Now let's go back to the bankers whose professional greed was previously highlighted by us.

Banking turns into usury when the payment for a loan is too high. On the other hand, too high an interest on a deposit is also unwelcome because such "banking products" can hide an elementary financial pyramid. Here is its simplest mathematical model — see Figure 15.19.

The correct banking system rests on *three* numbers. The first number N_1 is the payment for a loan. I take a hundred rubles from the bank — be kind enough at the end of the year to return $100 + N_1$ rubles. The second number N_2 is the percentage of a deposit. I put a hundred rubles into the bank — I get $100 + N_2$ rubles at the end of the year. The difference between the first and second number ($N_1 > N_2$) allows banks to work profitably. The third number N_3, backing up the two previous ones and forcing people to bring money to the bank — is the magnitude of inflation. In a normal economic situation, a low level of inflation and a not very high fee for a loan keeps the interest on the deposit within a narrow range:

$N_1 > N_2 > N_3$.

If inflation is high, many people, forgetting about the abnormality of this situation, readily believe in 20, 30, 50 and more percent per annum on the deposit (after all, the value of N_2 should be greater than the value of N_3) and fall foul of the start of the next financial pyramid. There are also less naive people who understand that a pyramid is a special kind of game where a player must be able to *"time out"*.

So, we are building a financial pyramid (Figure 15.19).

In a city of one million residents (variable N), seven of them buy one share at a price of 100 euro on the first day (D=1). Then the number of these people increases (vector NK). If people sell their shares in 50 days (Variable Time), they will receive 200 euro for each share transferred. These dynamics (selling rate and buying price of shares) is determined by two functions K(D) and P(D). In the city there is a certain excitement, which is determined by the variable K_a. From the cash desk every day a certain amount of money is taken (variable Expenditure) for renting premises, advertising, bribes to officials, etc., as well as 7 percent for the income of the organizers of the pyramid (variable Income). A more or less complicated operator of the problem shown in Figure 15.19, is the definition of the number of people who bought shares in a certain day. This value is proportional (with the coefficient K_a) to the number of people who have not yet bought shares multiplied by the number of people who have already bought shares. This relationship determines the shape of the two waves of buyers and sellers of shares shown in Figure 15.19.

$People := 1 \qquad € := ¤ \qquad Thousand\_€ := 1000\ ¤ \qquad Million\_€ := 10^6\ ¤ \qquad day := 1$

N	$Expenditure$	$Time$	K_a	$Income$	M_1	NK_1	SNK_1	MMM_1
$(People)$	$\left(\frac{Thousand\_€}{day}\right)$	(day)		(1%)	$(Million\_€)$	$(People)$		
10^6	300	50	10^{-7}	7	70	7	NK_1	M_1

$$K(D) := 100 \cdot € + 2 \cdot \frac{€}{day} \cdot (D-1) \qquad P(D) := 105 \cdot € + 2 \cdot \frac{€}{day} \cdot (D-1)$$

$$D := 1\ day, 2\ day..280\ day \qquad \begin{bmatrix} NK_{D+1} \\ SNK_{D+1} \end{bmatrix} := \begin{bmatrix} K_a \cdot \left(N - SNK_D\right) \cdot SNK_D \\ SNK_D + NK_D \end{bmatrix}$$

$$NP_{D+1} := \mathbf{if}\left(D \le Time, 0, NK_{D-Time}\right)$$

$$M_{D+1} := M_D + NK_D \cdot P(D) - NP_D \cdot K(D) - Expenditure - \mathbf{if}\left(M_D > 0, Income \cdot M_D, 0\right)$$

$$MMM_{D+1} := MMM_D + Income \cdot M_D \qquad Max := \max(MMM) = 337.836\ Million\_€$$

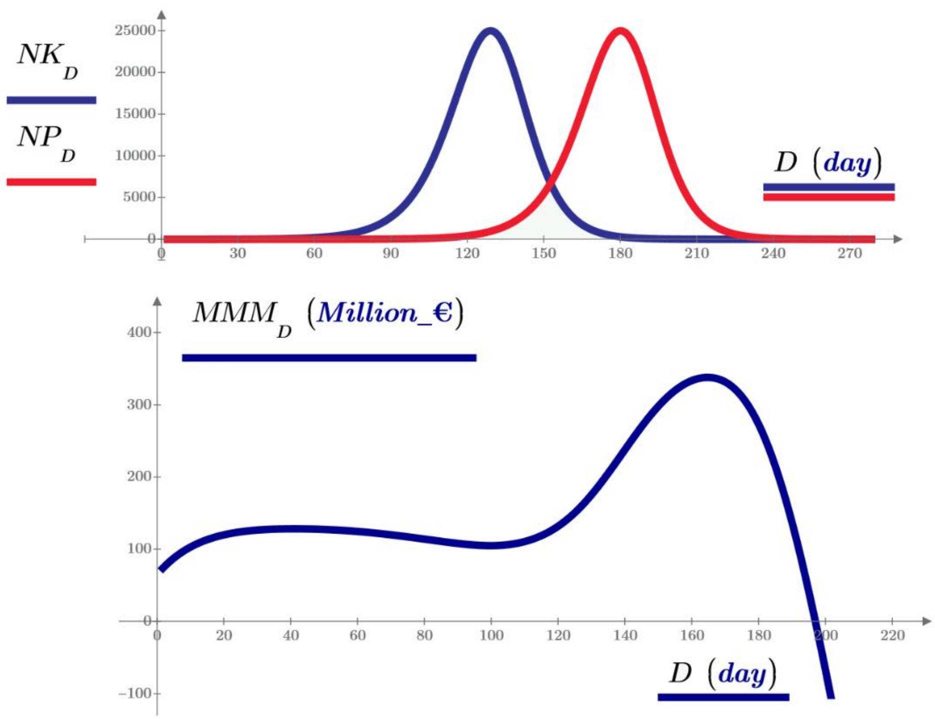

Fig. 15.19. Mathematical model of the financial pyramid

The last graph in Figure 15.19 shows the change in the amount of money in the cash register of the organizers of the financial pyramid. On the 164th day, the pyramid should be closed — we should stop buying shares and leave for somewhere out of this city.

We do not leave anywhere, we stay at our computer and, intending to invest money in some dubious enterprise, first we will calculate what can come of it. So we can easily return and even increase the money spent on purchasing the computer and its legal software.

If the model of the financial pyramid is extremely simplified, its solution can be reduced to solving a differential-integral equation — see Figure 15.20, where the initial growth of incomes of organizers is also visible, and then their decline.

Number of inhabitants in the city $N := 1000000$

Coefficient of excitement $KA := 10^{-7}$

Number of people who bought shares on the first day $NK_1 := 7$

y(x) - is the number of shares purchased at time t

Given

$$y(1) = NK_1 \qquad y'(t) = \left[KA\cdot\left(N - \int_1^t y(t)\,dt\right) - KA\cdot\int_1^t y(t)\,dt\right]\cdot y(t)$$

$y := \mathrm{Odesolve}(t, 365)$

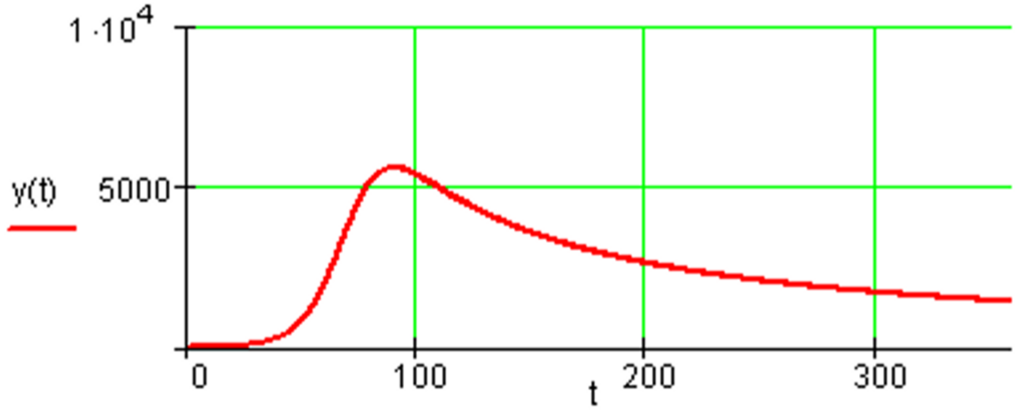

Fig. 15.20. Simplified mathematical model of the financial pyramid (only Mathcad 11)

Trading bitcoins and other crypto-currencies, by the way, has signs of a financial pyramid. On the other hand, all this is connected with attempts to find a substitute for the US dollar. The world financial equivalent can become energy resources.