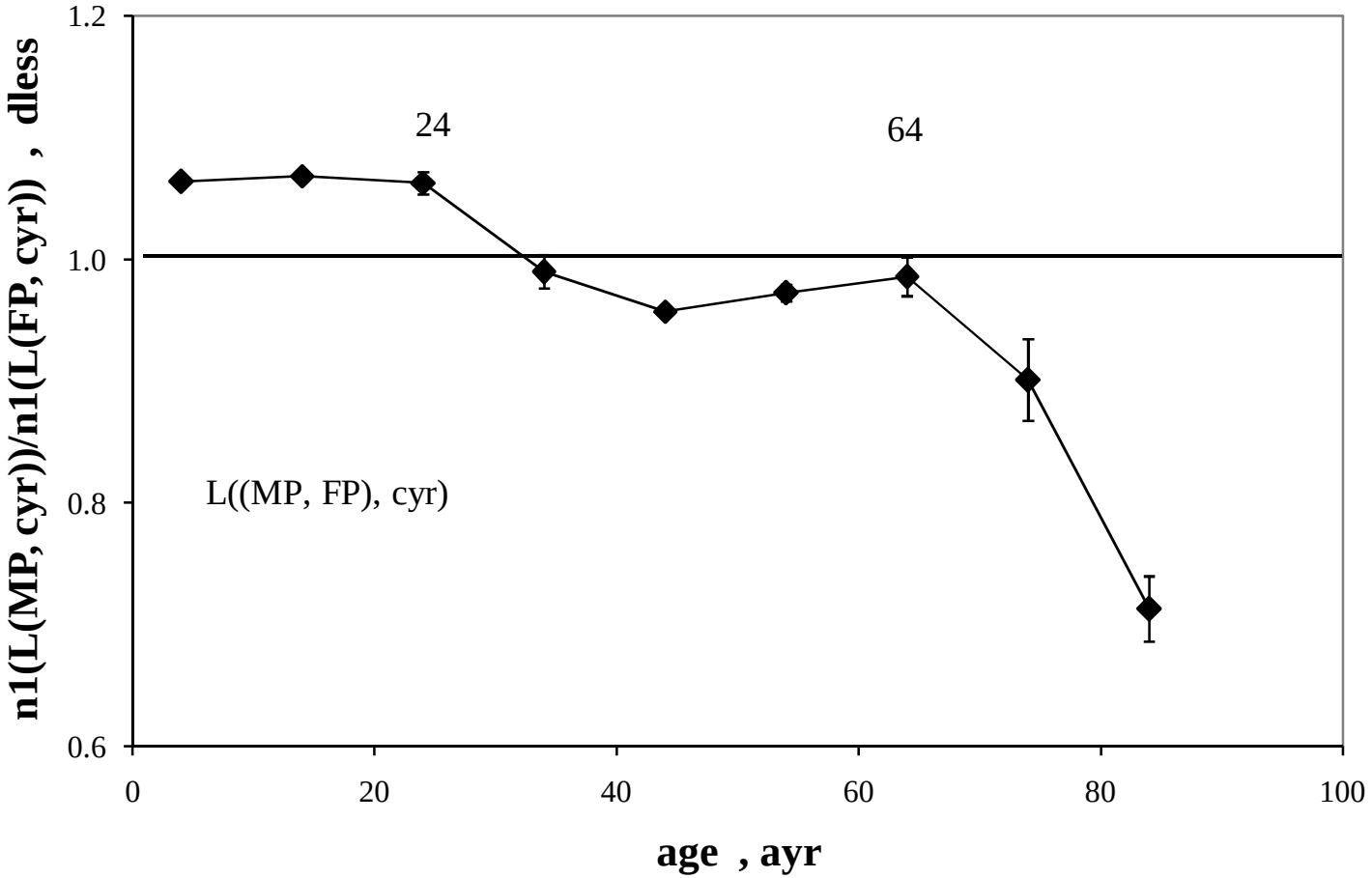

Figure 4. Variation of relative MP to FP time-rate with age averaged on the period 1901 - 2005 (7 cyr).

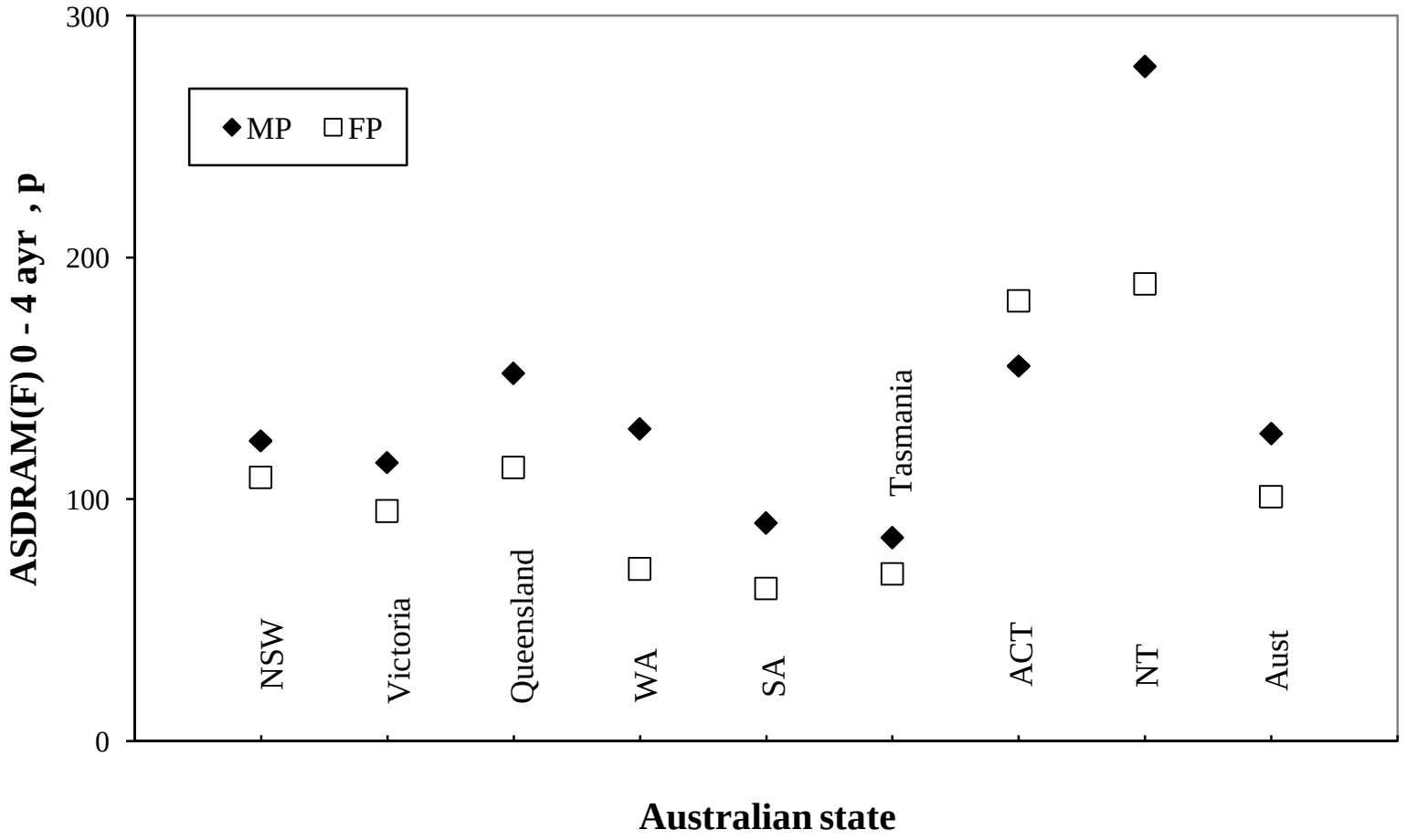

Figure 5. MP and FP child mortality (0 - 4 ayr) in 2004 cyr for all Australian states and territories.

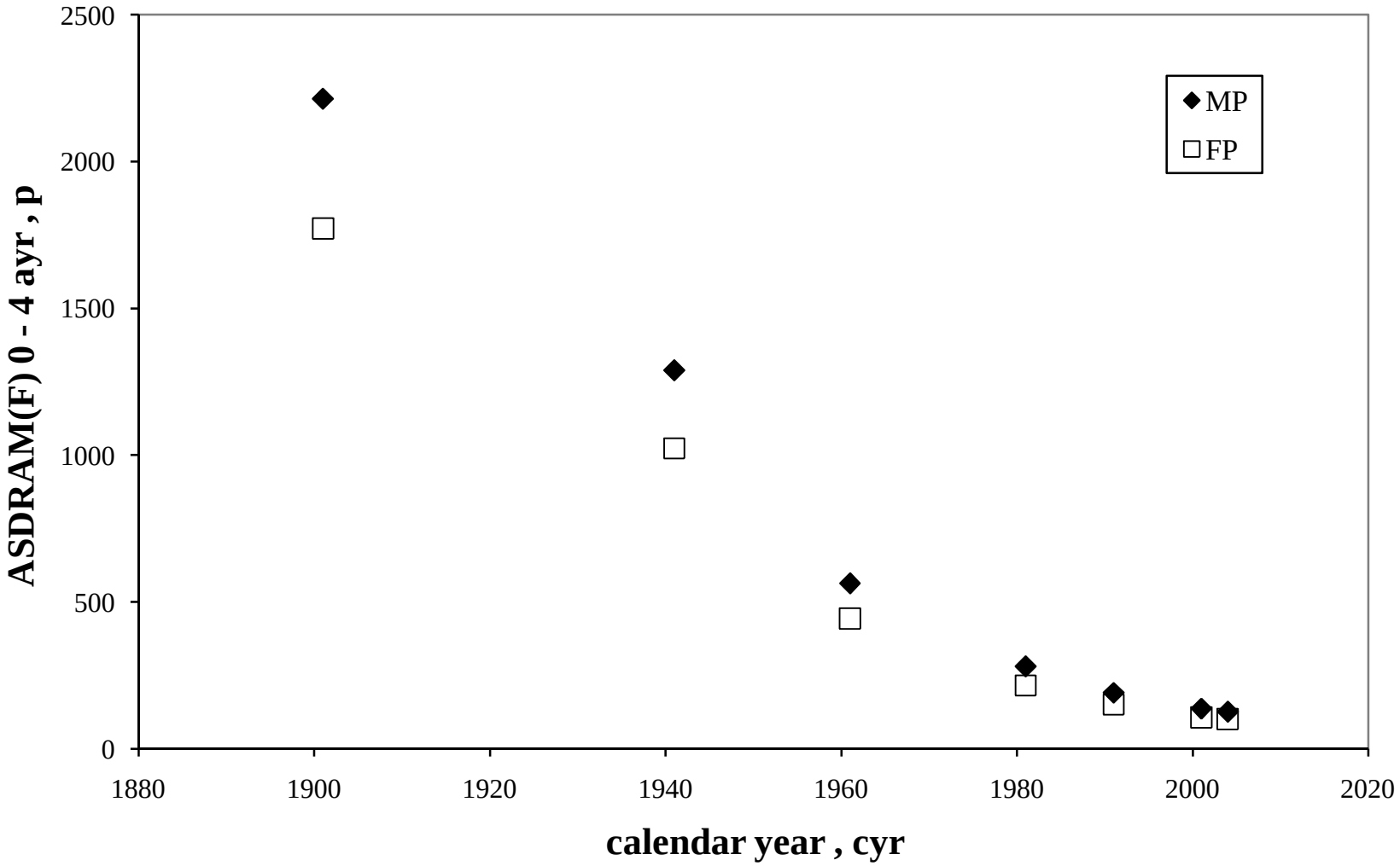

Figure 6. Variation of child mortality (0 - 4 ayr) in the period 1901 - 2004 cyr.

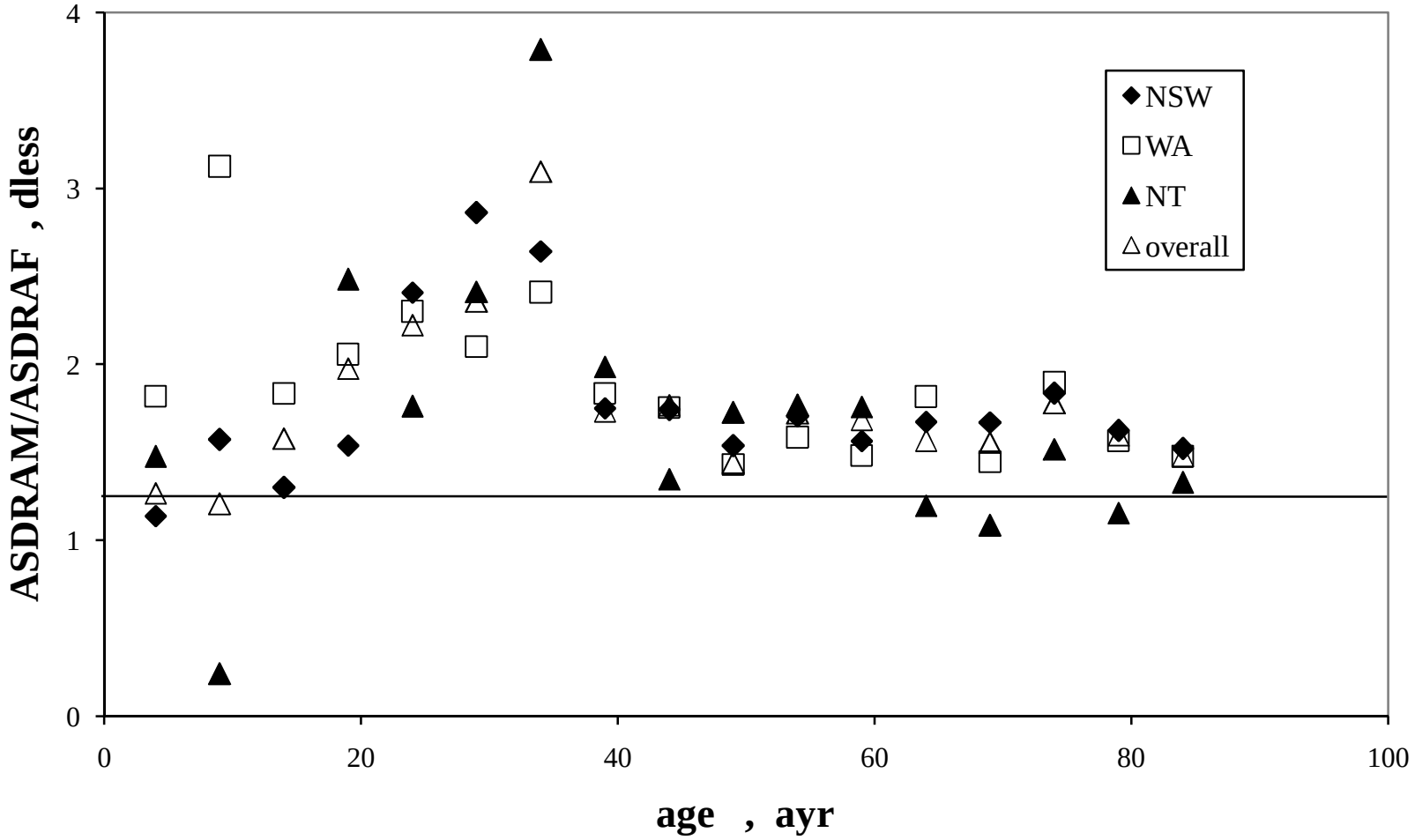

Figure 7. Variation of relative MP to FP death incidence with the age for a selection of 3 Australian states and the average values on all states in 2004 cyr.

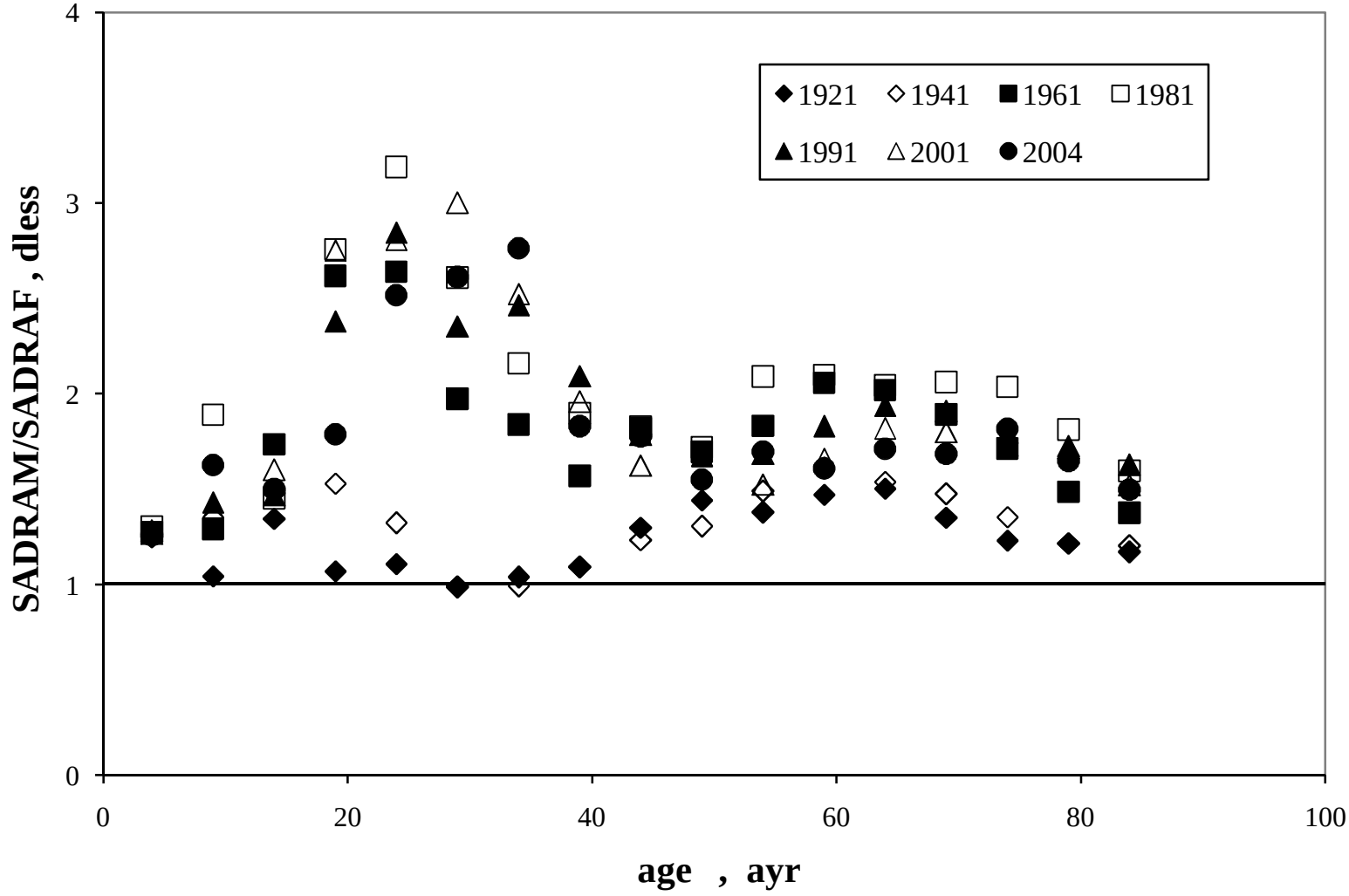

Figure 8. Variation of relative MP to FP death incidence in the period 1921 - 2004 (7 cyr).

Table 3. Maximum values of relative death rate = (ASDRAM/ASDRAF) in each state and in entire Australia in 2004. (see the cited sources for assignments and abbreviations of states and territories).

state	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
max*	2.86	2.89	3.31	3.13	3.64	2.74	4.09	3.79	2.76
age**	29	24	34	9	34	34	34	34	34

Table 4. Maximum values of relative death rate = (ASDRAM/ASDRAF) in entire Australia in the period of 1901 - 2004.

	1901	1941	1961	1981	1991	2001	2004
max*	1.50	1.61	2.64	3.19	2.84	3.00	2.76
age**	64	59	24	24	24	29	34

**max = max (ASDRAM/ASDRAF) ; **age at which max occurs (ayr)

Table 5. Ontogenic parameters of U(ASDRAM(F), age) as separated by sex and state in 2004 cyr .(Ao in ayr).

sex		NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust
MP	N	-12.01	-10.67	-10.44	-4.52	-21.04	-5.49	-9.93	-188	-9.3
	M	65.4	58	57	24.5	123	29.5	53	1493	50.1
	Ao	195	180	184	115	313	125	165	2793	168
FP	N	-8.73	-8.06	-8.8	-6.48	-7.56	-3.81	-5.17	-4.32	-7.72
	M	45.6	41.6	46.1	33.8	39.5	20.6	26.7	24.2	40.2
	Ao	154	147	156	134	145	107	117	119	145
Ao(MP)/ Ao(FP)		1.26	1.22	1.18	0.86	2.16	1.17	2.82	23.5	1.16

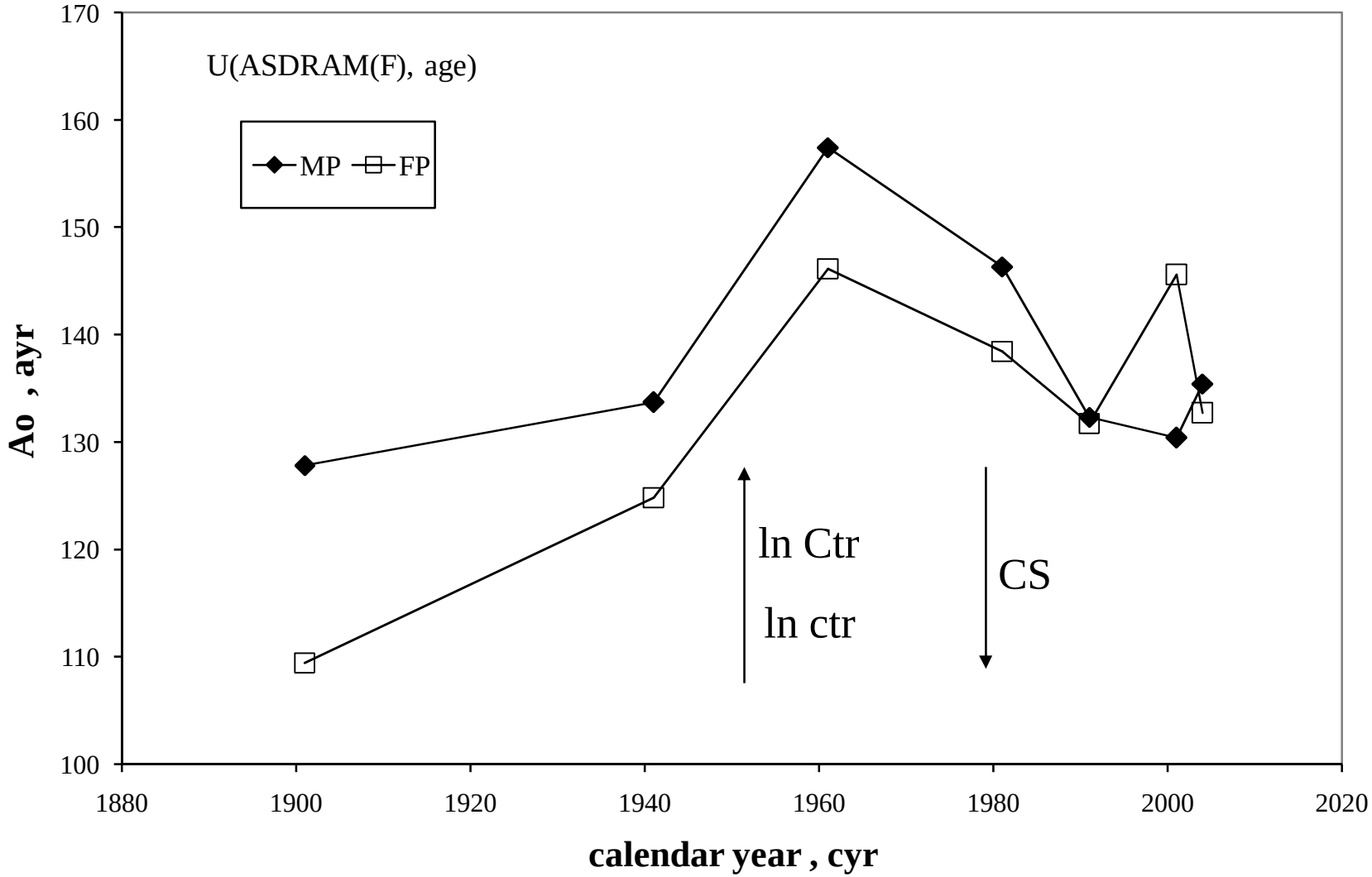

Figure 9. Variation of limit age (Ao) of MP and FP death process on the period 1901 - 2004 cyr.

Table 6. First phylogenic parameters derived from U(ASDRAM(F),age) grouping the population on sex and states in 2004. The associated uncertainties are SD.

source	sex	n1	m1	correl
L(N,M)	MP	- (8.07 ± 0.06)	- (26 ± 3.6)	0.9998
	FP	- (5.02 ± 0.17)	1.8 ± 1.2	0.996
L(M, Ao)	MP	1.821 ± 0.0045	76 ± 2.2	0.99998
	FP	1.847 ± 0.075	71 ± 2.8	0.994
L(M, -M/N)	MP	-(0.00172 ± 0.0001)	5.39 ± 0.046	0.988
	FP	poor		
L(M, -N^2/M)	MP	-(0.0152 ± 0.00026)	-(0.99 ± 0.13)	0.9999
	FP	-(0.0389 ± 0.0025)	0.11 ± 0.09	0.984
L(-M/N, Ao)	MP	1034 ± 56	-5484 ± 325	0.988
	FP	poor		

Table 7. First phylogenic parameters derived from U(ASDRAM(F),age) grouping the population on sex in the period of 1921-2004 The associated uncertainties are SD.

source	sex	n1	m1	correl
L(N,M)	MP	- (5.03 ± 0.30)	2.8 ± 2	0.991
	FP	- (4.60 ± 0.17)	4.7 ± 1	0.997
L(M, Ao)	MP	1.73 ± 0.17	77 ± 6	0.98
	FP	1.712 ± 0.058	75 ± 2	0.997
L(M, -M/N)	MP,FP	poor		
L(M, -N^2/M)	MP	- (0.0378 ± 0.004)	0.15 ± 0.15	0.97
	FP	- (0.0454 ± 0.0029)	0.35 ± 0.1	0.99
L(-M/N, Ao)	MP	poor		
	FP	- (32.89 ± 8.9)	311 ± 48	0.86

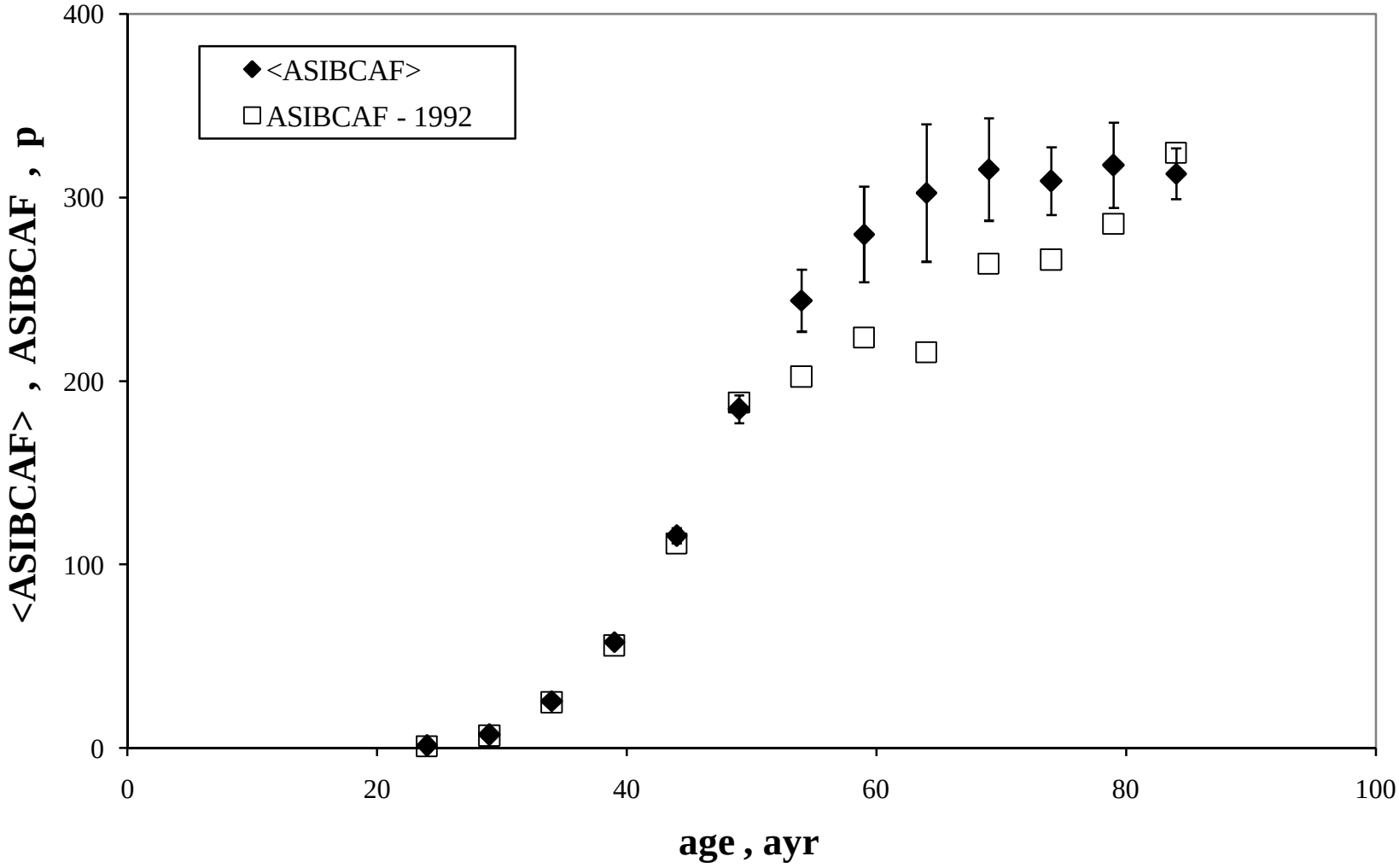

Figure 10. Variation of individual and average values of FP breast cancer incidence on age in the period 1992 - 2002 cyr.

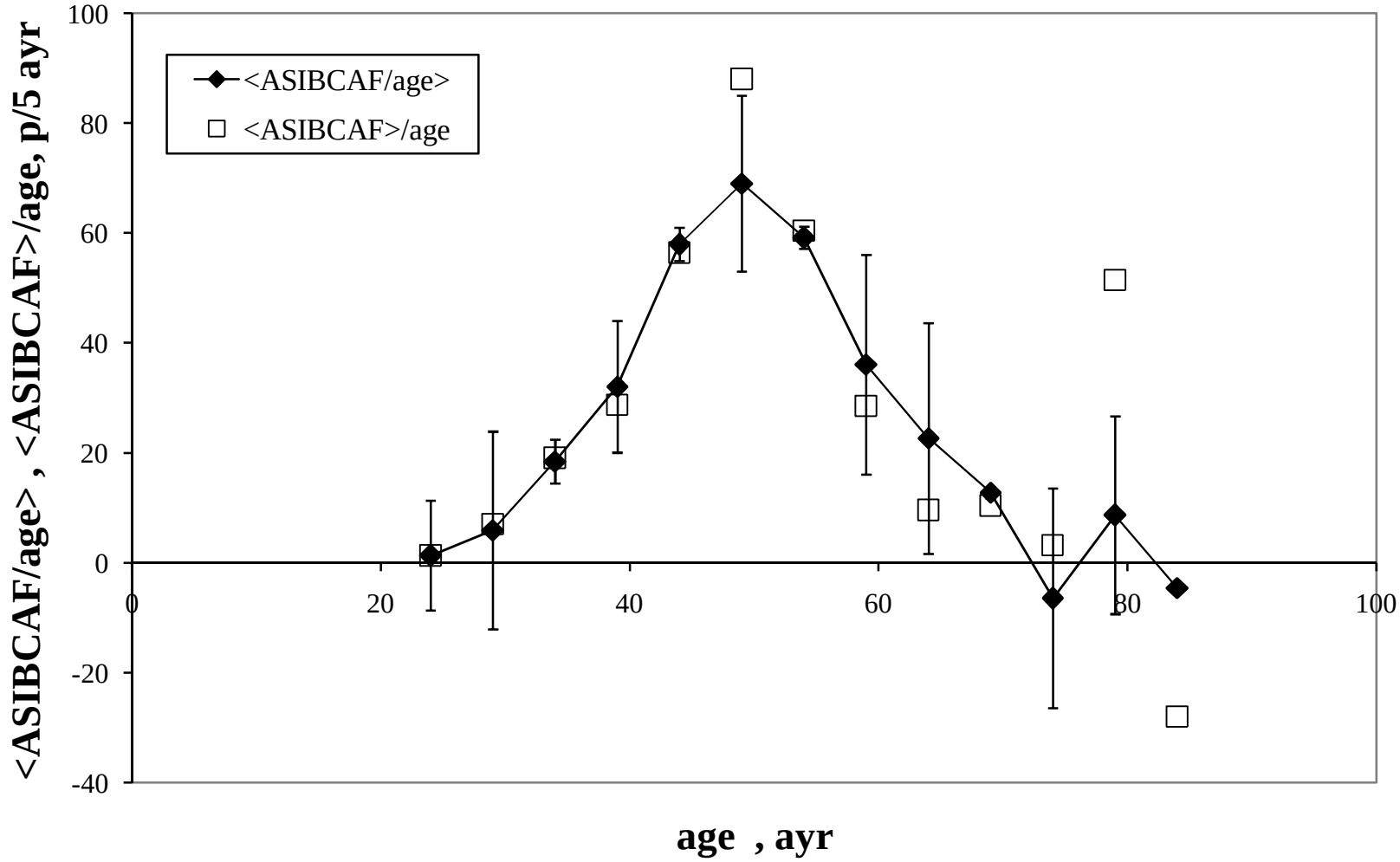

Figure 11. Variation of average values of age-rate incidence of FP breast cancer with age in the period 1992 - 2002 cyr.

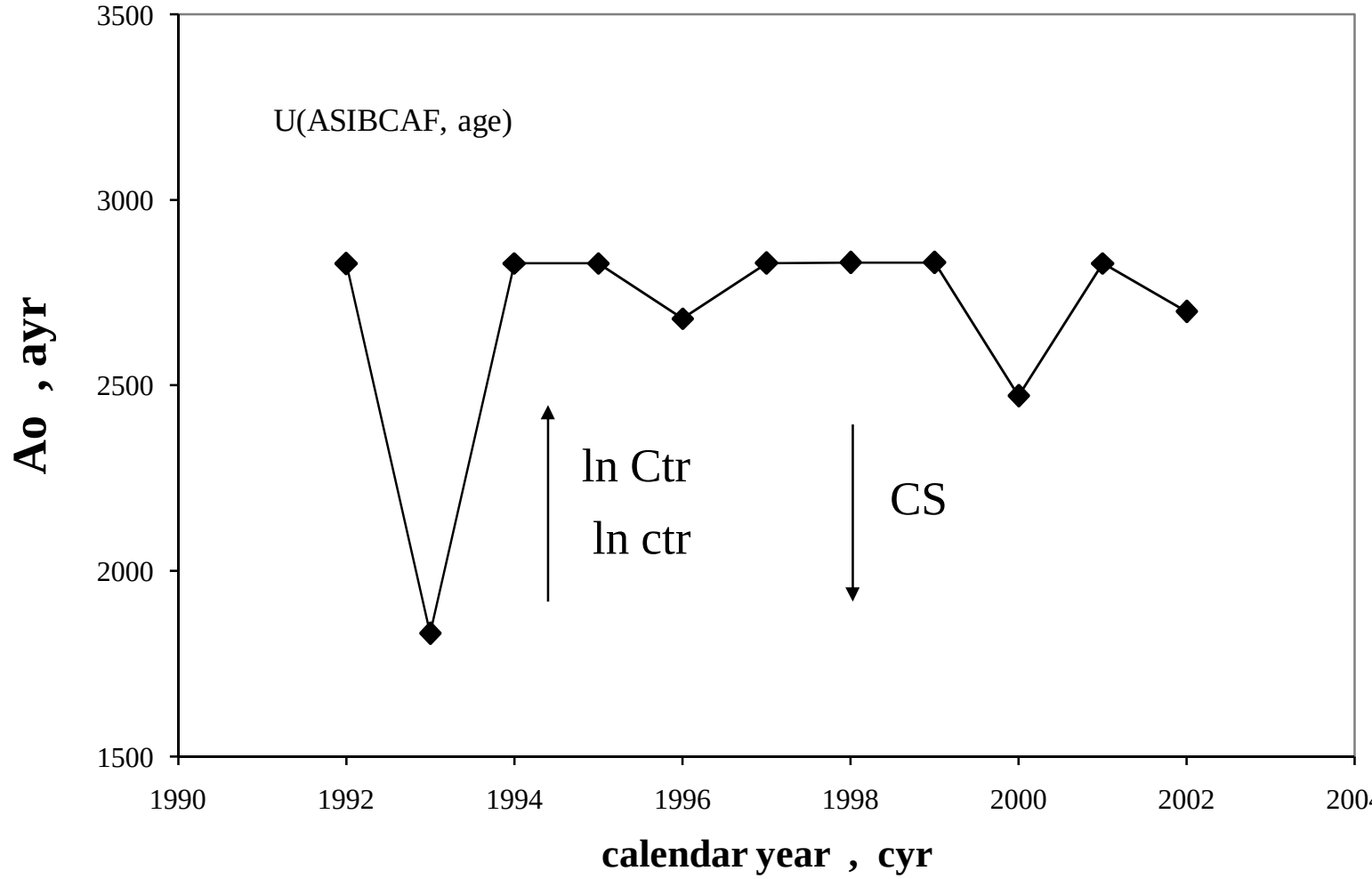

Figure 12. Variation of limit age (Ao) for FP breast cancer incidence in the period 1992 - 2002 (11 cyr).

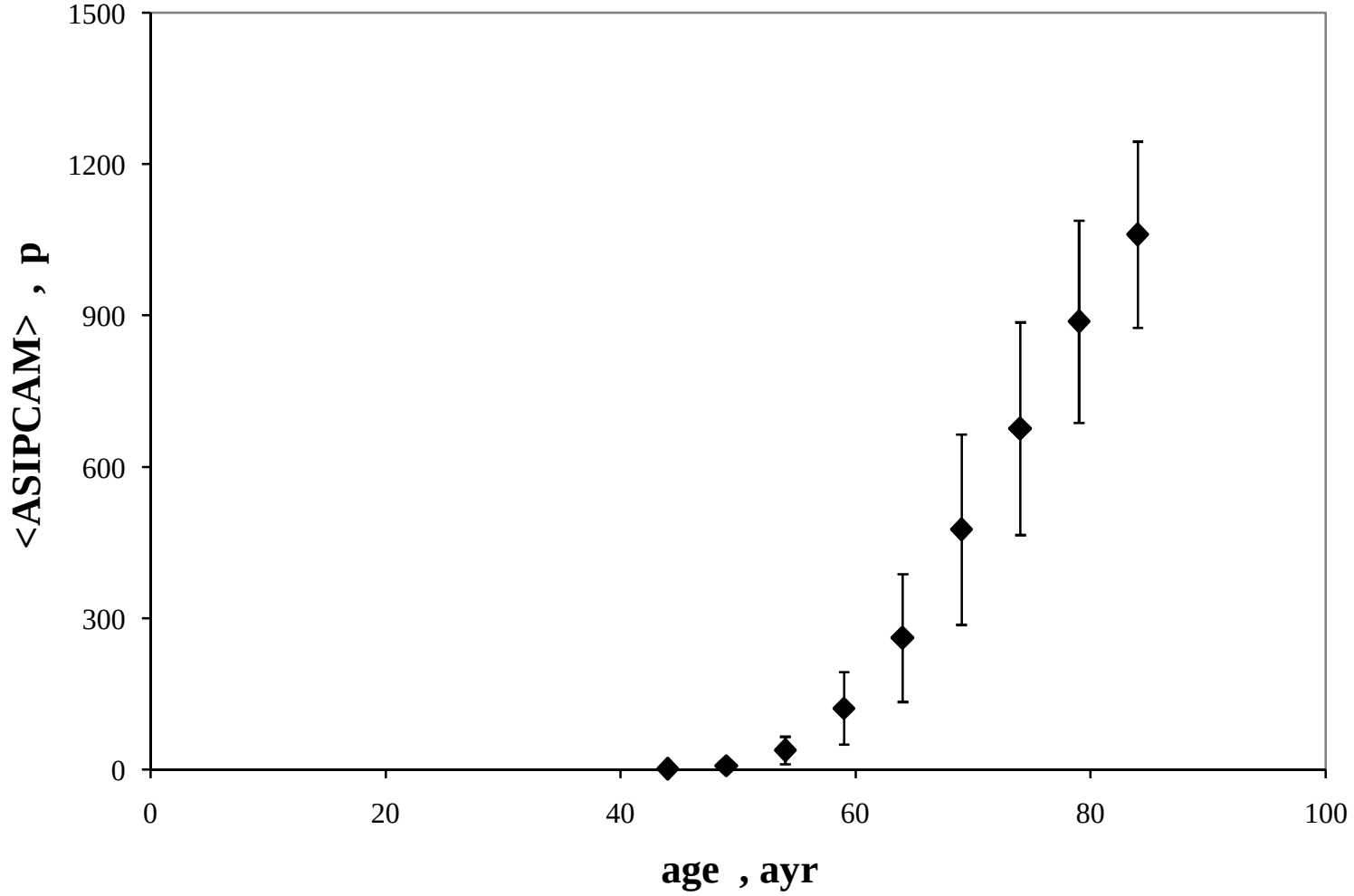

Figure 13. Variation of average MP prostate cancer incidence values with age in the period 1982 - 2003 (22 cyr).

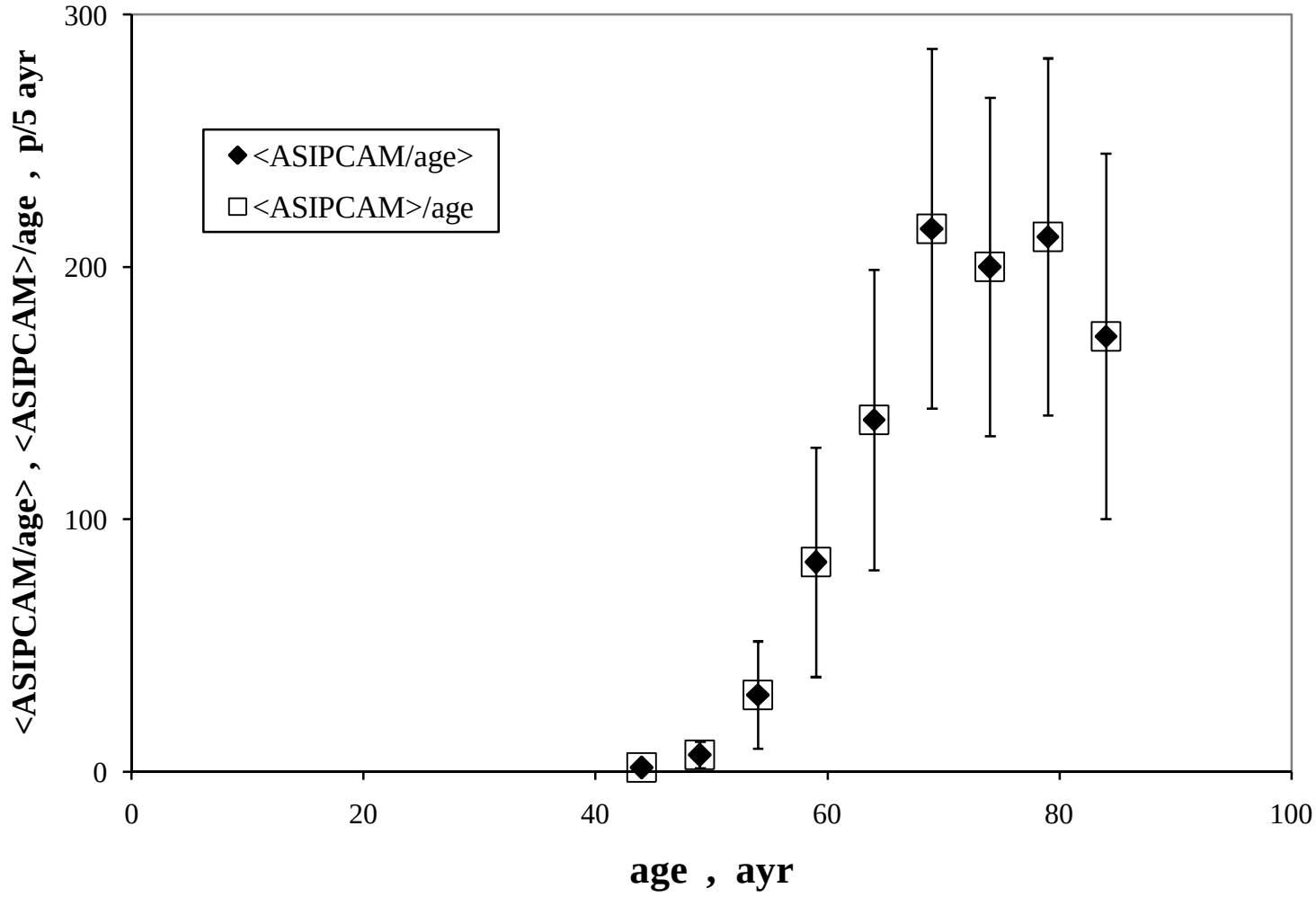

Figure 14. Variation of average age-rate incidence of MP prostate cancer with age on the period 1982 - 2003 cyr.

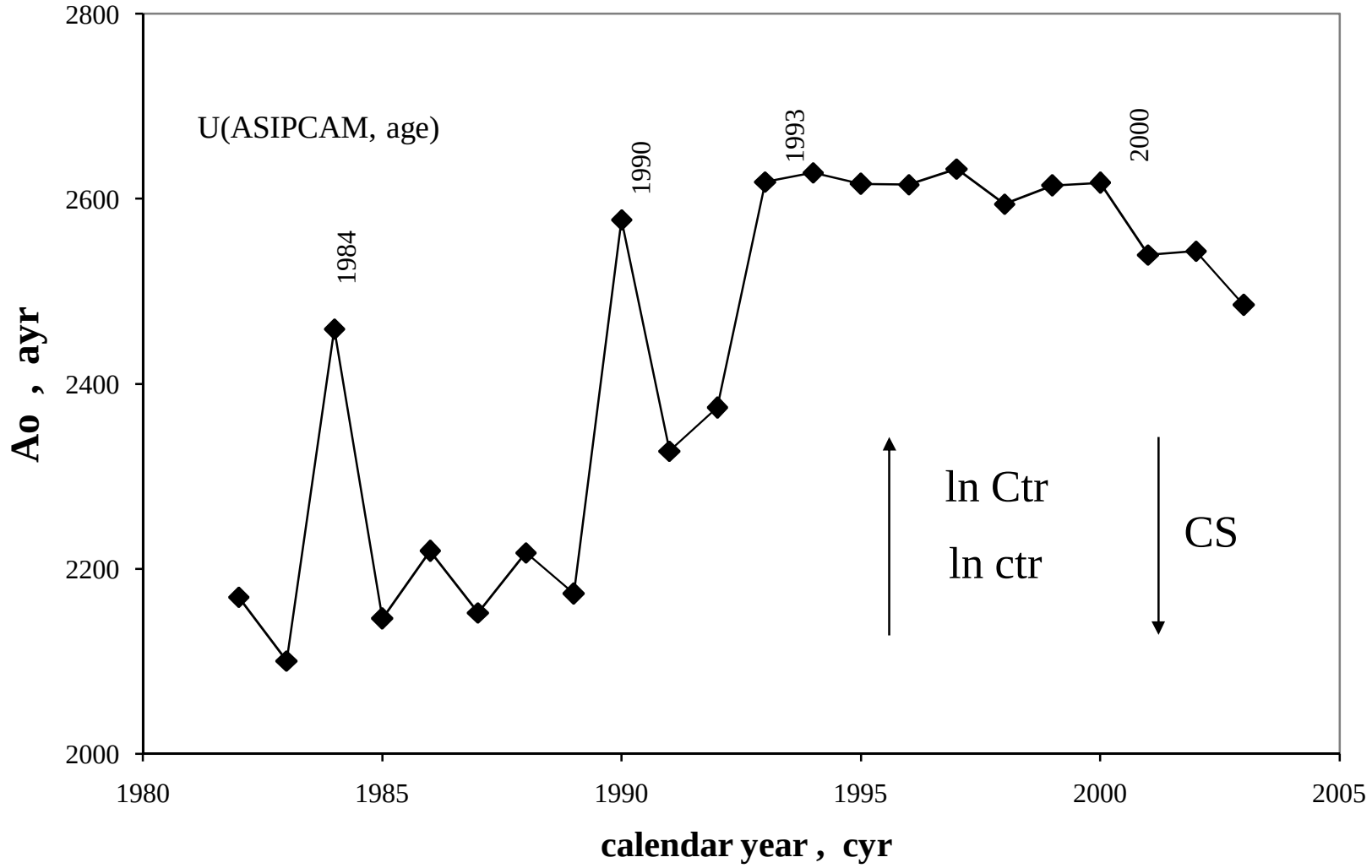

Figure 15. Variation of limit age (Ao) of MP prostate cancer as a function of calendar period (1982 - 2003)(22 cyr).

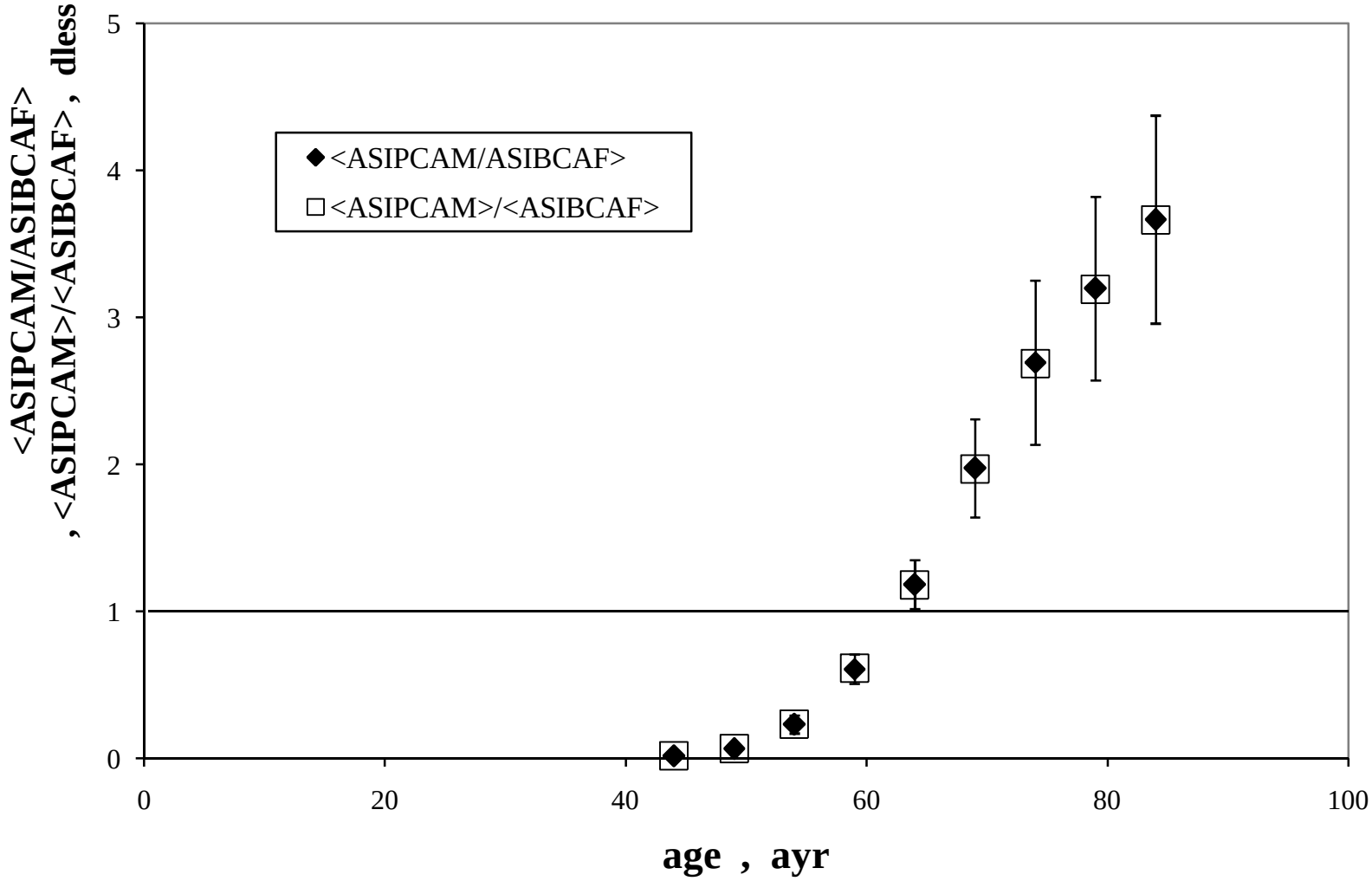

Figure 16. Increase of MP prostate incidence as a fnction of age reported to FP breast cancer incidence in the period 1992 - 2002 (11 cyr).

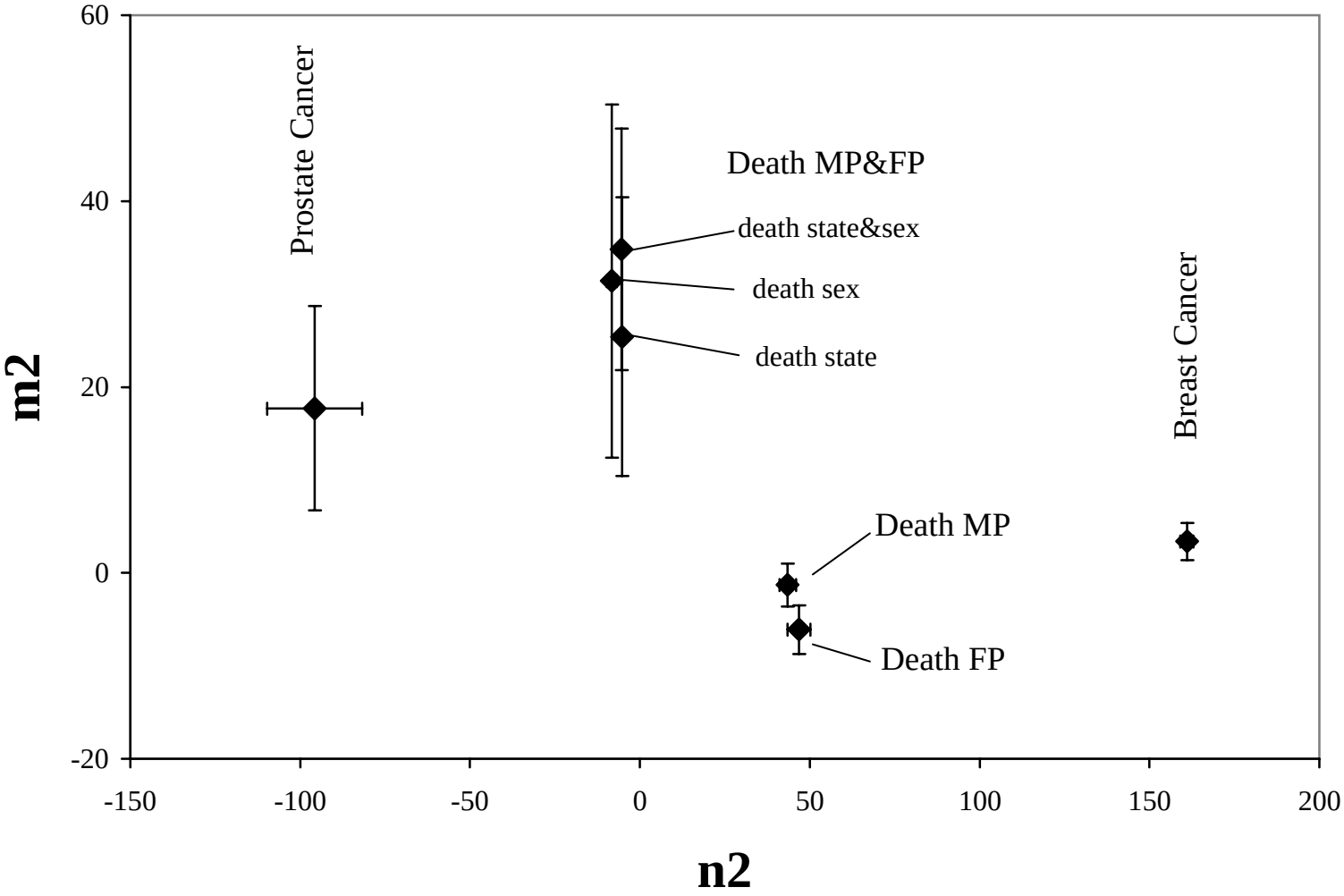

Figure 17. 2nd phylogenic parameters for death, breast and prostate cancer derived from U((MP, FP), age).

Conclusions

1. Australian population shows a linear increase on the calendar period of 1901 – 2005 (22 cyr) both for each age and sex groups and overall group. These linear relationships allow estimating independently and accurately the date of origin of Australian state as 1859 ± 3.2 (95%).
2. Statistic data on death, breast and prostate cancer have been grouped on sex and five year of age and normalized to a local population of 100,000 persons what allows their retrieval according to Universal representation. However, systematic great uncertainties (especially for cancer data) will make the object of the next more careful studies by taking into account topoenergetic principles.
3. The nature for death process at 0-4 ayr is different than for greater ages at both sexes.
4. The nature of death process differs by state (geographic region), calendar time and sex, but is the same for both MP and FP on a period of calendar time and the same geographic region.
5. Breast and prostate cancer have been chosen according to the previous studies as most representative forms of cancer affecting FP and MP, respectively. The results show the same nature as the other forms of cancer that does not depend on the geographic region and calendar time, but differ of death processes (Figure 17). The common nature of cancer diseases is the lifestyle at which the human being is exposed as the potential governing his life evolution.
6. Death, breast and prostate cancers are processes strongly coupled for both sex groups of populations and keep the same rules of variation with age, no matter the calendar time and/or geographic region, namely: (i) MP death is greater than in FP for all age groups and geographic region, but their ratio keeps a specific age spectrum; (ii) breast cancer in FP has the maximum age rate at 44 ayr at which prostate begins; (iii) the ratio of prostate to breast cancer expressed in standard and normalized figures of incidence for the same group of age, calendar time and geographic region, shows an exponential increase with the age which becomes greater than 1 at 64 ayr when breast cancer remains as constant.
7. Kinetics of living population, death and cancer diseases for age and sex groups, have revealed the difference between the time proper to age and proper to calendar. This difference is made by our mentality defining also the lifestyle.

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