

ברשות מורי ורבותי

Let us first mention that because of the nutrition and sanitary conditions the ethnographical situation in the antiquity as in the middle ages and until the middle of the 18th century, were the following: one born child out of three died before 1, and only one born child out of 2 reached the age of 15 and still less reached the age of 20, and still less were able to establish a family. The average life expectation of a newborn was about 25- 30 and that of an adult was about 40 to 50. Only 10% of the population lived more than 60. Taking into account that a significant percentage of the adults did not marry because of their economic situation an average married family must have about 6 to 7 children in order to behold an average number of two adults in the next generation and maintain a stable population. This was indeed the case of the Jewish population in the desert as we note that the census in the 40th year in Pinhas was slightly inferior to that of the year of the Exodus. The population of the Exodus and of the desert was a stable population, which did not grow at all.

In the middles-ages, in England, on the basis of parish records, the rate of mortality of the adults was about 30 per 1000 in normal times but it could reach 60 per 1000 and even more in some period of epidemic and starvation. These figures concern England, which was a rich country. Assuming a rate of mortality of 45-50 per 1000 and per year of the adult population in the desert, and taking into account, in order to simplify, an infantile death rate of 50%, we need a rate of birth of 90-100 /1000 and per year in order to maintain a stable population, as it was the case in the desert. In order to make things simple we will assume that the number of adult, above 20 men and women was the same, 600000 and the number of children was also the same, thus a total population, without the mixed multitude, the עירוב רב, of 2400000 people.

Now let us go back to the main subject.

The Levi'im counted from 1 month and beyond were 7500 (Gershon), 8600 (Kehat) and 6200 (Merari) and 22300 in total.

The number of the firstborn of Israel, counted from 1 month and beyond was 22273.

When the firstborn were redeemed by the Levi'im, we note that the number of effective Levi'im was now only 22000. The non Jewish dignitary asked already in Gemara Bekhorot 5a: ושלוש מאות היכן הלכו? The explanation given in Bekhorot 5a and quoted by Rashi ad locum, that the 300 Levi'im, not considered in the exchange, were themselves, Bekhorim, and they could not effectively redeem other firstborn, seems genuine.

Although the number of females is slightly superior to the number of males, we will assume that these two numbers are equal. The total number of Levi'im, men and wives was thus 44600 and the total number of their firstborn, boys or girls, was twice 300, we can thus infer that the number of families was 600 families, neglecting the families without children. If we divide 44600 Levi'im by 600 families we get 74, where 44600 is the total population and 600 is the number of families. Thus the average family included 74 persons, 2 parents and 72 siblings, 36 boys and 36 girls. If consider the period of fertility of women between 16 and 28, women must have 12 pregnancies of 6 siblings each time, between 16 and 28 with an average age of 22. Of course these figures seem surprising especially when we compare them with the figures mentioned above in a stagnant population of the middle-ages. A first reaction would be to say that this society was polygamous and such figures are not impossible when a man has several women. But the answer is that the number of men and women is about the same Let us now examine the general population. When a man has 10 wives, there are 9 men too poor to marry. At a statistical level we must consider that a man has one wife and not more.

Now let us consider the general population.

The number of firstborn from 1 month and beyond of the general population was 22273 males or 44546 males and females, corresponding to 44546 families with children. The total population was 603550 adult males, or 1,207,100 adults and 2,414,200 people above one month. If we divide 2,414,200 by 44546 families we get 54. The average family included 54 people, 2 parents and 52 siblings, corresponding to 12 pregnancies between 16 and 28 of 4.5 siblings. This calculation as the former one is rough for an additional reason: among these firstborn there are certainly fathers and sons and even sometimes grandsons. These families overlap each other and give way to repetitions.

Anyhow these figures are difficult to justify and accept, they are unimaginable and unacceptable.

Besides the problem in absolute values we have a problem about relative values. Why was the average family of Levi'im so different than the average family of Benei Yisrael?

Absolute value.

The only possible explanation would be that the order of Kadesh li kol bechor (Exod 13, 2) concerned, contrary to what I always had been taught and believed, only the future firstborn but not the firstborn already born, who were not retroactively sanctified. Let us think a moment to the passuk in Shemot 13:2

קדש לי כל בכור פטר כל רחם בבני ישראל באדם ובבהמה לי הוא.

And in Bamidbar 3 : 12 and 13 :

ואני הנה לקחתי את הלויים מתוך בני ישראל תחת כל בכור פטר רחם מבני ישראל והיו לי הלויים. כי לי כל בכור ביום הכותי כל בכור בארץ מצרים הקדשתי לי כל בכור בישראל מאדם עד בהמה, לי יהיו אני השם.

We were used to understand that all the existing bechorim had been sanctified. But is that logic and fair? Could such a deal really imply adult existing people? Was it possible to establish a posteriori the character of firstborn, more exactly the character of פטר רחם of each of them? Especially according to this view the male firstborn of the oxes, sheeps and donkeys were also consecrated retroactively and here it was nearly impossible to reconstruct the situation. Anyhow the former calculation seems to constraint us to reconsider the problem and reach a new and unforeseen conclusion.

Indeed it seems that the firstborn counted are those born after the order of Kadesh li kol bechor (Exod 13, 2) thus from Nissan 15 of the first year until Iyar of the second year thus during about one year and a half month. All the 22273 firstborn were thus born during this year.

This would give a birthrate of $22273 / 603550 = 36.90$ per 1000 of the general adult population and per year to which, we should add the births of the siblings. It could bring us to a birthrate of 90 - 100 per 1000 adults and year. This rate seems acceptable and logic as we saw. It is just sufficient to maintain the population of the desert.

What about the Levi'im, we know that their number, counted from 30 till 50 was 8580, representing 38% of the total population above 1 month of 22300. It make sense to consider that the population above 20 was 50% of the number of Levi'im above 1 month, thus 50% of 22300 or 11150.

Thus the birthrate of the firstborn would be $300 / 11150 = 26.9$ per 1000 adult and year instead of 36.9 per 1000 adults and year for the general population. This materializes again the difference between the Levi'im and the average population: a lower birthrate in the tribe of Levi.

Now we must accept that the בני ישראל mentioned in Exod. 24, 5 were firstborn (according to Onkelos, Rashi, Ibn Ezra, Ramban and Rashbam) not because of the sanctification

mentioned in Shemot 13, 2 but because of the ancient rule existing in the ancient society (see the selling of the firstborn rights of Esau to Jacob).

Our assumption is of course audacious, but less than you could think. If you read carefully the commentary of Ramban on Bamidbar 3; 43 on the verse: קח את הלויים תחת כל בכור בבני ישראל He writes: והנראה אלי כי הבכורים האלה כולם לא נולדו במדבר בשנה אחת כי לא נתרבו העם שם כל כך: In other words the idea that the considered bekhhorim were born during the first year of Exodus did not scare Ramban and it was in fact his first idea but he rejected it because he did not make our calculations. Therefore he was impressed by the number of firstborn, which seemed excessive for him. Nevertheless he should have been more familiar with the problem of infantile mortality and these figures should have been normal for him. Anyhow you see that Ramban had considered this possibility and he certainly did not consider it as heretic. Now there remains perhaps a little problem with Bamidbar 3:45

ואת בהמת הלויים תחת בהמתם

The case of a young bekhhor being orphaned and being the owner of his father's animals must have been tiny and exceptional but it was not impossible.

Another argument in favor of our understanding: parallel to the sanctification of the human firstborn, we find also the sanctification of the firstborn of the בהמות אשר: וכל פטר שגר בהמה אשר and here it is certain that this refers to the future and cannot refer to the past. Indeed people could not remember which animals were firstborn. Furthermore when this Mitsvah was given, the extant firstborn had not been treated according to the rules of the Kedushah of Bekhorot, they could have been used for working, for their wool or some of them could have been eaten. In short, it seems certain that this Mitsvah concerned the future.

Relative values

We noted above the following anomaly: the birthrate of levi'im is smaller than the general birthrate.

Even if we consider that the number of firstborn refers to the firstborn born after the Exodus, the problem remains the same and there remains an inexplicable sociological difference between the tribe of Levi and the general Israeli population. The tribe of Levi was abnormally small and more, their birthrate was significantly lower.

The small number of the tribe of Levi was already noted by Ramban (Bamidbar 3. 14) and he contemplated the possibility that it was the consequence of the curse by their father. Similarly the tribe of Shimon diminished to the half between the census of Bamidbar and that of Pinhas. This was probably for the same reason, but probably also because of the 24000 deaths in the outbreak mentioned at the end of Parashat Balak, which affected probably principally the tribe of Shimon. Ramban mentions also the fact that the benei Levi were not enslaved and he contemplates the possibility that the exceptional multiplication of the enslaved people did not apply to the tribe of Levi, which was not enslaved. This would explain the low population of this tribe.

The special situation of the tribe of Levi (low population and low birthrate) seems difficult to understand unless we accept the supernatural considerations of Ramban.

Now if we compare the general population: In Iyar 603550 and in arvot Mo'av 601730
Levi'im from 1 month and beyond In Iyar 22300 and in arvot Mo'av 23000

We note stagnation during the 38 years in the desert and no significant difference of evolution between the two populations.

Therefore the assumption that the birthrate was about twice the rate of mortality of the adult population is logic; it corresponds to the stagnation of the population of medieval or antique

society, which need a birthrate of twice the rate of mortality in order to ensure the stagnation of the population because only half of the newborn will reach the adult age.

To sum up, on the basis of simple calculations that apparently were not performed until now, we arrived to the conclusion that the order of, *קדש לי כל בכור בבני ישראל*, referred to the future newborn and not to the already born firstborn. It is probably the first time that a problem of Biblical exegesis is solved by such an internal calculation.

The principle of this study is not original. Professor Eliyahu Beller, retired professor of mathematical analysis but also belonging to *חוג הזון איש* made a much more elaborated mathematical model of the society of those leaving Egypt at the Exodus and published a mathematical paper in the Journal *Higayon*, vol 2 year 1992 and he reached after complex calculations, similar conclusions to my hyper-simplified calculations, especially about the firstborns. Of course his study gives a *גושפנקא*, a moral guarantee to my conclusion.

Another difficulty was, at the best of my knowledge, never raised.

In Bo, Shemot 13,13 we read: *Ve kol bechor adam bevaneikha tifdeh*

This parasha *Kadesh li kol bechor*, was said on Nissan 15th as Rashi tells on Shemot 12,17 in the former parasha: *Parasha zou néemra lahem be youdaled be nissan*

And in this parasha *Kadesh li kol bechor*, we have the two sentences Shemot 13, 3 and 4 *Zakhor et hayom hazeh asher yetsatem mimitsrayim* and *Hayom atem yotsin behodesh ha aviv*

The question is then the following : On 15 Nissan G d orders them to sanctify the firstborn, those of men and of animals, the Kosher ones and also the donkeys and it is specified that the human firstborn should be redeemed. But on that 15 Nissan of the year of Exodus, there was no reason to fear that the benei Israel would go astray and would be dragged in the sin of the goldcalf. Why then does the text speak of redeeming without any explanation : redeemed : why and by whom ? I didn't see anyone raising this question. I would propose the following answer. As we have seen the 22273 firstborn were born during the first year, more precisely between Nissan 15th and Iyar 1st.

Thus each year 22000 firstborn were poured on the market. What was the total number of the firstborn in that society? We have seen that an average family must include two parents and 6-7 children. Let us consider families of 8 people for the easiness. We have seen that the total population was about 2400000. The number of families was about 300000, the number of firstborn was 300000 and the number of male firstborn was 150000 and the number of adult firstborn was 75000 to compare with the 8580 adult Levi'im.

In other words, in the initial project, to work with the bechorim, it was certain that 90% of them would be useless and should then be redeemed and returned to the civil life. This could explain the mention of the redemption of the firstborn. We note nevertheless that the text speaks of the redemption of all the firstborn. Maybe that indeed all the firstborn were to be redeemed, independently of their future obligations of service in the Tabernacle or the Temple.