

De la Durée de la vie en France depuis le commencement du XIX^e Siècle*

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Among the different tables of mortality constructed according to the observations made in France, two alone have remained in use.

The one, in origin, obtained approbation from all the scholarly bodies: this is that which Deparcieux formed, toward 1746, out of the death lists of the tontines of 1689 and 1696, yet existing when he wrote.

The other was published by Duvillard, nearly 40 years ago. Despite some objections raised at first, it was soon employed generally: especially when the census effected in year XI, at the demand of Laplace, had given for the ratio of the annual births in the population, a fraction very near to $\frac{1}{28.75}$ a result from the table of Duvillard.

The exactitude of this table appeared thus confirmed by an authentic proof.

The work of Deparcieux was then forgotten in some manner, if it is not by a small number of scholars. His table appeared, and not without plausible reason, to be applicable only to the class according to which it was constructed: the class of tontine participants, a comfortable and tranquil people, of whom at first glance one regards existence as much more durable than life is able to be for the rest of society taken in mass.

A few years since, this same consideration which had extended the results of Deparcieux, had made use of them in the establishments of assurances on life and on life annuities. The French companies have adopted them, as the English companies have taken the table of Milne, for the cases where it was necessary to render the benefit certain by employing some terms of longevity to which man approaches only rarely.

The more time is elapsed, since the census of Laplace, the more the objections against the use of the table of Duvillard are renewed. It has happened often that the positive facts and some calculations based on this order of mortality, have manifested a complete discordance. In 1826, Mr. Mathieu reproducing this table in the *Annuaire de Bureau des Longitudes*, has judiciously shown that Duvillard has not claimed to give

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the laws of life beyond the past century. The notable changes happening unexpectedly in the elements of the population, require, he adds, a table which agrees better to the actual state.

Despite this salutary warning, repeated since eight years, many societies have seen to deny through the event their promises toward their shareholders, promises based imprudently on the table on which quite rapid mortality was announced to them; and each day it hatches some plans of omitted savings or retirement supported equally on a base become so defective.

It is therefore to render a real service that to show by some numerous facts and by an incontestable authenticity, the necessity to abandon finally the table of mortality of Duvillard; whether it had been able to be exact or not, in a period already remote.

Some researches had been commenced on this subject four years ago, in the archives of the realm. They had at the same time for end to determine if the official documents sent by the prefectures to the ministry of the interior, were able to offer some reassignments which permit replacing, by a new table, that of which the use must cease. These researches have remained unachieved, as much to the preparation of a table more conformed to the actual order of nature. But in other regards, they were nearly complete, and it is easy to separate from the totality of the work, the complete part containing the facts which prove with evidence that, if the law of mortality constructed by Duvillard, existed into the the eighteenth century, it is no longer in action since thirty years.

By a singular coincidence, the same facts tend to establish that in modern France, the general mortality approaches to the order received by Deparcieux, in the country of the 9360 tontine participants of whom he has transcribed in his book the death registers for more than 50 years.

Would it be necessary to conclude that, under the influence of modern civilization, death has lost its rigors, since it raises no longer at each age on the mass of the nation but the reduced proportion of which previously some chosen classes profited alone?

Would it be necessary on the contrary to consider the table of Duvillard, as resulting from elements or from erroneous calculations; to regard the number of 9 or 10,000 individuals gathered by Deparcieux, as sufficing in order to make evident the laws of general life, although these individuals were all possessors of an annuity of 30 francs at least in one tontine, and finally to admit that the march of mortality is little modified since 1746 to the present?

This is not at all the place to discuss the small number of facts which claimed a support to the one or to the other of these two opposed conclusions. The concern is only to demonstrate how much the actual order is extended from the results presented as exact, 40 years ago, and received as such yet today most generally.¹

¹Duvillard had made known neither the elements, nor the methods that he has employed in order to form his table.

A note in his work on smallpox (p. 122) teaches only that he is served of 101,542 deceased proceeding from a population of 2,920,672 individuals, of whom the movement was, says he, all the uniformity that one is able to expect in the course of so many physical and moral causes.

One is able to presume that the 101,542 deceased are the 101,534 deceased reported by Messance in his *Nouvelles recherches*. (p. 80).

There are indeed great analogies between the distribution of the deceased of Duvillard and of Messance in the different ages. The infant alone is more struck from 0 to 5 years by Duvillard, who however bears from 5 to 10 years a number of deceased inferior to the one which corresponds at each age in nearly all the known

By specifying thus the question, it will not be possible to resist to admit the solution given by the considerations which are going to be exposed.

If one knew all at once the number of infants born during a long period and the number of the surviving to a certain age; if the ratio of these two numbers differed from the ratio assigned by a table for the same age; if the difference was not only from a fraction corresponding to the deceased of one year or two, but that it is understood to the point of representing the mortality of *ten* years and even more, it would be palpable that the ratio assigned by the table in question would be able to furnish only an idea totally inexact of the true ratio.

Moreover, there would be visibly place to modify strongly a part of the ratios of the deceased to the living in the anterior ages; and, for the deceased of the following ages, it would become little probable that the change is limited to increase them proportionally.

If, for example, out of 100 births, the number of the surviving to the age of 20 years, is 60, and not 50 as one has believed; it is clear that the annual deceased who, from birth to 20 years, lead to this term of 50, must be attenuated, for certain ages, more or less greatly, according as the question will act to modify them in part or in totality.

The deceased which follows the age of 20 years must on the contrary be increased by ten: the greater vitality which announces one such delay in the deceased, no longer permits thinking that it suffices to distribute these 20 individuals in proportion of the deceased already assigned for each age.

A single ratio, when it embraces twenty years of life and when it is greatly changed, tends therefore to make reject each application of the table where it is found.

All that which comes to be said would be with much greater reason yet, if, in the calculations which give 60 survivors at 20 years for 100 births, one would have

tables.

One perceives in this last fact the hiding of a preconceived idea: and each carries to conclude that Duvillard has rendered the existence so short only because he has considered the population and the mortality as nearly stationary.

This is that of which one acquires the proof by dividing the population reported just now by the deceased, it is 2,920,672 by 101,542. One finds for quotient 28 years: 763,192: that is precisely the mean life of the table.

Thus Duvillard supposed essentially a stationary state in the different parts of the population: a hypothesis inadmissible in the statistical calculations on human kind: and which suffices perfectly to explicate the great mortality which he attributes to France of the past century.

One finds a new confirmation of this error of Duvillard, when one compares his table to that of Dupré of St-Maur (*Buffon*, t. I, or *St-Cyran* on *les rentes viagères*).

Nevertheless by making these comparisons useful in order to establish the statistical value of the table of which there is concern, I should remark well that the facts of mortality existing for the XVIIIth century in France, are so little complete that one is scarcely able to base some conjectures on the little information that they furnish.

It would not be necessary therefore to conclude in an absolute manner that the table of Duvillard has always been inexact; especially it would not be necessary to claim to infer from this very presumable inexactitude, that the vitality of the XVIIIth century was precisely the same as of our days. One is certain for the infants at least that the existence is much better conserved today.

But one is able to conclude, and from that to be supported of the opinion of the scholar Mr. Mathieu, that if the calculations of Duvillard have represented faithfully mortality, 50 years ago, they represent it no longer today.

It would seem, hence, useful to place the table of this author in the *Annuaire du Bureau des longitudes* only as example: a title alone to which the tables of Deparcieux, of Price and of Milne have been admitted recently.

exaggerated the number of births of the period considered; if the known number of survivors was on the contrary less than their true number; and if however the ratio of the known survivors to the exaggerated births remained quite superior to the ratio assigned by the table.

In this case, indeed, the number of the survivors being too small, and the number of births too great, the observed ratio of the one to the other would be evidently less than the real ratio; and the observed ratio surpassing by a very great fraction the ratio fixed by the table, the real ratio of them would be extended yet further.

These hypotheses are realized for France.

One is able effectively to procure the annual number of survivors to the age of 20 years, or at least a number little inferior.

Since 1816, the minister of war publishes annually the counts of the recruitment of the army, and the first element of these counts is nothing other than a census as exact as possible of all the young men of the class called to the drawing. The laws of recruitment, one knows, fix at 20 years the age at which all Frenchmen must satisfy this obligation. Generally since 1816, the drawings have taken place in the year which would follow that where the last born of the class had accomplished his twentieth year. The common age of the individuals counted has therefore always surpassed 20 years and one-half: in many cases even it is elevated to 21 and 22 years.

One comprehends immediately that the annual counts of the minister of war furnishes a number without doubt a little inferior to the total of the young men who attain each year the age of 20 years.

On the one side the whole class entire has passed this age, and death ought to make it subject to a reduction. On the other side, there have always been some omissions on the lists, either because, in certain localities, some individuals succeed in being subtracted at the drawing; or because the mayors of many communities do not bring enough care in constructing the table of the census; this is that which results from the counts of the recruitment in which some fears are expressed on this subject, and where one appeared to attribute to the inexactitude of the municipal magistrates, the diminutions which, from 1820 to 1825, are noted in the number of the young men counted.²

One could suppose, it is true, that the same lack of rigor in their operations, ought to lead some mayors to increase uselessly the lists of counts of the names of deceased individuals, finally to be more certain of omitting none of the survivors.

This assumption falls, when one reflected on the great number of deceased, of whom he would have had to justify after the drawing, if it had been based; to the small number of deceased really carried in the counts; and to the reproaches that a similar work had made to address to the mayors. Moreover, since 1827, one has verified annually the degree of instruction of the young men who have taken part in the drawing; and never the number of those of whom the instruction has been able to be known is elevated to 12,000; it is commonly remained under 8000. Now, an error of 12,000 young men too much, although it is considerable, would weaken without doubt the ratio of the survivors to the births; but it would leave it yet much greater than it is

²In examining the lists of conscription, I have acquired the proof that the omissions have been very numerous in origin. So that the lists would accuse a census much too deficient.

necessary in order to establish in a solid manner all that which has been advanced.

This error could not exist; a new law dissipates entirely the fear to find some exaggerated counts. Promulgated 11 December 1830, it prescribes to repartition the contingent among the cantons, according to the mean number of young men comprehended under the lists of counts of the classes of the preceding years. It is clear that, besides, each mayor, in the interest of his administrators, should reduce to the strict number of the real survivors the list of his census.

Now the execution of the law of 1830, when some rectifications have been made to the tables already published of the classes from 1824 to 1828, there is resulted of them only a diminution of 436 called out of 282,985, rising from the census of the class of 1828, that these rectifications have most affected. 436 individuals would form hardly the third of the number of the deceased which must have taken place from 20 to 21 years out of 282, 549, according to the most backward tables.

There remains therefore beyond doubt that the tables of census contain numbers of individuals inferior to the real numbers of the young men arrived each year to the age of 20 years.

Here are the totals of the rectified classes, such as they are evident from all the documents submitted to the king and to the legislative chambers, from 1816 to 1832:

1816	280,296	1824	275,964
1817	298,202	1825	296,935
1818	309,194	1826	283,501
1819	307,708	1827	283,531
1820	288,828	1828	282,549
1821	279,227	1829	294,594
1822	274,740	1830	294,593
1823	266,534	1831	295,978
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	2,304,729		2,307,645

It is not at all superfluous to report all the numbers of men of 20 years and more, furnished by the recruitment, although the corresponding numbers of the births are not known, or quite uncertain for the years which have preceded 1825.

The information on births was effectively more difficult to obtain. The first raised demanded from the prefectures, toward year VII, have not been published officially. It is only since 1817, that Mr. Mathieu has taken the pain to add each year the 86 tables of the departments; to demand even the tables not sent by some prefects, and to form thus the interesting series of births, marriages and deceased, that the *Annuaire du Bureau des longitudes* present.

For the years anterior to 1817, one is reduced to a table of year X, inserted into the *Moniteur* of year XII: the archives of the realm do not even contain an entirely complete collection of the pieces sent by the prefects on the movement of the population in the other years.

The gaps are nevertheless in very small number, and in order to compare the total of the births to the counts of the war, one is able to subtract from these the departments omitted in the first; or else to fill the gaps by taking for the number of births of the omitted departments, the result of neighboring and well-known years.

It was necessary here to be assured that the births would be able to be deficient by defect, that they would offer even rather some exaggeration. An attentive study of the original pieces of them has given some convincing proofs. It is useless to report them in detail: it is only proper to remark that in the origin the public treatments have been based on the importance of the population of the departments; that the conscription raised a considerable mass of young men; and that one was quite easy to show by the births, how many countries were able easily to support this tax, most onerous, although most necessary.

Besides, the governments which succeed were jealous to prove that the population increased under their laws also, even for the murderous times of 1803 and 1804, a considerable part of the tables of the prefectures offer an excess of births over the deceased, nearly double in two or three departments.

There could subsist therefore no doubt on the nature of the errors which are able to slide into the documents established by the prefectures, under the consulate and under the empire from 1803 to 1811. They offer after all exaggeration.

This point well-known, it is resulted from it an unexpected difficulty, it is that the error, involuntary or not, was able to have altered the ratio of the numbers of the boys and of the girls. There is place to suspect certain lists: they must contain the errors of this kind. But the brilliant discussion of the probable variations of the ratio of the two sexes, given by Mr. Poisson, in his memoir of tome IX, of the Academy of sciences, has especially raised this obstacle.

Mr. Poisson finds through the births from 1817 to 1826, that the mean ratio of boys to girls has been, in this interval, 106,56 to 100; the extreme limits of this ratio, limits beyond which there are odds more than 45267 against 1, that it will not fall, in the births of one year, are respectively:

105,59 to 100
and 107,53 to 100

One is able to establish that the numerous births, taken at different periods, give some ratios which are contained within these limits. It would be too much to press the conclusions, than to affirm hence that the cause of the phenomenon has not varied at all. But one acquires by these comparisons the certitude that these variations, although very extended, are not excessive. It is therefore permitted to say with quite strong reason that out of the set of births of 9 consecutive years, the superior limit has not been able to be attained. The analysis proves that the gaps of the variable effects, due to some variable causes themselves, diminish rapidly when the number of years that one examines has suddenly increased.

It will be therefore adopting a very large eventuality that to calculate according to the superior limit of 107,53 to 100 the number of boys who have been able to be found among the total births from 1803 to 1811; and one will not have to fear that the result is less than the real number.

In the actual case, this process has the advantage of erasing entirely the slight uncertainty that the gaps signaled previously would leave on this number, and which have been able to be filled only by an approximative calculation based on the births of nearby years.

It is quite worthy of remark that all the known documents on the births come, with a single exception nearly, in 1830, to be arranged within the limits that Mr. Poisson had concluded in some years.

Messance, in his *Recherches sur la population de la France*, Moheau, or rather Mr. de Montyon, in his *Recherches et considérations* on the same subject, have conserved some very great numbers of births, at different periods.

One deduces from these numbers, and from those which have been published more recently, the ratio consigned in the following table:

EPOCHS of the REGISTERED	NAMES OF THE LOCALITIES	BIRTHS		RATIO
		Boys	Girls	
from 1691 to 1701	Part of the generality of Tours (Moheau).	332,597	309,593	107,43
from 1752 to 1763	Part of the generality of Tours, of the Franche-Comté, of the intendances of Provence, of Bourgogne, of Alençon, of the principalities of Dombes, of the dioceses of Dax, Lombes, Rieux, Auch, Pau, and of the city of Paris (Messance and Moheau.)	874,717	822,595	106,29
from 1770 to 1774	Totality of the births, of the intendances of Provence, of Alençon, of Rouen, of La Rochelle, and 7 years of the city of Paris (Moheau.)	267,432	252,979	105,71
from 1771 to 1775	All the realm (Moheau.)	2,398,244	2,246,354	106,76
In year X	The 86 departments (<i>Moniteur</i> , year XII.)	470,846	442,608	106,62
In year XI	(Printed table from the Archives, corrected only as to the defects of impression according to the original.)	470,878	440,065	107,00
In 1801	80 departments (according to the original from the Archives.)	443,878	415,143	106,84
In 1817	(<i>Annuaire du bureau des longitudes.</i>)	488,457	455,668	107,20
In 1818		471,188	442,667	106,44
In 1819		509,311	478,607	106,42
In 1820		494,378	464,555	106,42
In 1821		497,621	465,737	106,85
In 1822		501,094	471,702	106,23
In 1823		496,517	467,504	106,21
In 1824		507,770	476,382	106,59
In 1825		503,532	470,454	107,03
In 1826		511,898	481,293	106,14
In 1827		505,307	474,889	106,40
In 1828		501,669	474,878	105,64
In 1829		496,163	468,364	105,93
In 1830		496,986	470,838	105,55
In 1831		509,029	477,680	106,56
In 1832		483,518	454,668	106,34
Mean from 1817 to 1822		7,974,449	7,495,915	106,38

It is evident from these facts that the ratio of the births of boys to the births of girls, does not attain 107,53 for 100, in France taken in masse, although it had approached it in Touraine, and that it had besides been able to differ notably from one locality to the other, or at different epochs.

The accord of the summaries from 1771 to 1775, from year X, from year XI, from 1810 and from the years posterior to 1817, merit especially to be taken into consideration.

This accord authorizes completely to affirm that from 1803 to 1811 the limit of 107,53, has been able to be offered only partially. Thus, by applying to the totality of the numbers of births of the period which, as one has seen above, are probably already too high; it is doubtful that the result is not superior to the real number of boys.

One will see besides further that if by chance the ratio of 107,53 to 100, had been passed, one would be able to increase the number of male births, as much as it would be necessary, without troubling the reasonings.

In order to leave no influence on the facts to the special ideas which directed in this research, it was convenient to not fill at all, according to these same ideas, the gaps of the documents of the archives. It has appeared quite preferable, notwithstanding an opinion nearly made on this point, to demand communication of the summaries constructed on the same original documents, but in some entirely different views, to the minister of Commerce by the care of Mr. Moreau de Jonnès. His accommodation has set in a position to present the results below, which differ little from the totals already obtained the last four years.

Years	Births	Deaths
In 1803	917,875	893,971
1804	909,388	929,385
1805	912,073	856,075
1806	910,166	781,804
1807	921,532	801,646
1808	904,313	778,981
1809	931,431	752,431
1810	932,700	731,552
1811	926,472	753,542
Totals	8,265,950	7,279,387
Year Mean	918,440	808,821

From 1803 to 1811, there is born in France, moreover, 8,265,950 individuals, boys or girls.

Partitioning this number in the ratio of 107,53 to 100, one obtains:

4,282,930 for the boys
and 3,983,020 for the girls.

This which would divide the mean year into:

475,880 boys
442,560 girls.

Now there remains no more but to add the counts of the classes from the recruitment corresponding to the births of the nine years from 1803 to 1811. These are those which have been reproduced in regard to the years 1823 to 1831, and of which the union gives 2,574,179 young men between 20 and 21 years.

By dividing this number by the total 4,282,930 of the births of boys, one will find that they are in the ratio of: 60.10 to 100.

It is necessary to repeat that the number of births is great by design, since one has made use of a multiplier too high, 107,53; while the results of the recruitment are able to be only exact or too deficient, especially when one reports them at the age of 20 years.

If one opens the table of Duvillard, and if one seeks the ratio of the survivors of the age of 20 years to the births, one finds that it not exceed:

50,23 out of 100

Thus, out of 100 male infants, this table lets survive only 50 of them to 20 years; and the counts establish that there remains of them in reality more than 60, even to past 20 years.

But if it is so for the male infants, the number of surviving females must be greater still. The feminine sex, this fact is no longer put in doubt, possessed in nearly all the ages, even anteriorly to infancy, the privilege to die in less proportion than the masculine sex. A table which comprehends the two sexes must therefore, in the actual century; indicate at the age of 20 years much more than 60 survivors.

In order to give a clear idea of the enormous difference that 10 more survivors bring to the age of 20 years, some developments are necessary. they will complete by proving besides that some considerable errors and by thence even impossible in the elementary numbers, would invalidate the conclusions not at all.

The time after which the number of births is reduced to half is that which one has named the duration of *probable life*. At the age where it is stopped one is able to wager 1 against 1 that an individual taken without choice will be dead or will not be.

The table employed until now had reduced to 50,23 the number of survivors of 20 years out of 100 births. It was to limit the probable life to 20 years and a little less.

There would be a question to know at what age is found deferred the term of probable life if there remains 60 persons out of 100, at 20 years.

In order to make the calculation, it is necessary to adopt an order of mortality.

If one takes in the *Annuaire du Bureau des Longitudes*, the table of Northampton, most rapid toward the age of 20 years and beyond, one will find that 60 individuals of 20 years is reduced to 50 survivors only by attaining the age of 31 years.

According to the table of Duvillard, out of 60 persons of 20 years, there would remain 50 to an age quite near to 33

The order of mortality of Deparcieux would lead to 43

Finally the calculations of Milne on the deceased of Carlisle would push the survivors to 40

One sees therefore that, without modifying the order of mortality of Duvillard in the ages beyond 20 years, the sole fact of the arrival of 10 more individuals, at that age, increases the extent of the probable life by *thirteen whole years*.

One is able to calculate according to the Annuaire that if there arrived only 55 persons to 20 years, the same order of mortality would yet prolong the probable life to 28 years, that is by *eight years*.

But it is quite easy to see that the ratio of the survivors to the births, found by the recruitment; would fall from 60,10 out of 100 to 55 out of 100, only under two hypotheses. The one would consist in saying that the counts of the minister of war contains an error by too much of $\frac{1}{10}$ or of 28 600 young men, mean term: now this is that which is not able absolutely according to all the conditions to which this work is subject, as one has been able to see.

The other hypothesis would be to admit in the annual number of births from 1803 to 1811, carried to475 880,
an error of at least 44 156.

This which would elevate the annual mean number of males of this period to520 036.

But since 1817 to 1832, in full peace, the mean of the male births has attained only498 403

The supposed error of 44,156, or even only of 20,000 in the births, is therefore, as that which one would wish to place in the counts, of a radical impossibility.

And however these impossible errors would not prevent at all the probable life to be today 8 years longer than the table of Duvillard carries it.

It would be bold to pronounce that this table must be replaced in general, and even today, by the order of mortality of Deparcieux. This scholar has been able to employ, for the ages inferior to 40 years, only some numbers less than 4,000; his ratios leave a notable uncertainty below this age. He has himself stopped his calculations at the age of 3 years, for which he possessed only 357 individuals out of which he counts four deaths. He has therefore not at all fixed proportions between birth and the age of 3 years.

It is necessary besides to remark that, from this age to 20 years, Duvillard is extended quite less than he has done for the other epochs, from the number of deceased indicated by Deparcieux.

Out of one thousand infants of 3 years, this one counts 814 survivors to 20 years; out of the same number that one leaves only 804 of them.

The difference is precisely of 1 out of 100 in 17 years.

In order to obtain from the table of Deparcieux 60,10 men of 20 years, it would be necessary to admit 73,83 infants of 3 years; and as one has seen that the number of 60,10 to 20 years corresponds to 100 births, it would be necessary to suppose a loss of 26,17 before the age of 3 years.

Duvillard gives for the number of the deceased from 0 to 3 years 37,53 out of 100. If one would wish not to modify his proportions of 3 to 20 years and to obtain at this age 60,10 survivors, the deceased would have to be reduced from 37,53 to 25,24 before three years, that is to two-thirds.

Beyond 20 years, the two tables are very different.

To adapt to that which proceeds with slowness a mortality of 26,17 out of one hundred in the first infant, has nothing improbable.

But it would appear difficult to restore the deceased of the low age to two-thirds in the other table of which the march is so rapid since one passes the twentieth year.

This would be to suppose in life an extreme force at the most tender age, and a singular feebleness at the period where man attains all his development.

All carries therefore to regard the order of mortality indicated by the counts of the minister of war, as much closer trully to the statistical work of Deparcieux, than it is of the calculations of Duvillard.

This consideration suffices in order that to the future and until better counts, one is permitted to guide by the first rather than by the second in all the operations which have for base the duration of the actual life of man in France.³

It is not at all possible to present the tables on which this discussion belongs, without expressing some of the reflections which they suggest.

Everyone will remark that the annual ratio of the births of boys to the births of girls, seems to have been higher at the beginning of the century than it is today.

One would be able to acquire with certitude in this regard only by a collection less incomplete of the births from 1800 to 1817. Since 1827 this ratio has sensibly diminished.⁴

Another reflection is born when one seek the ratio of the male births to the counts of 20 years for each of the years comprehended in the tables. One finds for the recruitment:

From 1823	56,17 out of 100
— 1824	58,70 —
— 1825	62,98 —
— 1826	60,14 —
— 1827	59,52 —
— 1828	60,44 —
— 1829	61,18 —
— 1830	61,10 —
— 1831	61,80 —

One is able to conclude that the successive generations are far from having the same longevity. But in order to well appreciate to what different point the laws to which they are submitted differ, it is necessary to make use of a formula of Laplace, and to determine the limit of the probable deviations of the ratio of the survivors of 20 years, out of the common year of 475,880 births, when the mean ratio, out of 4,282,930 of births, is of 60,10 out of 100.

One recognized thus that, if the causes of mortality had remained the same, there would be odds of more than 45267 against 1, that each year the ratio of the recruitment to the corresponding births, would fall between:

³*L'Annuaire de l'Observatoire de Bruxelles* of Mr. Quételet, is communicated to me at the instant by a member of the Institut.

Mr. Quételet, in the curious table that he has constructed for the cities and countrysides of Belgium, carries to 52,25 the number of survivors of 20 years out of 100 births: and he extends the probable life to 25 years.

Thus already it was recognized that the table of Duvillard would no longer be able to be applied to actual Belgians. But has Mr. Quételet increased the number of men of 20 years as much as the country Belgium permits?

Diverse counts contained in his works presume that life is at least as long in Belgium as in France.

⁴In 1833 it is elevated to 106,65; in 1834 to 106,47.

59,78 out of 100
and 60,44 out of 100

These limits have been constantly crossed from 1823 to 1831; the causes of mortality have consequently varied strongly from one generation to another.

These causes therefore do not seem of like nature as that which produces the superiority of the births of the boys: for this last the variations scarcely extend beyond the limits where the probability is 45000 against 1.

The proportion of the survivors is increased in the last years. The number of the years is much too small in order to affirm that there exists a continual increase in the vitality of the infants. Is perhaps this apparent variation only temporary?

The most deficient ratio, among the recruitments, 56,17 out of 100, is observed in 1823. Now one has been able to remark above that the years 1803, 1804 and 1805, have offered the greatest number of deceased. The infants born in 1803 have had to support, in the most critical age, the fatal influence of the maladies of these three years; and it is little surprising that they have furnished, all proportions guarded, a fewer number of men of 20 years.

When, from 1820 to 1825, the counts of the recruitment expressed, as it has been said, some doubts on the exactitude of certain municipal magistrates, and seemed to attribute to negligence the diminution of the products of the counts, it would have probably sufficed to reascend to the real births and to remember the maladies of 1803, 1804 and 1805, in order to explicate this diminution, considerable in effect. It is thus that the statistic made with truth, that which is the first condition of it, and followed with intelligence, is able to illuminate the administration.

The counts of the recruitment show also that there arrive rarely in France 300,000 young men to the age of 20 years. The mean of 16 years, from 1816 to 1831, is 290,000. It is hence easy to imagine how the repeated levies have depleted the nation toward the end of the empire. The void of the ages from 20 to 50, is very sensible in the tables of the deceased of the first years which have followed 1815. It is thence one of the causes which render difficult the calculations on the population and the longevity in France; likewise that the long wars of Louis XIV, the revocation of the edict of Nantes, the poverty and the epidemics at the end of the seventeenth century, influenced on all the summary statistics from the eighteenth century, and led Dupré de Saint-Maur and even the illustrious Buffon to singular errors.

Note to the support of the preceding memoir.

It is a character of the truth, a character well-known, to receive a new confirmation of all the proofs to which one submits it. Also, as the truth is my only end, one will find me always ready to cause to submit to the results which are able to be presented to me, all the practical verifications.

I hasten myself therefore to give some explications which have appeared desirable out of the elements of which I serve myself in order to establish the new fact that I have signaled. I have been able to give earlier these false developments of the time necessary. The functions that I fill leave quite little leisure in order to complete the scientific researches that sometimes they require. It is the same defect of time that has

delayed to here the redaction of the memoir which precedes, although the incomplete work to which it is attached reascends to many years.

Moreover, this point of date has only a secondary interest, since all the authors of modern tables on the mortality are approximate more or less of Duvillard, and that I put publicly some facts which deviate entirely from the law indicated in his work on the *petite-vérole* and in the *Annuaire du Bureau des Longitudes*. These facts were known, in part at least; but a person, that I know, had not brought them together the ones from the others, and the consequences had remained imperceptible to them.⁵

In order to arrive to my end, I have employed only a quite simple calculation. I have even taken care to separate all mathematical apparatus from this memoir which is addressed to all minds. It is important to convince everyone, when the concern is with a point of natural history and with social economy as interesting as it is an extension from 10 to 15 years *at the minimum*, in the duration attributed commonly to the *probable life* of man.

I have therefore taken the counts of the young men who have attained the age of 20 years from 1823 to 1831; counts effected annually for the recruitment of the army since 1816.

I have compared them to the births from the years 1803 to 1811 antérieurs of 20 years, and I have obtained the ratio of 60 out of 100 at most below.

Such are the only elements that I have employed. For it is useless to speak of the proportion according to which I have partitioned the births between the boys and the girls; since I have served myself with an extreme limit which would be able only to increase the number of the births of boys. Now, one would increase this number yet further without any change in the consequences.

Here is the means to verify easily, if not in totality, at least for the greatest part, the authenticity of the numbers which constitute my two elements.

For the first, the number of boys of 20 years, nothing is easier. It suffices to take the collection of the *counts of the recruitment* published by the minister of war, to the terms of the law of 10 March 1818.

⁵When I submitted this Memoir and this note to the Academy of sciences in 1835, I believed to be the first to employ the lists of the recruitment in order to establish a more exact opinion on the duration of human life. I conserve indeed a letter from a member of the Institute to this subject which goes back to 1829. Since, by giving me the volume 28 of the Bulletin of statistics, a friend has given to remark to me that Mr. the baron Charles Dupin had already been served of these lists in 1831, in order to support the calculations according to which he elevated the duration of mean life to 36 years, instead of 28 3/4 duration enunciated by Duvillard, and of 32 1/5 duration indicated by Mr. Mathieu in the *Annuaire*.

One will find page 7 of the volume cited the usage that Mr. Charles Dupin makes ably of the conscriptions from 1800 to 1807, and from the counts of the classes from 1822 to 1825. Mr. Dupin not possessing exact numbers for the corresponding births has not signaled the ratio of 60 out of 100. Now it is there my principal end, and I have place to deduce from this ratio that the *mean life* exceeds 36 years.

I have shown only that the *probable life* attains all at least 33 years: but an easy calculation, that I have not reported in order to avoid all complication in the enunciation of a new and contested fact, would carry the *minimum* of the mean life beyond this age.

Another person made me observe yet that Sir Francis d'Ivernois has already attacked the exactitude of Duvillard. I consign here this fact which was unknown to me three years ago. The observations of Sir Francis are found in the *Bibliothèque universelle* of Geneva.

One will imagine without difficulty that I have not had knowledge of the work of Mr. the baron Dupin and of sir F. d'Ivernois, if one wishes to reflect well that the very laborious annual rounds absent me from Paris during eight months and sometimes more, since near to five years.

But, finally to avoid the pain of rapidly perusing these counts, it will be simpler yet to consult the tables annexed from 1830 to the draft bill annually submitted to the chambers on the recruitment. One will find the complete table of the counts operated for the years 1825 to 1833, in n° 158 of the impressions (format in 8°) of the chamber of the deputies, session of 1835. Under this number in 8° attached to the draft bill for the raising of 80,000 men of the class of 1834, presented 23 March 1835 (posteriorly to the date of my memoir), is placed a sheet in 4° which contain the pieces to the support of the law.

The census of the class of 1824 is not at all in n° 158 of the session of 1835, nor in the preceding; it exists under n° 125, among the impressions of the session of 1830. It makes part of the pieces to support of the draft bill presented 3 December 1830, in order to modify the bases of the repartition of the contingent between the departments and the cantons.

The law rendered in this epoch, distributing the number of men to raise each year, according to the mean of the numbers of young men counted during the preceding years, makes from the census of these young men a piece of an authenticity and of an exactitude greater yet, if it is possible, than by the past. Also, as I have said it, the rectifications that the interests of each locality, better warned, have been able to make born, have brought to the counts already known only some changes completely insignificant, since they do not attain 500 individuals in the year most affected.⁶

I am obliged to refer myself to the same counts of the recruitment for the other years anterior to 1824. But as I have employed, in my calculations, only one alone of these years, 1823, and as it reduced the number of the survivors of 20 years, it would be superfluous to push further the indications to this subject.

One will judge without doubt now my results irrefutable, as much as they depend on the annual numbers of young men of 20 years: these numbers being able to be only too deficient for all the reasons exposed in the memoir.

If the first of my elements are found thus placed sheltered from doubt, through the official pieces, it is not likewise of the second, at least in totality; for it does not exist in the administrative publication which contains all the births of France since 1803 to 1811.

The laws of the state have not unfortunately imposed to the administration the need to render public, by printing, the lists of the annual births, thus as the lists of the recruitment. I should resort, in order to obtain them, in the counting of the *Tables of the movement of the population* sent by the prefects to the minister of the interior, and deposited in the archives of the realm. I have thought to demand to the scholarly conservator of the archives, a certificate verifying the exactitude of the extract that I have made of these tables, because I do not imagine that each reader would not know to go to the archives to recommence the examination of the hundreds of dusty sheets that it has been necessary for me to consult. But there was in this collection of tables some rather numerous gaps, thus as I have made known; and there would be need to discuss perhaps the following process in order to fill more or less arbitrarily these gaps. There

⁶The numbers cited in my memoir are extracts from the draft bill presented 21 February 1833 in order to raise the class of 1832. They differ some little from those which are annexed to n° 158 of March 1835 which was not yet published when I had submitted my observations to the Academy. But these new corrections rise only to a hundredth of individuals and are next indifferent in the question.

would remain in the mind doubt on the final result; for one would be able to acquire a total confidence in the manner to restore the births of the departments which are lacking, only by descending to all the details of the painful researches where I am entered, and which have apprised me that the errors of this restitution are not able to influence on the result. Moreover, a certificate from the conservator would not have established at all that the pieces abandoned since twenty-five years, and not published, had experienced the examination of the superior authority and received its sanction, which gives alone an official character.

This way would not therefore have been capable of giving to my lists of births the degree of authenticity that the counts of the recruitment assure to the lists of young men of 20 years.

Fortunately I have found a document which will give, I hope, the most manifest proof of the regularity of my work on the births; for it is in some sort a new work.

It is more than 22 years, in 1813, and consequently at an epoch where it was not able to be prepared for the consequences which are evident today, there has been published an official piece which contains the births of forty-three departments, during the ten years from 1802 to 1811. It is a joint table, under 2^o, in the *Exposé de la situation de l'Empire* presented to the Legislative Body, 25 February 1813, by Mr. the count of Montalivet, minister of the interior.

Each is able easily to examine this table, and it is clear that if the results which are deduced from it agree with mine, it will be a proof without replication of the exactitude of these last; for, I repeat, this table of 1813 was formed by some men who dreamt scarcely that one would reconcile one day the census of the classes of the recruitment from 1824 to 1831.

Now the agreement is perfect, as I just exposed.

The 2^o table of Mr. de Montalivet comprehends 50 departments of imperial France. Seven no longer make part of the actual territory; these are:

Dyle, Forêts, Lys, Mont-Blanc, Mont-Tonnerre, Deux-Nèthes, Sambre-et-Meuse.

The 43 others are very proper to give a just idea of all France; for chance makes that they are found nearly equally in the nine divisions that one traces often on the territory.

5 are in the *north*: Aisne, Eure-et-Loir, Nord, Pas-de-Calais, Seine.

8 in the *northeast*: Ardennes, Aube, Marne, Marne (Haute-), Meurthe, Meuse, Moselle, Rhin (Haut-).

4 in the *northwest*: Finistère, Ille-et-Vilaine, Morbihan, Orne.

7 in the *west*: Charente-Inférieure, Indre-et-Loire, Loire-Inférieure, Sèvres (Deux-), Vendée, Vienne, Vienne (Haute-).

4 in the *center*: Cher, Creuse, Loir-et-Cher, Loiret.

3 in the *east*: Isère, Jura, Saône (Haute-).

3 in the *southwest*: Gers, Lot-et-Garonne, Pyrénées (Hautes-).

5 in the *southeast*: Alpes (Basses-), Ardèche, Bouches-du-Rhône, Loire (Haute-), Vaucluse.

Finally 4 in the *south*: Aveyron, Corrèze, Hérault, Tarn.

This nearly regular distribution has nothing which must astonish, for the exposition of 1813 was able to contain only the departments of which the prefects had been most prompt to complete the series of tables of the civil state; and there was no reason in order that the most active prefects were not uniformly widespread in all the country.

But in an epoch where the empire was composed of more than 100 departments, it is rather singular that chance had reunited 43 of which the population forms today the half of the population of France.

If one wishes to make the addition in the *Annuaire* of 1835, one sees effectively that these 43 departments contain 16,298,106 souls, and that the total population is 32,560,934 of which the half would be 16,280,467

Another rather remarkable coincidence, is that by taking the births of boys and of girls in these 43 departments, for the 6 years from 1817 to 1822, of which the mean is calculated⁷ in volume 32 of the *Revue Encyclopédique*, book of October 1826, one finds that they have furnished, mean year:

251,348 boys and
235,828 girls,

whence is drawn the ratio of 106,58 to 100.

Now in all France, during the same years, there is had mean term:

494,227 boys⁸ and
463,649 girls,

this which leads to the ratio of 106,59 to 100.

Thus under two points of view completely different from the one which occupies me, the 43 departments represent very well all France.

I have established beyond that each of the numbers of births and of deceased inserted in the *Exposé* of 1813, is quite similar to the total of the corresponding table existing in the archives. Solely, for the years 1802, 1803, 1804 and 1805, one has taken totals from the year X, the year XI, the year XII and the year XIII of the calender of the epoch, which does not coincide exactly with the Gregorian years. But the difference bears only on the first 100 days of year X, to which it would be necessary to substitute the first 100 of year XIV (this which had been easy), could not alter the general results.

I have not been able to make use of the totality of births of the 10 years 1802 to 1811, because the tables of the minister of war gives the young men of 20 years, for each department separated, only since 1824. It therefore has been necessary to subtract from the births the years 1802 and 1803 corresponding to the classes of 1822 and 1823.

Thus the verification of the result of my memoir extends to 43 departments and to the 8 years 1804 to 1811.

I am going to give with detail the calculations of this verification.

The total of the table n° 2 of the *Exposé* of 1813 is indicated for 5,478,669.

But there are some errors of impression which make a show of the addition of the *total* column to 5,480,179,

⁷In correcting however an error in the number of births of girls of the department of Haut-Rhin for the year 1819. This error has been placed by the calculator of the *Revue* this department the 26th for the ratio of the girls to the boys, while it must be the 48th. This error consists in a transposition of the Rhône to the Rhin committed in the *Annuaire* for 1822 published in 1821. I owe to the calculation of the probabilities to have sought and recognized it.

⁸*Translator's note:* The *Revue* has 424,227.

while the addition of the totals of each year is only 5,477,669,
 and finally the addition of all the columns of 5,477,538.

Among these numbers (although the deviations from the one to the other are indif-
 ferent in the question), in order to not error and in order to be certain to increase the
 number of births, I will take the highest, let it be 5,480,179.

I will subtract for the years

1802	538,690	}	
1803	535,539	}	1,074,229

a number which one finds by adding the columns of the two years, and which is less by
 88 than the sum of their totals. Thus the rest 4,505,950
 will represent a number greater than the set of births from 1804 to 1811.

It is necessary to subtract the births relative to the 7 departments strange to France.
 The addition carries them to 692,426
 by taking the sum in the total column and diminishing this sum by the numbers regis-
 tered in the years 1802 and 1803. The difference is thus smaller by 173 than the total
 of the numbers of the 8 years 1804 to 1811 for these departments; and hence this error
 of impression is yet turned in manner to increase the total of births from 1804 to 1811
 in the 43 departments. With this precaution this total will be 3,713,524

One sees already that this total differs very little from the half of the births from
 1804 to 1813 that I have cited. They form together 7,348,075, of which the half would
 be 3,674,037.

It is thence a first verification: but one must be able to go further.

The ratio of the births of boys to the births of girls being the same in the 43 depart-
 ments and in all France, I determine the number of boys out of the total of 3,713,526
 births by applying the same superior limit of 107,53 to 100, of which I have made use
 in the memoir.

I find by this means that the total of the births of boys from 1804 to 1811 has
 certainly been less than 1,924,133

I obtain next the total of the corresponding counts of young men of 20 years, by
 making the addition of each of the years 1824 to 1831 in the imprints already cited, n.
 125 of 1830 and n. 158 of 1835 of the Chamber of the deputies. There returns from
 them for:

	Inserted.
1824	136,761
1825	145,812
1826	139,115
1827	139,249
1828	138,621
1829	145,466
1830	145,966
1831	147,818
of which the total is	1,138,808

Dividing this last number by 1 924,133, one is assured that the ratio of the survivors
 of 20 years to the births is at least of

59,18 out of 100,

a result which does not differ by one unit from the one that I have obtained for France, whole and which is of

60,10 out of 100.

A parallel accord would be sufficient in order to demonstrate the rigor of my deductions; for the calculation of the probabilities proves that the variations of the ratio of which there is concern are rather strong from one locality to another, in order to bring forth temporarily the difference of 1%.

But, as I have said, the accord is able to be carried much further.

Indeed, the 43 departments comprehend the Seine which contains Paris, of which the hospices receive a very considerable mass of abandoned infants, around the sixth of all the infants found annually. Paris presents beyond a very strong proportion of natural infants, less cared for than the legitimate infants and offering less survivors of 20 years. Moreover still, the young men born in this department being unknown to the municipal authority, are found often registered for the drawing in some other departments. Finally one knows that in Paris the ratio of the boys to the girls, quite far from being 107,53 to 100, scarcely exceeds 104 to 100.

All these causes make fall well below 60 to 100, the ratio of the young men of 20 years to the births for the department of the Seine.

It is agreeable therefore, when one considered the half of the population of France, by making enter only the half of the numbers relative to this department.

It is to observe also that among the 43 departments of the empire, many have submitted to rather notable diminutions of territory since 1814. There results from it that the numbers of births taken in these departments from 1804 to 1811, are too great relatively to the counts of young men of 20 years effected from 1824 to 1831. I have assured myself that the Haut-Rhin had thus lost nearly $1/6^{\text{th}}$ of its population in 1814 or 1815. But it is the one which has most suffered, and I have not been able to ascertain the diminutions much less great of 2 or 5 others. There would be therefore again to reduce the total of the births for this reason.

One sees easily in the tables already cited, that the births from 1804 to 1811 in the Seine, are raised to 176,673
of which the half is 88,556
and that the corresponding classes of the recruitment from 1824 to 1831 have attained only 41,342
of which the half is of 20,671

By subtracting from the total of the births 3,715,524
the half of the Seine 88,336
there will remain first 3,625,188

a number to correct yet for the Haut-Rhin which has lost the arrondissements of Delemont and of Porentrui forming at the minimum the 6^{th} of its population. I do not hold null count of the other reduced departments.

The Haut-Rhin enters into the births from 1804 to 1811 for 122,574, of which the 6^{th} exceeds 20,188

There comes therefore for the total of births to consider 3,605,000

One deduces from it as previously the superior limit of the births of boys, which are lowered thus to 1,867,901.

Subtracting the same from the number of young men of 20 years, this .. 1,138,808
the half of the recruitment of the Seine this 20,671
one will have alone 1,118,137

to compare with the 1,867,901 births.

The division gives for the ratio of the survivors to the births 59,86 to 100.

The ratio for all France being of 60,10 to 100, the approximation of the accord of the two results is quite remarkable.

The gap of 0,24 exceeds however the extent of the gaps for the set of which the probability would be of 45 267 against 1. This extent is scarcely that of 0,18; this which would hold to confirm that which I have said of the variation of the causes of mortality.

Also I regard this coincidence, nearly perfect, only as fortuitous, and a difference much greater between the general ratio and the ratio taken on 43 departments reunited by chance, would not have prevented me concluding in favor of the exactitude of my first calculations.⁹

I do not think however that the results of the statistical observations are able to descend much below 60 out of 100, all the time that one will take large numbers repartitioned out of all France, and that one will not stop at the total of some years unfavorable to human kind.

Effectively if, in the calculations which precede, one replaces the superior limit of the ratio of the boys to the girls by the mean result, which for the years 1817 to 1832 is of 106,38 to 100, one will find that the survivors of 20 years are to the births in all France as 60,41 to 100, and in the 43 departments as 60,16 to 100.

And however the numbers of births are probably a little too large, and the numbers of young men of 20 years are certainly a little too small: it was only because of the tardy counts effected alone toward the age of 21 or 22 years.

It is not necessary to forget besides that the females have a mortality less than that of men. So that in a table which comprehends the two sexes, there must exist without any doubt 61 to 62 survivors of 20 years for 100 births.

It is not by means of recruitment that I am arrived, a long time ago, to convince me that the table of Duvillard is no longer applicable in this century: it is by some other isolated facts, and by some methods of which the exposition would be too long in order to find place in this note.

I myself am assured in the same manner that the greater part of the tables of mortality are not formed conveniently, that the common defect of which they are affected, cause alone the rapidity with which they make men die. I have been able to acquire on this point a certitude such, that it suffices me in order to repel immediately all the plans of Societies of assurances, of Pay offices of retirements, etc., founded on some laws of mortality which are classified in the limits of the error which is known to me.

⁹However provided that this difference had not made the result fall to render it closer to the calculation of Duvillard than of mine. Because in this case, I would have immediately abandoned my conclusions: and proceeding to some new researches, I hope that I will have ended by determining the true ratio, so important to know in a crowd of circumstances.

The publication of the researches of which there is concern, when they were not applied to a considerable mass of facts, would have been able to be only a useless tentative in order to change an accredited opinion. But immediately that I have had knowledge of the counts of the recruitment where the numbers are by hundredths of thousand and by millions, I have seen the true touchstone of the tables of the movement of the population, and at the same time a simple means to manifest to all the eyes, without complicated calculations, the result of my anterior works. The expositions of the original calculations would have hardly demonstrated this result to the small number of scholars who had taken the care to study the development of them.

I dare to presume that one will find in the official pieces that I just cited some completely convincing proofs of the statistical result that makes the subject of my memoir.