A

TREATISE

ON THE VALUATION

OF

ANNUITIES AND ASSURANCES

ON

LIVES AND SURVIVORSHIPS.

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ON THE VALUATION

OF

ANNUITIES AND ASSURANCES

ON

LIVES AND SURVIVORSHIPS;

ON THE

CONSTRUCTION OF TABLES OF MORTALITY;

AND ON

THE PROBABILITIES AND EXPECTATIONS OF LIFE.

WHEREIN THE LAWS OF MORTALITY THAT PREVAIL IN
DIFFERENT PARTS OF EUROPE ARE DETERMINED,
AND THE COMPARATIVE MORTALITIES OF
DIFFERENT DISEASES AND OF THE
TWO SEXES ARE SHOWN:

WITH A VARIETY OF NEW TABLES.

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CHAPTER X.

On the Progress of Population.

ARTICLE 690.

I T has already been observed, (art. 192—197), that the hypothesis of the number of the people increasing in geometrical progression, is not consistent with the most accurate observations that have been made upon the progress of population, and the causes which accelerate or retard it. As the subject is both curious and important, it may be useful to lay the following facts and inferences, drawn from authentic documents, before the reader.

691. In constructing table I., the numbers of the marriages, baptisms, and burials, have been taken from the *Abstract of Answers and Returns to the Population Act,* 51 G. III. 1811; and the number of conceptions in each year, has been assumed to be the same with the number of baptisms in the year following.

. The prices of wheat are those given in the appendix to the report of the committee appointed to inquire into the high price of gold bullion, (Accounts, p. 109,) printed by order of the House of Commons, in 1810; except that for the last year, which has been deduced from the weekly state-

ments in the London Gazette. These prices have all been certified by Mr. Catherwood, receiver of corn returns.

692. It will be observed, that any material reduction in the price of wheat, is almost always accompanied by an increase both of the marriages and conceptions, and by a decrease in the number of burials; consequently, by an increase in the excess of the births above the deaths.

Also, that any material rise in the price, is generally attended by a corresponding decrease in the marriages and conceptions, and by an increase in the burials; therefore, by a decrease in the excess of the births above the deaths.

Thus it appears, that an increase in the quantity of food, or in the facility wherewith the labouring classes can obtain it, accelerates the progress of the population, both by augmenting the actual fecundity *, and diminishing the rate of mortality ; and that a scarcity of food retards the increase of the people, by producing in both ways opposite effects.

693. This table also shows, that an increase of food increases the actual fecundity, not only by promoting new marriages, but by rendering those already contracted more prolific. Thus,

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* By the *actual fecundity*, that part only, of the absolute physical power of propagation, is here to be understood, which the actual circumstances allow of being developed.

There were in the year	Marriages.	Conceptions.	When the price of the quarter of wheat was
1790	70,648	255,508	£2 13 2
1792	74,919	264,028	£2 2 11
Differences	4,271	8,520	£0 10 3

Whereby it appears, that a fall of 10s. 3d. in the price of the quarter of wheat, was attended by an increase of 4,271 in the number of the annual marriages, while the annual conceptions were augmented by nearly twice that number. Again,

There were in the year	Marriages.	Conceptions.	When the price of the quarter of wheat was
1795	68,839	256,781	£3 14 2
1797	74,997	270,535	£2 13 1
Differences	6,158	13,754	£1 1 1

Where the increase of the conceptions, accompanying the fall of wheat, was more than double that of the marriages.

But the mass of the population seems not to have recovered so quickly from the effects of the great dearth of 1800 and 1801; for although wheat was 50s. a quarter lower in 1802 than in 1801, and this fall was accompanied by an increase of 23,000 in the annual marriages, the conceptions only rose 21,000; and a further fall of 11s. in the price the year following, was attended by an augmentation of 4000 in the marriages, and only 400 in the conceptions; after this, however, these last resumed their usual course.

The relations between the *decrements* in the annual marriages and conceptions that accompany the *rise* of wheat, are generally similar to these; but, in the conceptions, not quite so regular: perhaps for this reason, that rising prices may deter from marriage, without the scarcity being so great, as to render those already married less prolific.

694. The hypothesis which has generally been adopted, that, *the number of the people increases in geometrical progression*, necessarily involves this other; that, *the excess of the births above the deaths, is always proportional to the contemporaneous population* *. But this is not reconcileable with the late returns to the population acts, for,

in the 5 years ending with	the annual average excess of the births above the deaths, was
1784	34,242
1799	69,492
1809	105,542

And the second of these numbers is more than double the first, while the third is more than triple the first, and half as great again as the second. So that according to the hypothesis, the population of England and Wales must have been doubled in the fifteen years between 1782 and 1797; trebled in the twenty-five years between 1782 and 1807; and must have been augmented in the ratio of

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* The increase from migration being neglected.

three to two, in the ten years between 1797 and
1807. But so rapid an increase cannot be credited
by any one who has attended to the subject; the
truth is, that the ratio of the annual excess of the
births above the deaths to the contemporaneous
population, has been increasing throughout these
thirty years, and that increase has been accelerated
within the last ten, principally by the practice of
vaccination.

695. Although there must be supposed to be
some deficiencies in the returned numbers of the
annual marriages, considerable ones in the burials,
and still greater in the baptisms; yet, as there is no
ground to suppose that the proportions which such
omissions bear to the true numbers, are materially
different in different years; it may reasonably be
presumed that the returned numbers are always in
the same ratio to the true; and this is all that is
necessary to the truth of the inferences drawn above
from the first table, with regard to the increase or
decrease of the marriages, baptisms, or burials,
each considered separately; when they are to be
compared together, the corrections required for
those omissions will strengthen the evidence that
has been adduced.

Thus, for example, if it be supposed that the re-
turned marriages are deficient of the truth by $\frac{1}{101}$th
part, and that the returned baptisms fall short an-
nually of the true number of births by $\frac{1}{5}$th part;
then, increasing the returned number of marriages

by $\frac{1}{100}$th, and the returned baptisms by $\frac{1}{5}$th, we shall obtain the true numbers, and the first statement of art. 693 will stand thus,

There were in the year	Marriages.	Conceptions.	When the price of the quarter of wheat was
1790	71,354	306,610	£2 13 2
1792	75,668	316,834	£2 2 11
Differences	4,314	10,224	£0 10 3

Where 10,224 is to 4,314 in a greater ratio than 8,520 to 4,271: the increment of the conceptions having been augmented $\frac{1}{5}$th part by the correction, and that of the marriages the $\frac{1}{100}$th part only.

696. It is also to be observed, that, although the progress of the population is evidently influenced by every considerable variation in the price of wheat, it does not correspond exactly with it; and small variations in the price are sometimes accompanied by alterations in the progress of the population, in the inverse order of that which generally obtains. An instance of this occurs in making the comparison between the years 1795 and 1796; when, although the price rose 3s., the annual marriages increased 4000, the conceptions 12,000, and the deaths decreased 20,000.

The reason of this seems to be, that the facility wherewith the labouring classes can obtain a subsistence, does not depend entirely upon the price of wheat; and a small deficiency in that crop may be more than counterbalanced by an abundant supply

of other food, or an increased demand for labour, and a corresponding rise of wages, which will give the bulk of the people a greater command over the other necessaries of life *.

The returns of epidemical diseases, especially the small-pox, may also have had a sensible influence in deranging the correspondence between the progress of the population and the supply of food, as we shall show presently (699).

697. As the encouragement to population increases or decreases with the proportion which the wages of labour bear to the prices of the necessaries and conveniencies of life; the influence of the real recompense of labour upon the progress of population, would be shown more clearly, by dividing the average wages of labour throughout the country, by the average price of the necessaries of life in each year; and comparing the quotient thus obtained, with the excess of the conceptions above the burials in the same year. But no general registers of wages or prices are kept; and they differ very much, both in different places at the same time, and in the same place at different periods of the year: it would therefore be very difficult, under the present circumstances, to make such comparisons to any good purpose.

Almost every permanent rise or fall in the price of food, is either preceded or followed by a corre-

* See the foot note at article 736.

sponding change in the wages of labour, the one change being generally the cause of the other: these corresponding fluctuations, however, do not succeed each other immediately; but the one is produced by the gradual operation of the other: in the interval of adjustment, the movement of the population is accelerated or retarded, and, besides favourable or unfavourable seasons, these are the principal causes of the effects that are most worthy of remark in the first table.

698. This subject may be further illustrated by the following

TABLE,

Exhibiting the Progress of the Population of Sweden and Finland, and the Characters of the Crops, from 1749 to 1803.

Year.	Conceptions.	Deaths.	Excess of Births above Deaths.	Character of the Crops.	Marriages.
1747	. . . . .	. . . . .	. . . . .	Failure	. . . . .
48	76,286	. . . . .	. . . . .	Poor	. . . . .
49	81,940	61,171	15,115	Ditto	19,045
1750	88,141	58,845	23,095	Abundant	20,927
51	84,368	57,377	30,764	Middling	21,335
52	85,479	60,667	23,501	Ditto	20,922
53	89,545	55,407	30,072	Abundant	20,089
54	91,281	64,311	25,204	Middling	21,994
55	89.084	65,618	26,263	Ditto	21,472
56	81.878	68,786	20,298	Scanty	20,007
57	83,299	68,054	13,824	Poor	18,799
58	85,221	74,487	8,812	Middling	19,484
59	91,102	62,662	22,559	Abundant	23,210
1760	90,075	60,323	30,779	Middling	23,383
61	89,162	63,185	26,887	Scanty	22,421
62	90,152	74,931	14,231	Failure	21,467
63	91,528	85,093	5,059	Poor	20,927
64	88,237	70,399	21,129	Scanty	
65	89,013	70,038	18,199	Middling	

Year.	Conceptions.	Deaths.	Excess of Births above Deaths.	Character of the Crops.	Deaths by Small-pox.
1766	92,531	64,870	24,143	Middling	
67	90,985	66,849	25,682	Ditto	
68	90,258	68,722	22,263	Abundant	
69	89,973	70,547	19,711	Ditto	
1770	87,460	69,895	20,078	Middling	
71	80,522	71,577	15,883	Failure	
72	72,594	90,081	− 9,559	Scanty	
73	91,590	117,509	−44,915	Middling	
74	95,712	56,361	35,229	Ditto	
75	90,793	65,023	30,689	Scanty	2,087
76	92,521	64,415	26,378	Middling	3,694
77	98,717	70,891	21,630	Abundant	4,354
78	104,146	70,716	28,001	Middling	8,473
79	102,217	73,420	30,726	Abundant	16,152
1780	96,221	59,610	42,607	Scanty	4,754
81	96,414	71,960	24,261	Ditto	4,455
82	91,859	75,056	21,358	Slender	3,673
83	96,447	81,166	10,693	Ditto	7,071
84	94,536	80,905	15,542	Middling	15,706
85	98,261	81,332	13,204	Slender	7,263
86	94,444	73,990	24,271	Middling	2,406
87	99,458	68,466	25,978	Abundant	3,655
88	94,280	80,774	18,684	Good	7,524
89	92,817	96,241	− 1,961	Middling	11,002
1790	97,041	90,493	2,324	Abundant	6,352
91	111,264	84,802	12,239	Good	3,323
92	109,109	70,829	40,435	Middling	2,411
93	107,296	73,094	36,015	Good	4,62°
94	103,100	77,287	30,009	Ditto	8,593
95	110,345	81,570	21,530	Ditto	8,745
96	112,912	74,618	35,727	Middling	5,945
97	109,710	71,035	41,87;	Ditto	2 629
98	106,870	71,581	38,12(	Slender	3,160
99	98,615	81,753	25,117	Ditto	9,353
1800	103,851	94,955	3,660	Ditto	13,447
1	103,474	79,612	24,239	Middling	6,458
2	105,412	75,115	33,359	Ditto	2,679
3	....	85,159	20,253	Good	8,610
				Annual average number	6.504

The numbers of the annual marriages from 1749 to 1763, inserted in the last column, were given by Mr. Wargentin, in *Kongl. Vetenskaps Academiens Handlingar*, 1766, Q. 1. The deaths of small-pox in each year, by Mr. Nicander, from 1775 to 1795 in the same transactions for 1801, Q. 4; and from 1795 to 1803, in the volume for 1805, Q. 4, table H. The rest of the table stands here, just as it was given by Mr. Nicander in the volume last-mentioned (p. 137), except that the number of conceptions in each year is here assumed to have been the same as that of the births in the year following *.

699. In comparing together the numbers in the above table, or in drawing any inferences from them, it should always be remembered, that the supply of food in any year depends principally upon the crop of the year preceding.

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* As Mr. Nicander has contented himself with designating the character of each crop by a single word, (and that not always written at length), as, besides, some of the terms he has employed for the purpose, are very nearly synonymous, it may be proper to give the original Swedish here, with the translations that have been adopted; they are as follow:

Swedish.	Translation adopted.
Ymnig	Abundant
God	Good
Medelm.	Middling
Klen	Slender
Knapp	Scanty
Svag	Poor
Missv.	Failure.

The propriety of adding the column of deaths by small-pox in each year, and the purposes it may be applied to, will be sufficiently evident when it is observed, that while the annual average number of deaths by that destructive epidemic is 6500, the number in some years hardly exceeds 2000, in others it rises to 16,000; and the difference in the number of its victims between two immediately successive years, varies from 200 to 8 or 10 thousand. So that according as the variation in the mortality from that disease operates with or against the variation in the supply of food, the apparent effect of this last upon the number of the annual deaths, may be magnified or diminished, and in some cases reversed, if the other be neglected.

It will be proper also to observe in this place, that the war with Russia, which broke out in 1788, and continued two years, augmented the mortality considerably, by introducing the diseases of camps and of military hospitals.

Omitting the years 1789, 1790, and 1791, the annual average number of deaths from 1775 to 1795 was	But the number of deaths was in		
	1789	1790	1791
By putrid fever	1751	10,874	9,474	6,381
By inflammatory fever . . .	4988	10,335	11,813	9,333
By both these diseases . . .	6739	21,209	21,287	15,714
Total in 3 years by both diseases	20,317	58,210		
Swept off by the introduction of the pestilence	37,893			
	58,210			

700. By the above table (698), it may be seen (as Mr. Nicander has observed), that the years 1749, 57, 58, 63, 72, 73, 83, and 1800, wherein the population was the least increased, or the most diminished, were always preceded by deficient crops. The epidemical diseases which raged in 1788 and 1789, sufficiently account for those years having been anomalous.

701. The observations that were made in art. 692 and 693, on the table for England and Wales, also apply to that for Sweden and Finland.

The greatest increase of annual deaths in England and Wales, from 1780 to 1810,

took place in	when they exceeded those in the preceding year, by about
1795	$\frac{1}{13}$th
1800	$\frac{1}{10}$th
1810	$\frac{1}{12}$th

But the shocks which the population of Sweden receives in years of scarcity, are much more severe; the greatest number of annual deaths there,

took place in	when they exceeded those in the preceding year, by about
1762	$\frac{1}{5}$th
63	$\frac{1}{7}$th
72	$\frac{1}{4}$th
73	$\frac{1}{3}$rd
99	$\frac{1}{7}$th
1800	$\frac{1}{6}$th

702. This last statement applies to all Sweden

and Finland ; but in some provinces, the mortality occasioned by deficient crops is still greater.

In K. V. Acad. Handl. 1776, Q. 1, there is a paper by Peter Jacob Hjelm, " On the progress of " population in the archbishopric of Upsal, from " 1749 till 1773," whereby it appears, that the numbers of births and deaths there, in the five years ending with 1773, were as follow :

In	Births.	Deaths.	No. of the living.	
			Increased.	Decreased.
1769	7450	5149	2301	....
1770	7598	5042	2556	....
1771	7293	5497	1796	....
1772	6360	7508	....	1148
1773	5307	11,616	....	6309

It also appears by a memoir of Mr. Wargentin, amongst those of the same academy for the year 1774, Q. 3, " On the increase of the people in the " diocess of Carlstadt, between 1721 and 1774," that the numbers there, in the same five years, were these :

In	Births.	Deaths.	No. of the living.	
			Increased.	Decreased.
1769	4872	5112	....	240
1770	5356	4033	1323	....
1771	5057	4421	636	....
1772	4296	9190	....	4894
1773	3072	11,408	....	8336