Microeconomic Tools Application for Marketing: Health Care Expenses in the Modern Russia

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***Abstract*—This work examines a method of evaluating demand for a product based on using a function of utility to the consumer and his or her budgetary limitations. Studies of the market for a product presuppose an analysis of the demand function and the possible volume of sales. To that end people most often use statistical data and establish corresponding relationships. In the present analysis we propose combining the utility maximization problem with statistical data to form an algorithm for assessing the demand function. As an object for the application of the method we chose the pharmaceuticals market in the Russian Federation in 2011. The result obtained by the method is compared with known evaluations produced by marketing specialists.**

Keywords- expenditure pattern, utility function, pharmaceuticals, health care.

I. Introduction

The main task of marketing is to determine the volume of the specific product required by the consumer, to assess sales trends and the relationship between the given product and others that might replace it under certain circumstances [1, 2]. In particular marketing in the pharmaceutical sphere relies on data on the demand for pharmaceuticals and the financial resources of consumers of pharmaceuticals and medical services. We see two ways of constructing a demand function. The first is econometric, based on data on sales from pharmacies, i.e. time series of prices and quantities. This method is the main instrument employed in the Russian Federation (RF) [3]. However, even if one obtains such data, there is no possibility of modelling the links between the consumption of different pharmaceuticals with the aim of analysing the market as a whole. Besides, the correspondences of prices and quantities to time that are obtained will have a significant random component, since pharmacies cannot differentiate customers by priorities and material well-being. They record the integral (aggregate) demand for a particular pharmaceutical. It is also important that the introduction of new pharmaceuticals forces out old medicines to some degree and that “spoils” the time series model, rendering forecasts inadequate.

The second way of constructing a demand function is by modelling in a way analogous to micro-economic analysis, based on the introduction of utility and the consumer’s budget.

From the most common positions the modeling consists in performance of the following steps. For each illness the medicine list which can be useful in the course of treatment is formed. The consumer, having the limited budget, chooses for himself an optimum mode of "recovery". Thus the quantity of necessary medicines is defined at the set prices. Given probabilistic distribution of diseases it is possible to find the number of drugs for one consumer with the set budget. However, consumers differ in their budgets therefore the optimum modes will have restrictions because of material resources differences.

If previously estimate distribution of expenses to health care (HCE) on all society, then there is an opportunity to summarize necessary amounts of medicine by diseases and on groups of consumers with different budgets. Such solution will allow analyzing all picture of health care consumption. Special work will be devoted to this second way of modeling. For implementation of the designated project it is necessary to execute an intermediate action: to create function of demand for medicines for the citizens of the RF depending on their income and preferences. The following text below is devoted to this task only.

It is also necessary to specify that modeling was carried out at a proposed out-patient stage of providing citizens of the RF with medical care. So according to Ministry of Health, at an out-patient stage of rendering medical care 70% of citizens buy drugs for their own money [4].

Here it is important to note that the consumer not alone makes the decision on an optimum mode of treatment: he, as a rule, does not possess sufficient knowledge neither in medicine, nor in pharmaceutics, in economy. Moreover, children and incapacitated people can appear to be consumers. Doctors (the law of the third force) offer the consumer (patient) for his illness one or several modes of recovery using these or those drugs [5].

They either estimate financial means of a consumer-patient or discuss options with him.

Unfortunately, in a drugstore the change of doctor’s prescriptions is possible because of the absence of prescribed medicine or certain preferences of a pharmacist. But finally, the patient pays only that mode of treatment on which he has money.

In the present work we set ourselves the task of determining why the consumer in the RF spends on average a particular sum on medicines per month, and not more or less. The result evidently depends on the material well-being (disposable income) of the consumer and some level of utility from using the pharmaceuticals. The taking of a decision between modes of treatment can be formalized using the apparatus indicated above, that is to say, the optimal behaviour for a patient in given economic conditions (given prices for pharmaceuticals and patients' budget restrictions).

The most of papers devoted to the analysis of expenses of households, use methods whether problem of consumer (the Marshallian demand function) or the Hicksian approach, i.e. minimization of expenses at the utility conservation [6,7]. At this paper households base a choice of preferences on economic factors. In the last two decades scientific literature on marketing was enriched with methods of the psychological analysis of the consumer behavior [8-11]. In it demand functions with use not only purely economic, but also psychological and information factors are under construction empirically. It is more adequate approach, but it has insufficiently deep mathematical study that complicates its use.

Besides, our choice of a type of utility function can seem subjective that, certainly, affects result. However Kobb-Douglas type functions are well studied and are widely used in economic literature, for example, [11,12].

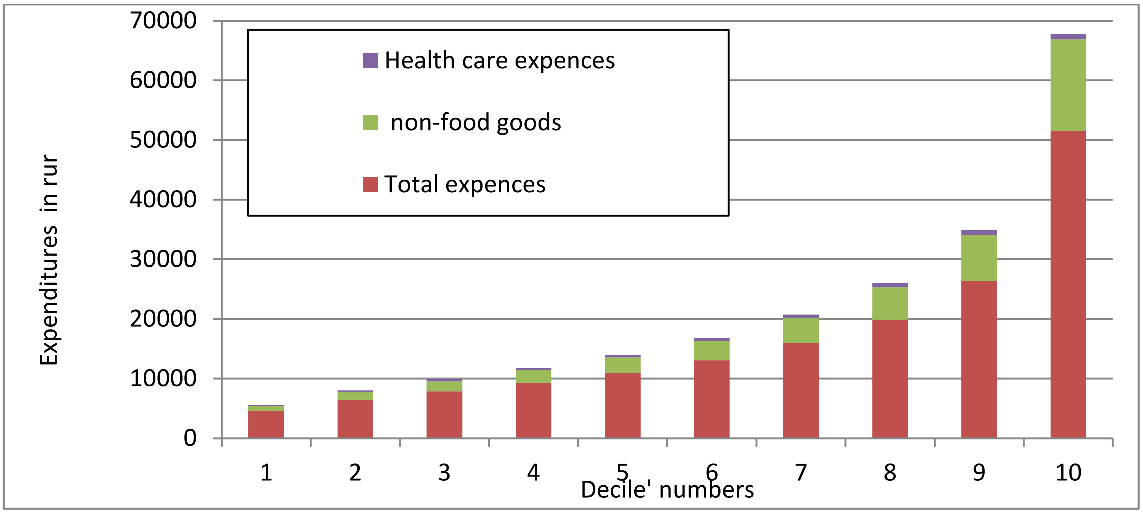
II. METHODOLOGY

In the present work we used official publications of statistical studies for the RF for 2011 [13]. The main thing was information about the structure and sizes of expenditures by Russian households with various levels of income. A household should be taken to mean an economic unit, consisting of one or more persons that supply the economy with resources (in particular labour) and uses the money obtained for them to purchase goods and services that satisfy human material needs. We defined the consumer of pharmaceuticals as a member of a household and we adduced his (or her) monthly expenditure in roubles across the whole spectrum of basic needs (including HCE). We know that in 2011 there were 142 million people living in the RF [14]. We further reckoned that decisions on expenditure in 2011 were taken by 142 million members of households (including children of all ages, the handicapped and invalids). Studies of households were carried out using special methodologies that, among other things, contained evaluations of margins of statistical error (for example, standard deviations) in both the absolute values of expenditures and percentage terms [13].

The main reason why the model obtained below was based on statistical data from "The Income, Expenditures and Consumption of Households in 2011" [13] was that that source gives averages for place of residence (or other factors) in the RF, but also indicates differences in the disposable income of household members (HHM). The entire population was arranged by increasing income and then split into groups of 10 per cent (deciles) with the mean income being calculated for each decile. As a result, the whole of society was divided up into ten groups with increasing levels of prosperity. For those groups we compiled tables of expenditures. The methodology we selected was founded on the fact that the average representative of each decile makes an optimal decision in accordance with his (or her) own budget limitations (different for each decile).

Table 1. Distribution of monthly income by deciles and expenditure on non-foods and medicines plus hygiene articles (all figures in roubles) [13].

Decile	1	2	3	4	5	6	7	8	9	10
Income (B_j)	4578	6453	7881	9336	10965	13044	15949	19897	26381	51487
Non-foods ($\bar{B}_j$)	866	1317	1669	2064	2598	3214	4222	5421	7694	15377
Medical goods and hygiene articles	192	266	326	369	434	505	568	656	795	906



Picture 1. The diagram of the expenses for different decile groups [13].

III. RESULTS

In microeconomics the "utility maximization problem" is the task facing the consumer – obtaining maximum utility within a given budget limitation [15]. If this problem can be solved, then it becomes possible to construct a demand function for a given product, which leads in turn to the prediction of expenditure depending on prices and the purchasing power of the population.

Specifics of a choice problem consist in comparison of various expenses for making decisions on the best expenditure but if data are obtained with big errors, and their absolute values are incommensurable, they cannot be compared. Certainly, any separate household does not address to statistical tables and formal comparisons to optimize expenses, but commensurable quantities of possible expenditures are, as a rule, taken into consideration.

It emerged [13] that household expenditure on health did not exceed 4% of all consumer spending (we only analysed the figures for 2011), while the possible error in the statistical study of the pattern of household expenditure ranged from 2% to 10%. That meant it was impossible to directly use the data from statistical reports to determine aggregate expenditure. We needed to carry out a detailed analysis.

This work proposes dividing the process of decision-making by the consumer (HHM) into several stages, so that the percentages of comparable expenditure were commensurable and exceeded the relative error of the statistical data. To that end we first solved the utility maximization problem at the upper level: all expenditures were divided into several large groups with roughly equal shares in the total budget and then in each group we examined a target item and formed a selection of items with a fractional share in the budget (for a group the expenditures obtained at the previous stage). If a target product's share in the budget was less than the relative error of the corresponding statistical data, then the process of extending the optimization tasks was continued.

Thus, consumer expenditure was divided into four major groups: foods, non-foods, services and other (including savings). Below is a hierarchy showing average statistical data across the RF (in the form of fractions with monthly expenditure per HHM above and the error, in the form of the standard deviation, below). The values are taken from Section 1.1 [13].

Available resources $\frac{16600\ RUR.}{2.1\%}$;

a. Expenditure on food $\frac{4078\ RUR}{1\%}$;

b. Expenditure on non-foods $\frac{4444\ RUR}{2.5\%}$;
   i. Expenditure on primary necessities: clothing, footwear, linen, fabrics, furniture, household care items and fuel $\frac{2159\ RUR}{2.5\%}$;
   ii. Expenditure on non-primary necessities: TV and radio equipment, leisure items, vehicles, building materials $\frac{1768\ RUR}{3\%}$;
   iii. Expenditure on pharmaceuticals $\frac{517\ RUR}{5\%}$;

c. Expenditure on services $\frac{2985\ RUR}{5\%}$;

d. Other expenditure $\frac{5093\ RUR}{3\%}$.

For these groups (a, b, c, d) we constructed a utility function and solved the utility maximization problem. In order to accomplish this, we had to introduce certain abstract concepts: units of an item in each group and the cost of those units. Additionally, proceeding from the statistical data and certain assumptions, we introduced minimum permissible quantities per month for one HHM. As is known, the ability to solve the utility maximization problem leads to assessments of price elasticity and budget size, in other words, one can ask questions in the directions indicated by Slutsky and Hicks [15]. Further, we included expenditure on pharmaceuticals in the non-foods group (i, ii, iii). For each type of expenditure we calculate its share within the group from known data [13]. All the characteristics are found as functions of the level of household budget. Aggregate expenditure over time and across the whole population of the RF provided the solution for the problem of HCEs.

It is necessary to make the remark concerning the statistical data which we used to solve the given problem: namely, in Goskomstat documents [13] there is not quite a certain and unambiguous classification for medicines and services on the market. So in one of the tables data on health care are provided in general, in another table medicines and sanitary products are given, and in the third one drugs, out-patient services and services of hospitals (the latter includes part of medicine in the cost) are appeared.

This situation did not give the chance to compare data of monitoring of the drugs market on other sources. In particular, according to DSM Group [3] in 2011 pharmaceutical market volume in the prices of final consumption equaled to 824 billion rubles that consisted of public sector of ready medicine – 226 billion rubles, pharmaceutical sector of parapharmaceutics – 130 billion rubles and commercial sector of GLS – 468 billion rubles ([3], Fig. 2).

There is a basic difference between Goskomstat and pharmaceutical market analysts monitoring: the general statistics of expenses of households is conducted on records of households by Gosconstat, unlike pharmaceutical market analysts who are guided by data of distributors, pharmacy networks, and hospital drugstores. Making entries about structure of expenses, an average consumer of drugs and medical services cannot separate in the general check how much money was spent services and how much on used materials and drugs, which discounts were at the expense of municipal and federal budgets, etc.

Besides, errors of data collection are so great that with 95% probability confidential interval of final total market volume reaches nearly 100 billion rubles ([13] the Section "Assessment of Accuracy of Separate Indicators"). All this reduces the value of final conclusions a little, but coincidence of orders of numbers confirms the offered algorithm adequacy.

IV. Formal Definition of the Problem

So, let us assume that a consumer had a budget B for the purchase in one unit of time (in our case one month) [13] of goods and services belonging to four categories – foods in the amount of x_1 units, non-foods (of all types) in the amount of x_2 units, services in the amount of x_3 units and other expenditure (including savings) the amount of x_4 units. Given prices for those goods and services of p_1, p_2, p_3 and p_4.respectively, we arrived at the consumer's budget limit:

$$p_1x_1 + p_2x_2 + p_3x_3 + p_4x_4 = B. \quad (1)$$

Utility from acquisition of any quantities of goods is defined for a consumer by some utility function $u(x_1,x_2,x_3,x_4)$ which has to satisfy the following properties: acquisition of each following commodity unit brings to a consumer benefit, i.e. $\frac{\partial u}{\partial x_i} > 0$; besides, on the set of variables determined by the budgetary restriction (1), the utility function has to reach the greatest value at the single point.

The first property is interpreted as a reasonable choice of a consumer (acquisition of each following commodity unit is desirable for a consumer). The second property guarantees the existence of an optimum choice to a consumer and this choice is unique what guarantees the acceptance of exactly this decision [15].

In the proposed model the following analysis is based on a very simple power function:

$$u(x_1, x_2, x_3, x_4) = (x_1 - \varepsilon_1)(x_2 - \varepsilon_2)^{\propto}(x_3 - \varepsilon_3)^{\beta}(x_4 - \varepsilon_4)^{\gamma} \quad (2)$$

Further we obtained by a single way the greatest value for the utility function (2) for a budget limitation (1).

For this purpose Lagrange's function was applied

$$L(x_1, x_2, x_3, x_4, \lambda) = u(x_1, x_2, x_3, x_4) + \lambda(B - p_1x_1 - p_2x_2 - p_3x_3 - p_4x_4). \quad (3)$$

Derivatives of Lagrange's function in relation to the variables x_1, x_2, x_3, x_4 were calculated and equated to zero. As a result linear system of equations concerning x_1, x_2, x_3, x_4 was received. Having solved it, we received the greatest value of the utility function (2) on the budgetary restriction (1):

$$x_1^* = \varepsilon_1 + \frac{B - B_0}{p_1(1 + \alpha + \beta + \gamma)}; \quad x_2^* = \varepsilon_2 + \frac{\alpha}{p_2}\frac{B - B_0}{1 + \alpha + \beta + \gamma};$$
$$x_3^* = \varepsilon_3 + \frac{\beta}{p_3}\frac{B - B_0}{1 + \alpha + \beta + \gamma}; \quad x_4^* = \varepsilon_4 + \frac{\gamma}{p_4}\frac{B - B_0}{1 + \alpha + \beta + \gamma}. \quad (4)$$

Here $B_0 = \sum_{i=1}^{4} p_i\varepsilon_i$ – the minimum budget of HHM.

We will stop on interpretation of B_0, ε_i from the economic point of view in slightly more detail.

Food products, non-food products and services (education, housing, medicine, etc.) for a consumer are vital in the sense that at zero value of any of them HHM dies owing to the lack of food, clothes, medical assistance, etc.

The material provision of the smallest consumption levels in society is assigned to relatives, friends and, of course, to the state which from the budget finances orphanages, nursing homes, grants to needy families, minimum medical support in the form of free drugs, inspections or hospitalization.

As the authors did not find certain values for the minimum quantities ε_i in scientific literature, they estimated them as follows. According to the table B "Distribution depending on level of average per capita located resources on 10 percentage (decile) groups of the population" ([13], the Section I, paragraph 1.1) the "poorest" HHM has ratios between expenses by the rule:

$$p_1\varepsilon_1 : p_2\varepsilon_2 : p_3\varepsilon_3 : p_4\varepsilon_4 = 1927 : 866 : 1077 : 708.$$

Further, we calculated quantities ε_i so that B_0 was 5 times less than the minimum living wage which is officially determined by the Government of the RF by its decrees annually. For example, in 2011 the minimum living wage equaled about 6370 rubles a month on one HHM. Then, according to the assumption, it was considered that for 2011 B_0 =1274 of rubles.

But it is impossible to receive quantities ε_i since measure units of all four considered goods and their prices were not entered. For the definition of units of generalized products and simplicity of a statement we considered that the level of the minimum living wage corresponds to the unit of consumption of each of four goods at the prices connected by the relation (it is received from table B [13], the Section I, paragraph 1.1 for the second decile):

$$p_1 : p_2 : p_3 : p_4 = 2570 : 1317 : 1437 : 1129.$$

Now it is possible to calculate quantities ε_i and p_i prices. According to the last relation we receive proportionality ratios:

$$p_1 = 2570\mu;\;\; p_2 = 1317\mu;\;\; p_3 = 1437\mu;\;\; p_4 = 1129\mu.$$

And we chose coefficient of proportionality from condition

$$p_1 + p_2 + p_3 + p_4 = 6370,$$

i.e. $\mu = 0{,}987$, that leads to final level of the generalized prices:

$$p_1 = 2537;\; p_2 = 1300;\; p_3 = 1418;\; p_4 = 1115. \qquad (5)$$

To estimate quantities ε_i, we applied extrapolation in the direction of reduction from the first two deciles to data on expenses. As the assessment did not need the maximum accuracy, it was possible to use linear extrapolation. Omitting trivial expressions for formulas of linear extrapolation from the relation of expenses we received final values of quantities ε_i:

$$\varepsilon_1 = 0{,}03;\; \varepsilon_2 = 0{,}41;\;\; \varepsilon_3 = 0{,}21;\;\; \varepsilon_4 = 0{,}32. \qquad (6)$$

Thus, $B_0 = 1274$.

Using formulas (4) and (6) we received the demand functions for goods from four large groups which could be analyzed from the point of view of one product replacement by others at the change in price.

$$x_1^*(B_j, p_i) = 0{,}03 + \frac{B_j - 0{,}03p_1 - 0{,}41p_2 - 0{,}21p_3 - 0{,}32p_4}{p_1(1 + \alpha + \beta + \gamma)};$$

$$x_2^*(B_j, p_i) = 0{,}41 + \frac{\alpha}{p_2}\,\frac{B_j - 0{,}03p_1 - 0{,}41p_2 - 0{,}21p_3 - 0{,}32p_4}{1 + \alpha + \beta + \gamma};$$

(7)

$$x_3^*(B_j, p_i) = 0{,}21 + \frac{\beta}{p_3}\,\frac{B_j - 0{,}03p_1 - 0{,}41p_2 - 0{,}21p_3 - 0{,}32p_4}{1 + \alpha + \beta + \gamma};$$

$$x_4^*(B_j, p_i) = 0{,}32 + \frac{\gamma}{p_4}\,\frac{B_j - 0{,}03p_1 - 0{,}41p_2 - 0{,}21p_3 - 0{,}32p_4}{1 + \alpha + \beta + \gamma}.$$

For our work the second of four received functions of demand is necessary only. Actually, it gives the budget restrictions for the second stage of the task: $\bar{B}_j = x_2^*(B_j, p_i)$.

It is achieved with quantities that have a linear relationship to the budget. We shall cite only the equation for the quantity of non-food goods.

$$x_2^* = \varepsilon_2 + \frac{\alpha}{p_2}\frac{B - B_0}{1 + \alpha + \beta + \gamma}; \qquad (3)$$

Here $B_0 = \sum_{i=1}^{4} p_i \varepsilon_i$ is the minimum budget of a HHM. Inputting positive parameters $\propto, \beta, \gamma > 0$ and $\varepsilon_i > 0$ provided the consumer with the minimal acceptable quantity of all goods and established a differing level of utility for different goods. From the definition of prices for a unit of pharmaceuticals we obtained the unknown parameters: $p_1 = 2537;\; p_2 = 1300;\; p_3 = 1418;\; p_4 = 1115;\; \varepsilon_1 = 0{,}03;\; \varepsilon_2 = 0{,}41;\;\; \varepsilon_3 = 0{,}21;\;\; \varepsilon_4 = 0{,}32. B_0 = 1274$.

The last formula containing the values found for the parameters expresses the demand function for non-foods that we require for further analysis.

Fig. 1 shows a graph of actual data and values given by the model. The parameters of α, β and γ were selected so as to make the modelled line approximate in the best possible way to the statistical data. It turned out that such a selection can be made and that only one meets this condition. In our example the optimal parameters are α = 1.52, β = 0.8 and γ = 2.1.

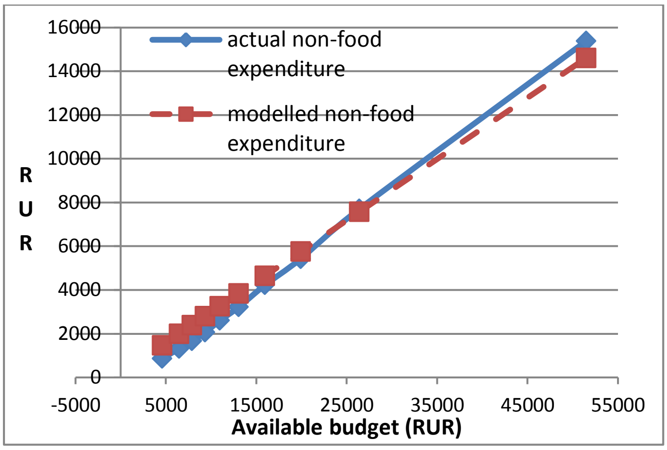


Fig. 1. Actual [13] and modelled distributions of expenditure in the pattern of households

V. ESTIMATION OF EXPENDITURE ON HEALTH CARE.

In the present work we evaluated the share of pharmaceuticals and hygiene articles within the group of non-foods, as their share within disposable expenditure or consumer expenditure is too small, being commensurate with the margin of error of the statistical data (2% to 10%). Thus the aim of the next reasoning and deductions lay in transforming the demand function for the whole non-food group into a demand function giving expenditure on pharmaceuticals and hygiene articles.

We created three sub-groups within the non-food group, with pharmaceuticals and hygiene articles being one of them. This division is simply a convenience, but at the moment of deciding how to redistribute expenditure a HHM's preference may be affected by a great variety of factors, even including ethnicity or the geographical location of the household. The first sub-group comprised expenditures on primary necessities: clothing, footwear, linen, fabrics, furniture, household care items and fuel. Other goods, apart from pharmaceuticals, were placed in the second sub-group, as non-essentials. Finally, the third sub-group comprised pharmaceuticals and hygiene articles. This division is shown as sub-groups i, ii, iii of group b in the hierarchy given earlier. The data have been assembled in Tabl. 2.

Table 2. The distribution of actual expenditure by decile groups in rows 3–5 [13], modelled data in the bottom three rows (all figures in RUR)

1	Decile	1	2	3	4	5	6	7	8	9	10
2	Non-food budget	866	1317	1669	2064	2598	3214	4222	5421	7694	15377
3	Subgroup i expenditure	490	753	961	1202	1512	1884	2495	3095	3773	4786
4	Subgroup ii expenditure	184	297	382	492	652	825	1159	1669	3126	9685
5	Subgroup iii expenditure	191	267	326	369	434	505	568	656	795	906
6	modelled i	1007	1144	1251	1371	1534	1721	2028	2392	3084	5421
7	modelled ii	-471	-178	50	306	652	1051	1703	2480	3952	8928
8	modelled iii	330	351	368	387	413	443	491	549	658	1028

The utility maximization problem for the three sub-groups was formulated with the same kind of demand function as (2). Moreover, leave the same designations for the variables and the parameters:

$$u(x_1, x_2, x_3) = (x_1 - \varepsilon_1)(x_2 - \varepsilon_2)^{\propto}(x_3 - \varepsilon_3)^{\beta}. \quad (8)$$

The budgetary restriction has an appearance (1), but for three subgroups of goods:

$$p_1 x_1 + p_2 x_2 + p_3 x_3 = \bar{B}. \quad (9)$$

Here $\bar{B}$ denotes expenses on non-foods. For various decile groups they are different.

Now it was again necessary to examine the question of prices and units of measurement for the input generalized goods. We repeated the method used for the top-level expenditure groups (a, b, c, d). It was assumed that the third decile with its expenditure on the non-food group of 1669 roubles per month per HHM would purchase a single unit of goods in each of the sub-groups. Thus we obtained $p_1 = 961$; $p_2 = 382$; $p_3 = 326$. The calculation of parameters $\propto, \beta > 0$ and $\varepsilon_i > 0$ was carried out as before. So we arrived at rough figures for the parameters in the model of $\varepsilon_1 = 1.28$; $\varepsilon_2 = 0$; $\varepsilon_3 = 1.12$.

By analogy with the solution for the top-level groups we obtained demand functions for goods in the three sub-groups that could be analysed with regard to the replacement of one item by others in the event of price changes.

$$x_1^*(\bar{B}_j, p_i) = 1{,}28 + \frac{\bar{B}_j - 1{,}28p_1 - 1{,}12p_3}{p_1(1 + \alpha + \beta)};$$

$$x_2^*(\bar{B}_j, p_i) = \frac{\alpha}{p_2}\frac{\bar{B}_j - 1{,}28p_1 - 1{,}12p_3}{1 + \alpha + \beta};$$

We need only the third demand function:

$$x_3^*(\bar{B}_j, p_i) = 1.12 + \frac{\beta}{p_3}\frac{\bar{B}_j - 1.28p_1 - 1.12p_3}{1 + \alpha + \beta}.$$

The indices of the powers in the utility function were calculated in such a way as to get the last formulae to approximate in the best possible way to rows 3, 4 and 5 of Table 2. As a result we obtained values of $\propto = 2.13$; $\beta = 0.158$.

In the following fig. 3 the result of approximation of real data on medicines by model data (the continuous line – real data, and dashed – model) is shown.

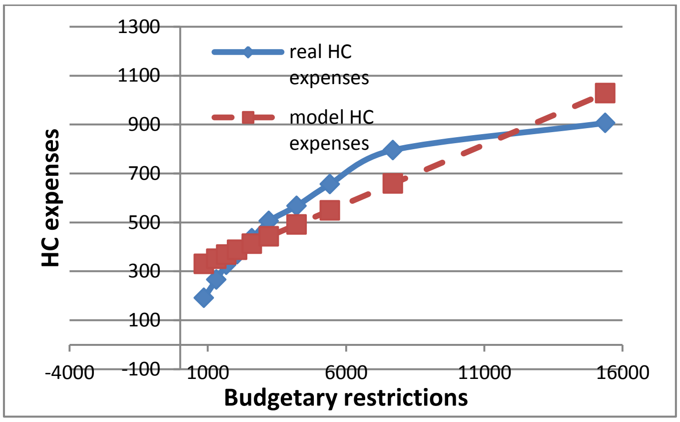


Fig. 3. Image of these data in tab. 2 (line 8 and 11), as functions corresponding to budgetary restrictions [13].

The continuous line reflects the real data of expenses on medicines and sanitary products, and the dashed line is the result of modeling of demand function for HC.

Note. Statistical data on the first and on the last decilies significantly distorted the picture since in the first, "poor" decile absolutely low-profitable HHM got and averaged with a little more well-off, but situation in the last "rich" decile is much more contrast, where among 14 million HHM there was an extra rich group with the income over 10 million rubles a month and making less than 1% decile. If to exclude this group from consideration, i.e. to remove 0,1% of extra rich members from the considered population, then the received approximations shown in fig. 2 were much more adequate.

Total expenditure on pharmaceuticals across the RF in 2001 was obtained by adding up the monthly figures per decile across the whole population of the country (142 million). The total of row 5 in Table 2 (actual statistical data) coincided absolutely precisely with the data from the model, given in row 8 of the table: 855.2 billion roubles over the year. This is slightly more than the figure of 824 billion, which is known from the statistics but considering the imprecision of the statistical data we consider the result adequate.

The last formula made it possible to analyse how total expenditure on pharmaceuticals and hygiene articles changes if prices for those goods decrease or increase. It turns out that for a 1% change in prices total expenditure changes in the same direction by 0.69%. In economic theory such a relationship corresponds to elasticity of expenditure on pharmaceuticals with regard to consumer prices. We would point out that such an analysis is impossible if one relies solely on statistical report data or monitoring of the pharmaceutical market.

VI. CONCLUSION

On the whole consumer choice turns into the demand for pharmaceuticals across the country. As we know from microeconomic analysis, the demand functions obtained make it possible to analyse the elasticity of expenditure on pharmaceuticals, the substitutability of products and the influence of the inflation rate on total expenditure. If the goal of the works was to assess total expenditure for medicinal purposes, then it would be sufficient to use the statistical data [13]. Even the task of arbitrarily subdividing the population in respect of expenditure data could be tacked more simply – by the construction of piecewise-linear approximations. Evidently the bottom two and top two deciles represent a special object for research, as the polarization of incomes is too extreme in the RF.

In Fig. 3 it is visible that the last two points of schedules show considerably heavy expenses on non-foods at households. In this sense the consideration of different models on population groups is of interest, for example, one fifth of "poor" group, three fifth of a middle part and one fifth of "rich" group can be considered. It is clear, that on this way more exact results can be received.

The work entailed an assessment of expenditure on pharmaceuticals by households in the RF in the year 2011. Since the statistical data have considerable degrees of imprecision, direct comparison of the available information is not a viable option. It is all the more problematic to examine possible changes in the market of goods and services. This produced the need to split all the expenditure data into a hierarchy of groups and to solve the utility maximization problem for each group. As a result we obtained corresponding demand functions for medical goods and carried out general evaluations of expenditures. This information can be successfully called upon by pharmaceutical companies and the health-care management system. This is especially relevant in a situation where the state reimburses expenditure on pharmaceuticals only to a limited extent and a lack of an insurance system for medicines.

It is a known fact that as a household's income grows, the proportion of expenditure going on food decreases, although the absolute figure of course increases. A similar picture is found with expenditure on medicines and hygiene articles: their share of overall expenditure decreases, but in absolute figures the outlay increases. The wealthier members of society spend large sums on pharmaceuticals, disregarding prices but demanding high quality and effectiveness. Considering the presence on the pharmaceutical market of both original drugs and generics, it is interesting to examine the market volumes for three sections of the population: the bottom five deciles (71 million people), the next three deciles (42.6 million) and the top two (28.4 million). Using row 8 of Table 2 we obtain annual pharmaceutical market volumes for these sections of the population of 271 billion, 295 billion and 290 billion respectively. Obviously the first group, being less well-off, will look to a greater extent towards generics that cost much less and, thus, in terms of quantity their 271 billion will buy a far greater amount of pharmaceuticals than the similar outlays of the other groups. For example, if the original drug costs five times as much as the equivalent generic, the amount of the medicine consumed by the first, "poor", group will be five times greater than the amount consumed by the third, "wealthy", group.

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