ISSN 1392–1258. Ekonomika. 1996. 41

A SURVEY OF HOUSEHOLD INCOME DYNAMICS IN LITHUANIA (THE SEASONAL ASPECT)

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Households constitute one sector of the economy which is singled out in the National Account System (NSA). An important statistical indicator of a household is the income their members receive for their labour independent activities, in profit and in kind, for the capital owned, in interest, dividends, etc., and in the form of transfers (allowances, pensions, charity).

After deducting direct taxes and payments into the funds of social insurance and pensions, the disposable income is received and may be used for the acquisition of consumer goods and services, as well as for saving purposes. The household income reflected in various aspects may be a good indicator of the country's standard of living and its changes.

In the article, methods for the determination of regularities in the variation of household income were reviewed and the dynamics of household income were examined in the course of five years by revealing its seasonal prevalence. Seasonal fluctuations of income were evaluated and attempts were made to apply spectral analysis for the determination of constituents of periodicity.

It should be noted that, not infrequently, the pace and direction of income represented in official statistics become a means of argumentation in political debates, the object of which is to evaluate decisions made by one government or another. The increase or decrease of household income observed in the course of some months does not necessarily signify certain general tendencies. It does not do to judge the efficacy of decisions made by state authorities according to these increases and decreases. Changes in household income may be a simple manifestation of seasonal prevalence.

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For this very reason, it is extremely important to single out all the most significant constituents of income dynamics: the trend, seasonal, or random fluctuations.

So far, the seasonal fluctuations were almost never reflected upon nor considered in the official statistics of Lithuania.

1. Indicators of Household Income. Owing to the different number of members in the household, official statistics express the level of disposable income by the average disposable income per member of household (ADI). The period in which the household income is calculated is usually one month. The household income may be calculated for a particular month, or as a monthly average in the course of a quarter or a year.

The real changes in household income may be calculated only after the elimination of the inflation effect; further, both indicators are changing at a different pace (fig. 2).

In this case, a well-known scheme may be applied: the index of nominal income is divided by the price index for consumer goods and services. Both indices should refer to the same period.

Dynamic of Household's Average Monthly Disposable Income

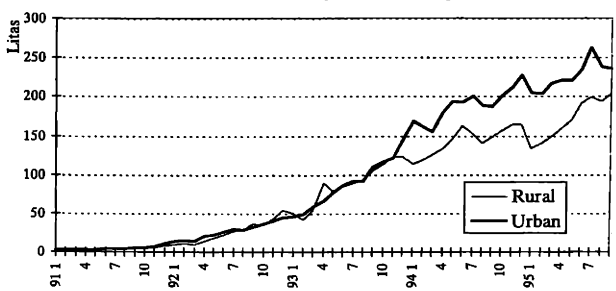

Fig. 1.

Until 1992, the data on a population's income were received by examining family budgets. In 1992, a transition was made from family budgets to household surveys according to a new programme and newmethods. Approximately

one and a half thousand households were surveyed, having been selected with the help of the stratified three-stage sample method applied by the place of residence and family size. In 1995, approximately 1,250 households were surveyed. A rotation of households under examination also took place.

Dynamics of Household Average Disposable Income(ADI) and Prices for consumer Goods and Services (CPI)

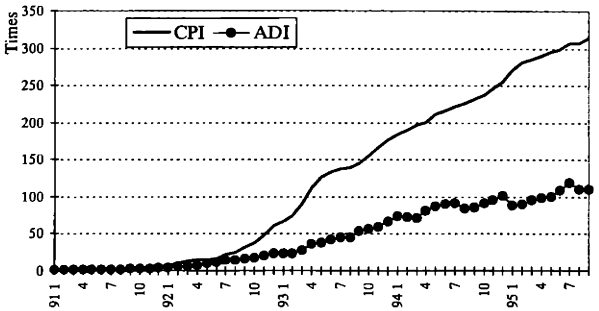

Fig. 2.

Notes: 1) CPI and RII are calculated with respect to December 1990.
2) Untill July 1993 ADI was expressed in roubles and talons. Here it is converted into litas.

Due to populations' frequent reluctance to supply information about the sources of its income and its size to statistical authorities, the indicator of the income level was received smaller than exists in reality. Households which receive an especially great income avoid providing these data. Nevertheless, the data obtained represent rather well the general tendencies and periodical fluctuations of change in household incomes (so much as monthly data may reflect).

According to the data of household surveys performed, the cash income and, therefore, the disposable income per member of a household is increasing. In the third quarter of 1995, the average cash income per member of household was 265 Lt per month, in urban households, 291 Lt and in rural, 213 Lt.

The growth of disposable income outpaced the advance of prices in some periods only after the introduction of the litas. In the course of this period, the household real income has somewhat increased, however, insignificantly, and in the last months did not make 40% versus December 1990 (fig. 2.). The low level of rural real income may be accounted for by the fact that many agricultural partnerships broke down, and the farmers who established themselves in these places are not yet economically sound.

Dynamics of Household Real Income

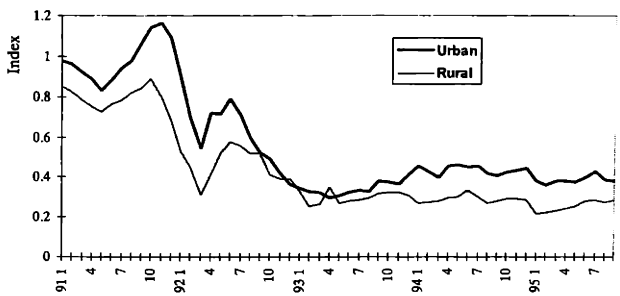

Fig. 3.

Note: The index of December 1990 is equal to one.

2. The Tasks of the Survey on Seasonal Prevalence and a Review of Methods. The decrease of household income in August (fig. 1) cannot be regarded as a new tendency. It is, rather, a seasonal prevalence of household income. Seasonal fluctuations are here called periodical fluctuations which are, directly or indirectly, related to the seasons of the year, progressing one after another. These fluctuations may be determined by having in one's disposition, indicators of quarters, months, or even shorter periods. The row of indicators should, in fact, cover a period of not less than four years.

The first image of seasonal fluctuations (the seasonal wave) may be obtained by averaging the values of indicators for months of the same name.

Dynamics and Seasonal Prevalence of Household Disposable Income

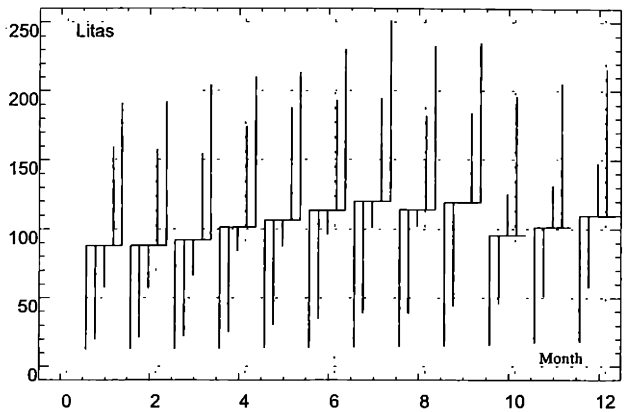

Fig.4.

Note: This chart represents not only the level of household disposable income in each month, but also the character of seasonal prevalence (the horizontal dots represent the average level of income in a particular month, thus making a seasonal wave, and the vertical dots represent the level of housechold disposable income of the current month in a respective year).

In social-economic surveys, the seasonal aspect is rather multi-sided. During the survey not only should the character of seasonal fluctuations be determined (it is reflected by the so-called seasonal wave), but also the intensity of fluctuations. The degree of concentration measured, the evolution of the seasonal wave described, and its factors and sometimes constituents which correspond to different cycles of periodical fluctuations should be determined. Seasonal fluctuations are, not infrequently, determined for

the purpose of their elimination (filtration), in order to make other constituents of the time series more distinct; the trend and the cycles of conjuncture. Sometimes the elimination of calendar non-uniformities is inevitable, for instance, when values of the so-called interval (flow) indicators differ, owing to the different number of days in some months.

The importance of seasonal surveys in social-economic processes is beyond any doubt, since the very existence of this phenomenon and, in particular, the unawareness of this phenomenon or its disregard may often cause negative consequences and other consequences: the uneven workload of workers and equipment; additional expenditure for safeguarding or storing purposes; the uneven movement of the circulating capital. The seasonal prevalence of household incomes depends upon the sphere of circulation and on production, although indirectly. Therefore, while making decisions at different levels, one ought to know the character, intensity, direction of evolution, and the factors of the seasonal fluctuations. One also ought to evaluate the consequences caused by them. Based on such information, more detailed forecasts of indicators may be worked out in order to soften the negative consequences of seasonal prevalence, and to adapt to seasonal conditions when its is impossible or inexpedient to eliminate the seasonal prevalence as a phenomenon.

To solve the problems of seasonal analysis related to household income, the following statistical methods or groups of methods and statistical procedures may be suggested to begin with:

Methods for determining indices of seasonal prevalence (methods of arithmetical averages, medians, Pearsons, Struck methods, etc.).

Use of variational measures for measuring the intensity of seasonal fluctuations.

Use of Lorenz curves for evaluating the concentration of seasonal fluctuations. (The maximal concentration appears when the yearly volume is realised in the course of one month, e.g. trade in Christmas tree decorations; zero concentration means absolute equality. Usually, the seasonal prevalence of high concentration causes more important economical consequences).

Use of moving averages, least squares, and moving functions for the elimination of the trend and, isolating by this, the constituent of seasonal prevalence.

Application of the Furrier series and spectral analysis for isolating periodical fluctuations of different cycles (a cycle of fluctuations may take from two to twelve months) and longer cycles. So-called cycles of conjuncture fluctuations may be reflected as well.

It should be noted that opportunities to use these methods for the examination of seasonal prevalence in the Lithuanian household income are rather limited for the fact that the statistical information is not abounding (due to the period surveyed that was too short in duration).

Application of correlation regression methods, as well as the cross spectral analysis for the examination of the factors of seasonal prevalence and relations of its constituents. The correlation methods may be used to evaluate the degree of typicalness for the average seasonal wave (the wave's similarity to the average in one particular year).

For the examination of seasonal fluctuations, the immediate task is their diagnosing, i.e. determining (measuring) their character and intensity. This analysis is designed just for this aspect of seasonal prevalence.

In social-economic surveys, the seasonal prevalence is expressed in two ways: it is expressed by absolute or relative deviations subject to the form by which the amplitude of fluctuations is more stably expressed in the period surveyed. When changes in the amplitude of fluctuations are very great, the logarithmic scale may be applied as well.

Perhaps the most acceptable form of seasonal prevalence in economical indicators are seasonal indices (coefficient Z_i). In the simplest cases, they are calculated in the following manner:

$$Z_i = \frac{12 \sum_{j=1}^{m} y_{ij}}{\sum_{j=1}^{m} \sum_{i=1}^{12} y_{ij}}, \qquad (1)$$

Yij is the level of indicator in *i* month of *j* year, *m* is the number of years.

The principle of *structural relative quantities* may be applied as well, when the yearly volume of the indicator is equal to 100 per cent, and when the average level of one month makes 1/12, without taking into consideration the seasonal prevalence.

The method of simple averages is not, however, appropriate for a description of the seasonal prevalence in household disposable income, due to a general tendency of its growth, which signifies that, even in the absence of seasonal prevalence year after year, the level of monthly income in December is higher than that in January (fig. 1). In this situation, the seasonal fluctuations should be examined with respect to the trend, but not to the *total* average. As mentioned above, the latter may be determined with the help of various methods; moving averages, least squares, moving functions, etc. (fig. 6.).

To determine the seasonal constituent, the method of moving parabolas is very useful. It was suggested by S. Bobrov in 1930 for smoothing the series of dynamics. Its scheme is as follows:

Monthly (quarterly) average levels are calculated individually for each year.

Parabolas of second degree are calculated for the first four years with the help of the least squares method. Then, moving by one year, the same is calculated for the other four years, the procedure being proceeded analogically to the principle of sliding averages.

Smoothing of the Average Disposable Income Series

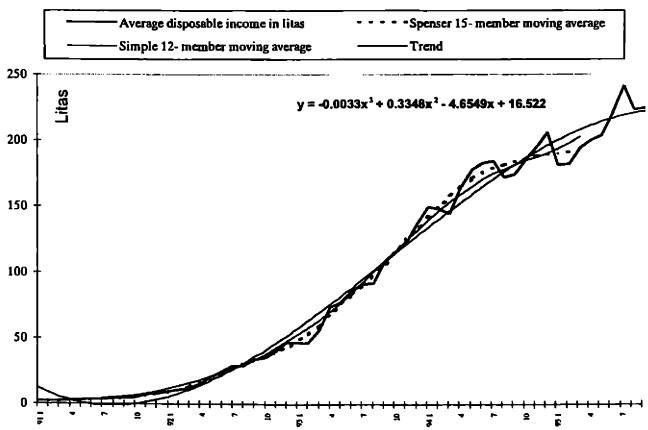

Fig. 5.

For each year, starting with the third year, the monthly (quarterly) values are interpolated according to the function received.

From the received smoothed values in all three or four parabolas, the arithmetical averages are calculated for each month individually, and these arithmetical averages are smoothed values for all periods surveyed, except for the ends of the series of dynamics.

To smooth the ends of time series, according to S. Bobrov , two functions may be used; the linear function and the second order. For averaging the values of the indicator which were received by these functions, the following weights should be taken: For the last but one year: for a straight line, 0.4, parabola, 0.6, and for the last year, 0.8 and 0.2, respectively (6; 477).

The method for smoothing the series is a rather effective filter for the elimination of the trend and long- term fluctuations, as it creates good preconditions for obtaining the pure wave of seasonal prevalence. It is a pity that, for the time being, this method of smoothing cannot be used for the examination of household income dynamics, due to the period surveyed which is too short in duration.

When the trend is calculated, the seasonal indicators may be estimated by various methods. However, with the aim of forecasting the seasonal prevalence, it is very important to use differential fluctuations of individual years, i.e. the summarized seasonal wave should be more influenced by fluctuations of recent years than of earlier years. It should be acknowledged that the seasonal fluctuations almost always undergo an evolution, more or less, but the "breaking" points are sometimes not determinable. Therefore, the fluctuations of some years should be weighted, taking into account their "age."

The simplest principle is to apply special coefficients calculated for each year individually (for j year from m number):

$$C_j^m = \frac{1}{m} \sum_{k=1}^{j} \frac{1}{m - k + 1} \qquad (2)$$

It is obvious that the total of these coefficients equals 1. Therefore, it suffices to multiply the deviations for a given month of an individual year by the coefficients of individual years, where Y_{ij} are the values smoothed by some method or other.

$$z_i = \sum_{j=1}^{m} \frac{y_{ij} C_j^m}{\hat{y}_{ij}}, \qquad (3)$$

For the valuation of the seasonal prevalence of household income, the principle of *prescription* may be realised in another way, too.

When you have in your disposition, smoothed values of the indicator, then it is expedient to use the following formula, where Yij are smoothed values.

$$z_i = \frac{\sum_j y_{ij}}{\sum_j \hat{y}_{ij}} \qquad (4)$$

One should bear in mind that:

$$z_{ij} = \frac{y_{ij}}{\hat{y}_{ij}} \quad \text{and then} \quad z_i = \frac{\sum_j z_{ij} \hat{y}_{ij}}{\sum_j \hat{y}_{ij}} \qquad (5)$$

In other words, the arithmetical weighted average is realised when the smoothed values are taken as weights. If the indicators show the tendency of increase, then the deviations Z_{ij} of the last year are evaluated by apportioning greater weights. With the help of the latter scheme, the seasonal indices for urban and rural household average disposable incomes were evaluated (Table 1, Figure 6).

3. Results of the Survey on Seasonal Prevalence. Having generalized the data of the last four years, seasonal fluctuations both for rural and urban household disposable monthly incomes revealed themselves

From Fig. 6. it is clearly seen that households receive the greatest income in June and December, and the smallest in March and August. It may be easily explained from an economical standpoint. At the beginning of summer, the urban households receive a greater income, since, at that time, employee leaves carry a mass character (usually, employees receive both monthly wages and compensations for their leaves), and, in December and January, they are paid premiums (bonuses) for yearly results, etc. In the

Table 1. Seasonal Indices for Household Average Disposable Monthly Income (in per cent)

Month	Rural	Urban
January	93.4	104.3
February	89.1	98.8
March	86.2	94.4
April	104.7	104.5
May	102.4	105.7
June	108.0	108.3
July	103.5	102.5
August	98.1	92.4
September	103.6	94.0
October	100.3	94.3
November	103.5	96.2
December	107.4	104.6

Seasonal Prevalence of Household Disposable Income per Member

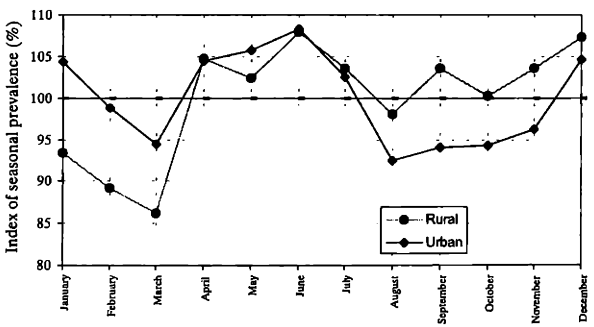

Fig. 6.

beginning of summer, the rural households also receive a greater income from household farming (for instance , milk purchases from the population increase greatly), and, at the end of the year, the income increases due to livestock sold. Furthermore, the seasonal prevalence in rural households is

more strongly expressed, judging by the variatonal coefficients of the seasonal indices (The intensity of seasonal fluctuations for urban household income reaches 6 per cent, and for rural income, even 11 per cent).

Both the change in level of real income and its seasonal prevalence are conditioned by inflation processes. The inflation, reflected by indices for consumer goods and services, also carries a distinctly seasonal character. Only the seasonal prevalence of inflation is opposingly directed (fig. 7).

As seen in fig. 7, the seasonal prevalence of inflation softens the seasonal prevalence of real income, however, it does not entirely annul it. The intensity of the fluctuations of this indicator expressed by a variational coefficient of seasonal indices for urban households reaches 5.3 per cent, and for rural households, 6.7 per cent.

Seasonal Prevalence of Average Disposable Income and CPI (in %)

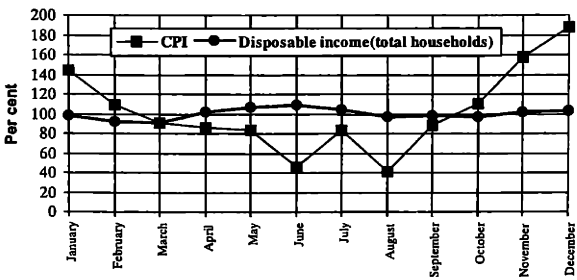

Fig. 7.

The seasonal indices show that the drop of real income both in urban and rural households takes place in March and April (fig. 8).

4. Spectral Analysis of Household Income. To the aim of deeper examination of fluctuations in the level of household income, the principle of harmonic analysis may be applied. It helps to detect hidden fluctuations. It is clear that the seasonal wave is only one of several forms by which

Seasonal Prevalence of Household Real Income.

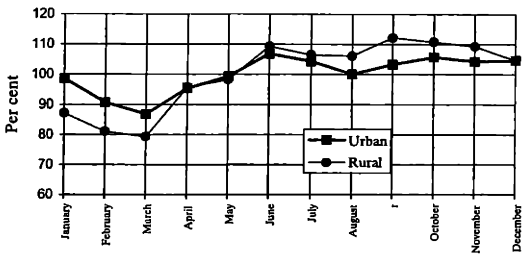

Fig. 8.

periodical fluctuations are manifested. On the other hand, the seasonal wave may be the only final result caused by various periodical fluctuations measurable on the monthly time scale. However, fluctuations of different cycles are caused by different factors. Therefore, even the one-measure harmonic analysis helps one, not infrequently, distinguish the factors of periodicity or at least frame a respective hypothesis which can be checked by other statistical methods afterwards. For a survey of processes under examination, one method of harmonic analysis may be suggested, i.e., the *spectral* analysis.

We shall discuss in short the most general features of the spectral analysis for the economical time series. As the theory and practice of this method shows, one can expect good results only when having a sufficiently long time series (200 or more observations), and when the latter reflect permanent processes.

From the standpoint of the stationarity of the series, judging even by the charts available, the dynamics of the average household disposable income is clearly not a stationary process, whereas that of the real income is only approximately a stationary process (fig. 1 and 3).

Therefore, first of all, a filtration of time series should be performed. For the series of total average household disposable income, a parabola of third order was used (fig. 5.). Thus, statistical estimates of spectral density

are calculated out of the deviations from the determined trend. The statistical estimates of spectral density are expressed by the empirical autocorrelation function r(K). The simplest estimate of spectral density is the following:

$$\hat{p}(f) = 2[1 + 2\sum_{K=1}^{L-1} r(K)\cos(2\pi fK)], \quad 0 \le f \le 1/2. \tag{6}$$

It is very important to choose an appropriate parameter L, i.e. the time lag. When it is exceeded, an insignificant correlation appears. The author's experience in working with economical time series dictates that 20-30 per cent of the time series' length should be taken. For a shorter series, the time lag should be respectively shorter. For L values that are too small, biased values may be expected, whereas for that are too high, valves "false" peaks may be received for spectral density estimates (local maximum points).

The estimates may be improved by introducing the so-called "windows." For the processing of the economical time series, most often, Parsen "windows" (weights) are used (8; 68):

$$g(K) = \begin{cases} 1 - \dfrac{6K^2}{L^2}\left(1 - \dfrac{K}{L}\right), & 0 \le K \le \dfrac{L}{2}; \\ 2 - \left(1 - \dfrac{K}{L}\right)^3 & \dfrac{L}{2} \le K \le L. \end{cases} \tag{7}$$

When using Parsen weights, the final modification of the spectral density function is the following:

$$\hat{p}^*(f) = 2[1 + 2\sum_{K=1}^{L-1} r(K)g(K)\cos(2\pi fK)] \tag{8}$$

In fig. 10 and 11 the spectra of two time series are provided: one for the household average disposable income (after filtration) and the other for the dynamics of real income indices (without filtration). Fig. 9 shows that deviations from the trend carry a more permanent character than the prime values. We failed to reach the full stationarity (the variance is not yet constant).

In the dynamics of real income, the economically significant cycles of fluctuation are not reflected (fig. 10). It may be explained by a lack of It is specifically, caused by increases that occur too suddenly in the household

stationarity, and by the duration of the survey, which was too short. Naturally, it cannot be disregarded that the aggregate reflection of disposable income and inflation processes, by means of real income indices, eliminates, to a large extent, the cyclic fluctuations.

Deviations of Average Disposable Income From the Trend

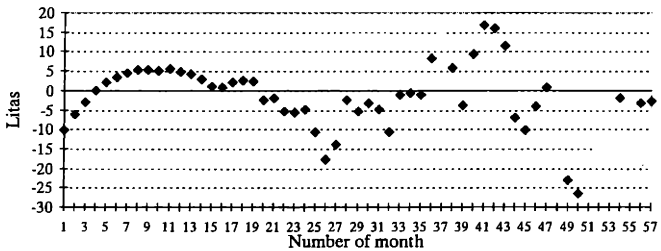

Fig. 9.

Spectrum of Dynamics for Household Real Income

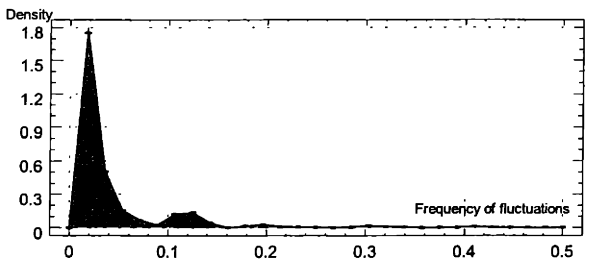

Fig. 10.

Notwithstanding the comparatively short period under consideration and the incomplete stationarity, one peak in the spectrum of disposable income may be regarded as significant and explainable from an economical standpoint (fig.11).

Spectrum of Dynamics for Total Household Disposable Income

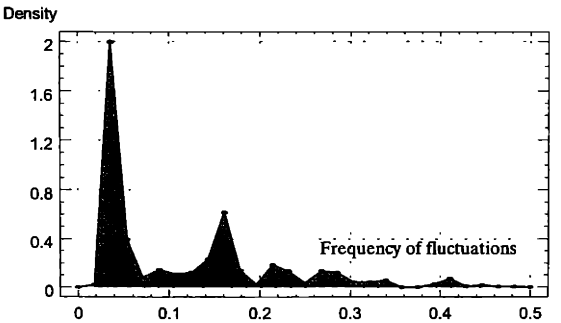

Fig. 11.

income received at the beginning of the summer and at the end of the year. In the beginning of the summer, employees of the public sector (and not only) most often receive compensations for yearly leaves. Besides this, tourism is activated. Regarding agriculture, here the income remarkably increases, due to a growth in milk production. At the end of the year, and at the beginning of the next year, premiums and dividends are usually paid, and in the agricultural sector, the income increases, owing to a seasonal increase of livestock sales and other factors.

The distinct peak at the frequency equal to zero, which appears in both spectra, is caused by long-term fluctuations (longer than one year) that are not eliminated.

We have dealt with only some aspects of the great variety of seasonal aspects of household income. Nevertheless, in our opinion, the results obtained provide valuable information for the development of trade and banking, and for the solving of social problems in the State.

SUMMARY

In the period of transition to a market economy, the household income is becoming an especially important, social indicator and the changes in it may cause serious political discussions. The discussions are not always reasonable, since attempts are often made to perceive tendencies of income variation during a short period of time, while ignoring the seasonal prevalence of income. As may be seen from this analysis, in Lithuania, the seasonal prevalence in the dynamics of household disposable and real income is very clearly expressed, although the general character of income variation ranges greatly. Both urban and rural household income reaches its highest level (with an elimination of the trend) in June and December, and its lowest level in March.The amplitude of fluctuations reaches 18 percentage points. The seasonal prevalence of real income carries a somewhat different character, owing to the existing seasonal indices of consumer prices. The seasonal peak of household real income is reached in August. Its drop in March is greater than that of the disposable income. The spectral analysis of fluctuations of household income, although not based on very long time series, showed that the most distinct cycle of fluctuations for household average disposable income was 6 months, and not 12 months. This is a rather important feature of seasonal prevalence. Awareness of it enables one to better understand seasonal factors and to forecast income as such.

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NAMŲ ŪKIŲ PAJAMŲ DINAMIKOS TYRIMAS (SEZONIŠKUMO ASPEKTAS)

Jonas Markelevičius

SANTRAUKA

Pereinamuoju į rinkos ūkį laikotarpiu namų ūkių pajamos tampa itin svarbiu socialiniu indikatoriumi, kurio kitimas dažnai sukelia didelių politinių diskusijų. Jos ne visada būna pagrįstos, nes dažnai bandoma apžvelgti pajamų kitimo tendencijas per trumpą laikotarpį, ignoruojant jų sezoniškumą. Tuo tarpu, kaip plaukia iš šios analizės, Lietuvos namų ūkių disponuojamų bei realiųjų pajamų dinamikoje sezoniškumas yra labai aiškiai išreikštas, nors bendras pajamų kitimo pobūdis labai įvairuoja. Tiek miesto, tiek ir kaimo namų ūkių pajamos aukščiausią lygį (eliminavus trendą) pasiekia birželio ir gruodžio mėnesiais, žemiausią – kovo mėnesį, o svyravimų amplitudė siekia per 18 procentinių punktų.

Realiųjų pajamų sezoniškumas yra kiek kitokio pobūdžio dėl vartotojų kainų indekso sezoniškumo. Namų ūkių realiųjų pajamų sezoniškumo pikas pasiekiamas rugpjūčio mėnesį, o kovo mėnesį jo kritimas yra didesnis negu disponuojamų pajamų.

Spektrinė namų ūkių pajamų svyravimų analizė, nors grindžiama nelabai ilgomis laiko eilutėmis, parodė, kad ryškiausias vidutinių disponuojamų namų ūkių pajamų svyravimų ciklas yra ne 12, o 6 mėnesiai. Tai yra gana svarbi sezoniškumo savybė, kurią žinant galima geriau suprasti sezoniškumo veiksnius ir prognozuoti pačias pajamas.