ESTIMATION OF UNDERGROUND ECONOMY USING NATURAL-VALORIC INTER-BRANCH BALANCES

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Abstract: *The article presents the analysis of macroeconomic forecasting process of Moldovan economy on the basis of inter-branch balances. This model is both simple and effective, so that it allows detecting nonstandard phenomena and their impact on the whole economy. Having the statistic data available, inter-branch effective balances in natural terms allow to estimate underground economy. The first model for Moldavian economy was developed in 1991, when was created the first program on computer which allowed to identify macro indicators and relations between them, in line with System of National Accounts.*

Keywords*: macroeconomic, forecasting process, inter-branch balances, System of National Accounts.*

Rezumat:*În lucrare sunt analizate problemele de prognoză macroeconomică a dezvoltării a Republicii Moldova pe baza modelelor balanţelor interramurale. Aceste modele sunt un compromis între simplitate şi eficiente, reuşind să surprindă fenomene nestandarde care pot avea loc într-o economie. În baza datelor modelului BIR a fost posibilă estimarea economiei tenebre. Realizarea acestei balanţe în Republica Moldova datează încă din 1991, când s-au pus bazele unui program automatizat de calcul a macroindicatorilor, ceea ce a permis şi depistarea legăturilor între ei, în conformitate cu Sistemul Conturilor Naţionale.*

Cuvinte cheie*: macroeconomic, proces de prognoză, balanţe interramurale, Sistemul Conturilor Naţionale.*

JEL Classification: **E100, E600, P000, C000.**

Introduction:

Production and distribution of production on the national economy, inter-connections, the use of material and labor resources, creation and distribution of national income are matters of prime importance in the scientific research. One of the tools that allows to reflect quantitatively the national economy is the mathematical model "Input-Output" (IO) or so-called inter-branch balance. This model was developed in the ’20’-‘30’s of the twentieth century, and one of the founders is well-known scholar Russian-born American economist W.W. Leontief.

Input-output model has found its application immediately after its launch. In Romania the first input-output table was developed in 1990 and the oldest data table in this regard is the table for 1998. In 1991 Russia implements the System of National Accounts and in line with the concept of this system first input-output balance are compiled in 1995. Other countries that develop IOT (Input-Output Table) - America (1939), France (50s), England (1991), Japan (1995), New Zealand (1953).

In 1995 the OECD set up a project to develop an input-output table globally, bringing together 10 countries, on a historical period of 1968-1990. Over the years the global resource database and uses (World Input-Output Database) has been updated so that in 2015 it includes the supply and use table for 40 states, among which are the most countries of the European continent.

OECD table draw resources used at national level for all OECD member states and a number of non-Member States, covering the period 1995-2011. Using a list of standard economic activities based on Classification ISIC Rev. 3, global IO table allows cross-country comparison.

It is considered there are four functions of NVB (Natural–Valoric Balance). NVB ***statistical*** function enables the integration of statistical data in a concise framework, with the possibility of verifying the consistency of economic information describing the inputs and outputs of goods and services.

Through analytical function can be analyzed proportions consumption in the production process, distribution of production in manufacturing industries, and the rate of final consumption in total global production. The role of the evaluation function is to estimate main macroeconomic indicator and evaluate underground economy. BNV offers the possibility to forecast the main macroeconomic aggregates and develop scenarios of economic development, also to anticipate consequences from modifications in various internal and external factors on demand. The general scheme of inter-branch balance consists of four parts, called quadrants.

Quadrants of natural valoric inter-branch balance

	Intermediate consumption	***Final consumption***
Intermediate goods	***I***	***II***
Gross value added, import, net taxes	***III***	***IV***

Quadrant I is a square matrix of inter-branch flows of production and shows intermediate consumption in various branches/products of national economy, which are calculated based on technological coefficients; quadrant II contains information about the final product use, which includes un productive consumption, investment, savings and exports; quadrant III includes the

use of inputs sources (capital and labor) to the gross value added, imports and net taxes on each branch and import of goods. Columns quadrants I and III, offers information on the intermediate product and added value, reflecting inputs. Rows quadrants I and II, provide information about intermediate consumption and final consumption, showing the use of resources, so the exits.

Leontief models explain the scheme of product realization through final demand in the economy: consumption, investment and export. The models in question are a compromise between simplicity and efficiency of reflecting economic processes taking place in reality, thus being a convenient tool, useful and practical.

When constructing models on inter-branch linkages the authors used the following basic assumptions about economic system properties.

1. An economic system is composed of a number of specific economic elements - branches. Each branch is characterized by a numeric indicator showing the overall volume of domestic production, in natural or value terms.
2. To produce a certain volume of production each branch uses strictly determined production quantities of other branches of the same system.
3. Increase in production volume in one branch requires proportional increased consumption of all items included in the technological scheme of production.
4. Production provided by each branch is partially used in the production process of other industries, and the rest goes outside the production system, as final product.

Double entry ensures equality between gross output and gross input of each branch. Therefore BNV enables accurate detection of the origin of inputs (resources) and output destination (s), making it possible to estimate the underground economy. The BNV presented in the paper is the input-output model of W. Leontief adapted in line with the System of National Accounts. Since resources are equal to uses, there is equality between the total amount for quadrants I to III and the total amount for quadrants I to II, which may be expressed by the following formula:

$$Q_{pb} + M + T - S = CI + CF + F + V + E \qquad \textbf{(1)}$$

where: Q_{pb} – production volume in basic prices;
M – import of goods and services;
T – indirect taxes on goods and import;
S – subsidies on goods and import;
CI – intermediate consumption;
CF – final consumption;
F – Gross fixed capital formation;
V – changes in inventories;
E – export of goods and services.

Developing inter-branches natural valoric balance

Most methods of forecasting economic indicators can be divided into: forecasts of experts in the field; simple econometric models; structural models. Simple models forecast dependencies and correlations of the indices of previous periods. Structural models present in explicit form the behavior of economic agents and uses macroeconomic balances .It is regarded that namely structural models may take into consideration unforeseen changes in the economy.

Moldova continues to be a country strongly dependent on political games of the great powers, as confirmed by recent events: the upward trend on fuel prices, Russian embargoes for a number of countries, including Moldova, economic and military conflicts on the territory of Ukraine. The last years are also characterized by intensifying natural disasters. All this has a negative influence on the economic development of the country. If the first factors are political, the last ones are of a natural order and, if there would have been done the necessary investments in agriculture then this dependence would not be so obvious.

In the forecasting of macroeconomic indicators authors used macro-econometric models, expert models and inter-branches balance based models.

Evaluation underground economy using natural inter-branches balances

For estimating underground economy of the Moldavian economy were drawn up effective balances on 2013 year. For their compilation were used a set of official report issued by National Bureau of Statistics, Moldova.

Natural inter-branches balances were developed in accordance with the System of National Accounts. For the calculation of intermediate consumption volume on the main types of production an algorithm was developed in Excel package using technological coefficients. Unorganized market sales volume was calculated as the difference between resources (the volume of production, import, beginning inventory) and use (intermediate consumption, sales volume in the retail networks, ending inventory).

Agro-industrial complex

Analysis of effective balance of Agro industrial Complex (AIC) for 2013 in natural terms allowed to track significant deviations from the following items:

1) Unfermented tobacco. Developing inter-branches balance for 2013 in natural terms for this kind of production showed that the resources account for13 4510 t and uses14 - 6380 t, other words, there were used 2.07 thousand tones over the official available resources. This difference is explained whether by illegal import or that producer beginning stocks were not recorded correctly or illicit manufacture occurred. Consolidated state budget incurred losses just from VAT and customs service tax of about 9.54 million lei.

2) Tobacco manufactures. In 2013 this product had the following values: resources constituted 8.1 billion. pcs., but its use in all forms of consumption were higher than the resources with 0.4279 billion. pcs. (which constitutes 5.1% of resources). In retail trade were sold 7.64 billion. pcs., 1.015 billion. pcs. went to export, the balance at the end of the year constituted 0.18 billion. pcs., not taking into account the unorganized market. Thus, the official import of 4.49 billion. pcs. doesn't show the reality, underground production and illegal import summing at least 0.4279 billion. pcs. The state budget incurred losses of excise, VAT and taxes missed about 92.95 million Lei.

In 2013 the import of tobacco manufactures constituted 65.59 mil. USD (4487.6 million units) which amounts to 97.9% compared to the previous year, or 1.35 times compared to year 2000 (3328.9 mil pieces or $ 48 mil.). Analysis showed that the measures taken by the government in previous years have led to a slight legalizing the importation of tobacco.

3) Alcohol. In 2013 this product had the following values: resources amounted to 0.54 mil. dal, and its use in all forms of consumption were higher than the resources with 1.3226 mil. dal (which represents 245% of resources) and amounted to 1.87 mil. dal. In this way, the official import of 0.0168 mil. dal does not match the reality. Effective import equaled 1.34 mil. dal of alcohol. Therefore the loss of revenue to the government from VAT, excise and customs services translates into 850 mil. lei.

4) Cognac. The resources of this product amounted to 2.35 mil. dal in 2013, which were used in the production process - 0.001108 mil. dal, in final domestic consumption - 0.77 mil. dal and exported 2.526 mil. dal. Analyzing foreign trade data from the National Bureau of Statistics of the Republic of Moldova and comparing it to data from "Indicators on circulation of industrial production in natural terms in a.2013" there is a difference in the amount of 0.1834 mil. dal. Still, there is also unorganized market. This indicates a more than 1.384 mil. dal illegal import. As a result, the state budget was deprived of 107 mil. lei from VAT, excise duty and customs services.

[13] Calculated as sum of inventories at the beginning of the year, domestic production and legal import

[14] Calculated as sum of export, domestic intermediary and final consumption, losses and inventories at the end of the year.

5) Liqueurs and other spirituous beverages. In 2013, this product accounted to 3.87 mil. dal on resources. The uses, on all forms of consumption, were higher than resources with 1.39 mil. dal (which constitute 36% of resources). Only exports in 2013 equaled 4.27 mil. dal, which shows that there was illegally imported an amount of 1.39 mil. dal or illicit manufacture of this product occurred. The state budget missed revenue of about 881,3 mil. lei from VAT, excise duty and customs services.
6) Sugar Beet. The resources of this product amounted to 1.009 thousand tons in 2013, from which were used in production 1.128 thousand tons. Analyzing foreign trade data from the National Bureau of Statistics of the Republic of Moldova is noted that the import of beet is not recorded and the difference between resources and uses is 119 thousand tons. This indicates that illicit import or underground production amounted at least 119 thousand tons. The government missed out revenues of about 5.4 mil. lei from VAT and customs services. However, it is not excluded that a possible cause of this phenomenon was the high level of sugar in the beet registered this year.

Assessing import and export volume in underground economy in 2013 and using the official tariffs on import and export prices for the analyzed production was estimated the amount of losses in the state budget on account of agroindustrial complex - approx. 1946.2 mil. lei.

Machinery Construction Complex

Drawing up the effective inter-branches balances in natural terms for 2013 showed the following differences:

1) Jewelry. According to natural balances set up for this product, the resources of this item equaled 125,48 mil. lei in 2013 (from production – 10,21 mil. lei, imports – 115,27 mil. lei and inventories at the end of the year in retail units – 365 mil. lei), while uses equaled 318.6 mil. lei (sold by retail units – 240.58 mil. lei, exports – 6.64 mil. lei) and inventories at the end of the year – 365 mil. lei, which is 486.745 mil lei more than resources (exclusive underground trade). Deviations obtained show that real import was greater than the official one (115.27 mil.lei) and has to reach 602.015 mil.lei. According to our calculations state budget missed up revenue from taxes, VAT and customs duty from illicit import of jewelry in amount of 168.7 mil. lei.

2) Non-ferrous metals. Export of non-ferrous metals from Moldova in 2013 amounted to 8430 t (24013.4 th. USD). Imports equaled 5284 thousand tons (34300.4 th. USD). For there are no non-ferrous metals resources in Moldova, we can consider that the difference between imports and export indicates continuous theft of electricity networks, irrigation, selling of machines as scrap metal etc. or there were illegal imports. Export price (2847.64 $/ t) was approx. 2.28 times lower than the import price (6496.93 $/ t). It seems that this product is re-exported to other countries and illegally imported, are committed thefts in order to export cheap. According to our calculations the consolidated budget missed customs duties, VAT and taxes of customs for the illegal import of non-ferrous metals in the amount of 52 mil. lei.

3) Pharmaceutical preparations. According to inter-braches balance developed the resources of this product in 2013 amounted to 3571.16 mil. Lei (production - 465.4 mil. lei, import - 3105.8 mil. lei and the ending inventories in retail units - 420 mil. lei), but have been used quantities amounting to 3886.5 mil. lei (sold by retail units - 2462.5 mil. lei, export - 1424 mil. lei) and the stock at the end of the year at manufacturers and retail units was 420 mil. lei, which is 735.4 mil. lei more than resources (without unorganized market sales). Deviation analysis showed that real imports were higher than the official (3105.8 mil. lei) and must reach the level of 3841.2 mil. lei. According to our calculations the consolidated budget missed customs duties, VAT and business services for the illegal importation of drugs amounting approximately to 59.4 mil. lei.

4) Small capacity engines. This product is not produced in Moldova and just imported. In 2013 imports amounted to 78 600 units. The resources of this product equaled 78,600 units and uses, in all forms of consumption, were higher than the resources with 596,6 th. units (which is 7.6 times the resources). Only exports in 2013 were recorded at 656,81 th. units, which shows that there were

illegal import and re-exportation of this product. There are significant gains from reexporting this product, while the average import price is 713 lei/ un., and export is made at an average price of 37.76 lei/ un., which shows direct tax evasion. The state budget missed revenue from VAT in the amount of about 111.7 mil. lei.

The most significant deviations are shown in Figure 1.

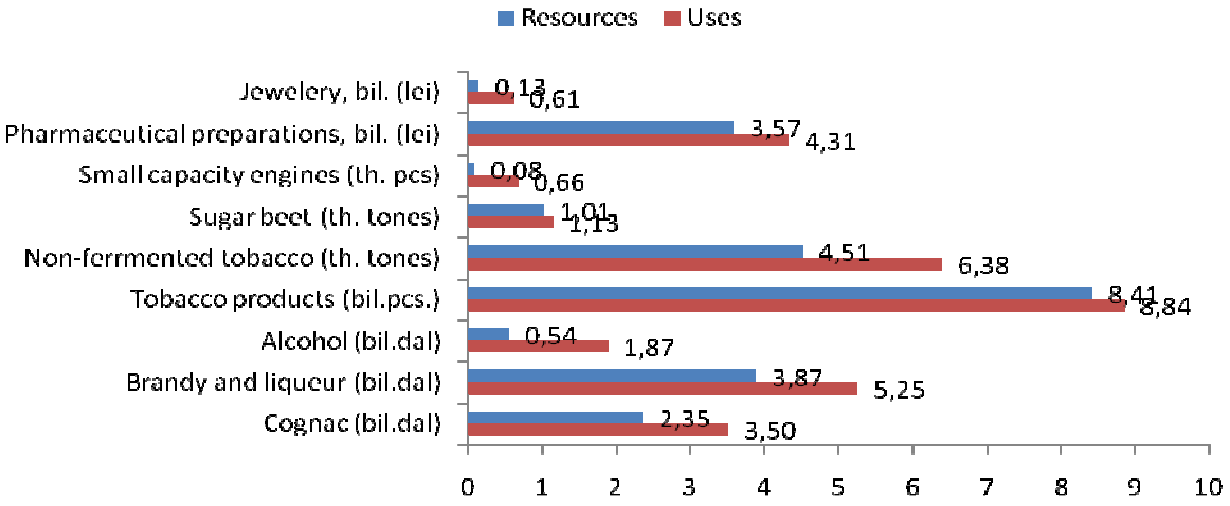

Figure 1. Balance deviations on products

Sourse: [4,5].

Assessing the underground volume of imports and exports in this two economic complexes, also using official prices and tariffs on import and export for the having quantities, we estimate that the government budget missed up revenue from taxes in amount of 391.8 mil. lei.

In addition to the items listed above, the inter-branches balance elaborated allowed us to detect the following interesting ***negative phenomena*** in the national economy:

In the context of ***food security*** analysis was performed balance of strategic products. On the bases of the analysis carried out it was found that meat production (Fig. 2) is 2.6 times lower compared to the average of the volume set out under the rules of subsistence food basket [3, Annex, column 20]. *Taking in consideration the imports of meat and meat products, domestic consumption is well below the minimum consumption norms, reflecting low purchasing capacity of the population.*

Other products which show decreased food security are beans and diary.

Volume of beans recorded in 2013 was 7 times lower the volume required by minimum subsistence food basket [3, Annex, column 20]. Domestic dairy production have covered less than a half of domestic needs of population, calculated on the basis of these rules. Studying price elasticity of strategic products the authors found an absolute sensitivity of the demand on market price deviations, *and surplus of this product on the market is due to the low purchasing capacity of the population*.

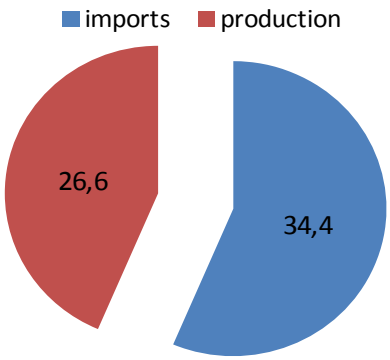

Figure.2 Import and production of meat in 2013, thousand tones

Sugar stocks remain quite high over the last years: at the beginning of 2013 amounted to 52.250 th. tons and at the end of the year – 116.125 thousand tons at producers. In 2013 Moldova exported 28.680 th. tones of sugar and although stocks were quite large, imports equaled 36.110 th. tons. According to official statistics on sugar in Moldova, average export prices constituted $ 815.48 / t, or 43 USD less than the previous year, also higher than the import price of sugar with 117 USD (698 USD / t). Importing sugar is mostly from CIS - 93.52% and namely from Belarus- 93.46%, with 695 USD / t price. Domestic sugar is

exported mainly to EU countries - 92.57%, 5.95% in the CIS and only insignificant volumes in Other countries - 1.48%.

Imports of pastry and confectionery in 2013 increased by 20% compared to the last year, amounting 12880.05 tones, but import prices went down by 2.2%, amounting 37.75 th.lei/tones. These products go to export on a 31.54 th.lei/tone, which is higher than the import price. The main import partners for confectionery are CIS countries – 67.63%, including Ukraine – 45.39%, Russian Federation – 21.65% and Belarus- 0.6%. Other countries share in imports in 2013 equaled 26.42% at an average import price of 21.34 th. lei/tone, while imports from EU countries had a share of about 5.95% at an average import price of 77.9 th.lei/tone. The biggest export volume for pastry in 2013 went to CIS countries – 88.15%, including Ukraine- 68.67% at a price of 34.86 th.lei/tone and Russia – 19% at a price of 53.77 th. lei/tone. Because of import price lower than export price for Ukraine, on domestic market are mostly traded Ukrainian pastries. On the basis of the aforesaid we conclude is absolutely necessary to support local production on domestic market and *in order to make the government can make use of protectionist policy leveraging tools.*

The volume of imported beer in a.2013 decreased by 4.8% and amounted to 9.39 million dal, but import prices rose by 3.8% and amounted to 60.83 lei / dal. Imported beer is carried out mainly from the CIS (96.2%) including Ukraine (85.23%, with a price of 51.8 lei / dal). Export of beer was quite small, about 1.2% of production. Based on the above we can conclude that *in this case it is necessary to sustain domestic production through protectionist policies.*

Although Moldova have been producing milk and dairy over the last years and a quite big amount of it went to export, it is noteworthy that the volume of this export has decreased by y.2006 (6600 t. - y.2001, 4200 t. - y.2002, 2700 t. - y.2003, 4200 t - y.2004, 3800 t - y.2005 at an average price of 21.8 th. lei/ tones). In the years 2007-2011 the export of these products did not exist or was rather small. Since 2012 Moldova restart exports of dairy products (y.2012 - 856 tons, y.2013 - 1286 tons). In 2013 Moldova imported 17 661 tones or 25.5% more than the previous year, at a price 30 000 lei / t. Leaders in imports of these products are the CIS countries - 69.8%, of which the main import partner country in trading this product is Ukraine, the share of imports from the country made up 64.6% of total imports of diary, with a price of 44 350 lei / t. The share of imports from EU countries accounted for 30%, including Poland - 4.5%, Germany - 4.15%, Bulgaria - 3.5%, Lithuania - 3%.

An indirect analysis of strategic commodities groups was carried out, commodities which do not permit elaboration of inter-balances because of lack of norms and statistical data in division. In the case of diesel oil imports the analysis reveals a significant gap between imports and domestic consumption. Only agricultural sector consumption estimates made on the basis of technological norms of diesel consume on sown areas[15] and diesel consumption in transportation for population and other services performed (which was collected from the energy balance) shows that demand for y.2013 was 705 500 t, for y.2012 - of 674 400 t and y.2011 - 703 200 t. Even if you take into consideration that some households for purposes of economy, does not meet all technological standards, the calculations show that the minimum necessary in y.2013 was 594 300 t, in y.2012 - 558 300 t and y.2011 - 593 300 t of diesel. Comparative analysis with actual data (see Table 1) shows that the underground economy imported at least 148 300 t of diesel in y.2011, 160 300 t in y.2012 and y.2013 - 139 300 t.

Considering the situation on diesel market, the state budget missed about 573.9 mil. lei in 2013 form of excise, VAT and customs services because of illegal import. From underground petrol market the budget losses are about 338.5 mil. lei.

Estimates show that the state budget missed up revenues of at least 3250.4 mil. lei from customs duty, excise, VAT and customs services as a result of illegal imports of diesel, gasoline, tobacco products, alcohol, spirits and liqueurs, cognacs, non-ferrous metals, jewelry, medicines etc. and as a result of illegal production (non-fermented tobacco).

[15] On the basis of data provided by Food and Agriculture Ministry of Republic of Moldova

Conclusion

Promoting domestic goods in foreign markets is carried out through the Moldovan Investment and Export Organization (MIEPO), Chamber of Commerce and Industry of Moldova, the commercial representatives of the embassies of the Republic of Moldova abroad and associations of local producers on different branches of production. An effective tool for stimulating trade is cross-border cooperation, which is actively implemented by the Government.

Proposals for promoting local production:

- Specifically to the local manufactory industry is that is provides services rather than goods, so this economic branch exports cheap labor instead of material goods. We can thus conclude that, in order to diminish negative trade balance it is necessary to provide this industry partially with imported raw materials, and also to assure the export of its finite product.
- Sheep farming has been a traditional branch in the Moldovan economy and a long period of time wool processes were developed and wool fabrics went to export. Today textile industry works mostly in lohn system, processing raw material received from the client (imports of wool fabrics) and exports labor services. Having our local wool materials necessary efforts should be made in order to re-establish wool industry.
- The internal market is oversaturated with goods produced from imported chicken meat of poor quality. *Government in order to protect local producers and local public health should use protectionist policy.*
- Import of confectionery production in 2013 increased and the largest volume of imports originate from Ukraine. The low price of imported confectionery from Ukraine makes this production more competitive in terms of price compared to local homogeneous production, and as a result substitutes the local final product. *So to improve this situation is necessary to analyze the cost of the goods and final price, and recommend producers to avoid expenses that are not justified.*
- Share of nuts exports constituted 4% of total exports in 2013 (in 2012 - 4.7%), which is higher than the share of cognac of 2.54% (in 2012- 2.41%) of total exports. *Due to this, we believe that efforts should be made in order to develop nut growing industry because this type of product is required on the external market.*

Based on this analysis, we consider appropriate to implement measures to improve the situation:

1. Moldova imported about 26,600 tons of meat and by-products of first category (including poultry 69.4%) at a price lower than the price of domestic producers. In this context, it is necessary to create long-term favorable conditions for attracting domestic and foreign investments in this sector, in order to enhance competitiveness. Besides that, as urgent actions, is necessary to apply non-tariff barriers for halting imports of meat and by-products of low quality and protect domestic producers.

In the republic there are potential for raising animals. For example, in 2013 were exported 47,400 t (81,200 t in 2012) of animal feed (bran, sunflower seeds, pressed soybeans, etc.) at a discounted price (2.6 lei / kg) compared with the market.

2. The major problem remains stimulating import substitution industries, including: *manufacture of perfumes and cosmetics, medicines, confectionery, grits, potatoes, lemon salt, synthetic detergent, essential oil and etc.* Although the country is producing perfumery and cosmetics, however import of this product is approximately 9.7 times the volume of domestic production.

The preconditions for the development of this sector are favorable in terms of the existence of raw material base, especially essential oils, apiculture products etc. The same situation occurs in the production of medicines, where import volume is 12.7 times higher than domestic production. *In these two sub-sectors it is necessary to create favorable conditions for attracting investments.*

3. Moldova is an agricultural country and agriculture is the basis of its agroindustrial complex. Dynamics of food production, export potential and level of assurance to the population with food depends on stable development of agriculture.

Agroindustrial complex evolution depends strongly on climatic factors. In the last decade have become outdated and obsolete: agricultural equipment, mineral and organic fertilizers, irrigation systems etc. The results are: decreasing soil fertility, farmers infringe crop cultivation systems, reducing yields, reducing the capacity and productivity of cattle.

By using mineral fertilizers yields would grow from 30 to 50%. Different countries use various amounts of fertilizers: developed countries such as the Germany - 145 kg / ha, EU countries – 91 kg/ha, Latvia-41.3 kg/ha, Romania – 35.3 kg / ha, while in developing countries they use 10-25 kg per hectare. In the past years Moldova use of fertilizers decreased from 136 kg / ha in 1991 to (19 kg / ha in 2004) 53 kg/ha in 2013.

Because the fall in using mineral fertilizers there has been decreasing soil fertility and majority crop yields by 30-50%. To increase efficiency in agriculture is necessary increase use of mineral fertilizers by 3 times. If the state is interested in the actual development of farming, then mechanisms must be found to reduce fuel prices. The state must solve this problem because the country's energy security must not be affected.

Bibliography:

1. Anuarul statistic al Republicii Moldova. Ch.: Statistica, 2014, 558 p. ISBN 978-9975-78-932-5;
2. Leontief, Wassily W. Input-Output Economics. Scientific American Volume 185, Number 4, October, 1951, p.15-21. ISSN: 0036-8733;
3. Regulamentul cu privire la modul de calculare a mărimii minimului de existență. Monitorul Oficial Nr. 104-108, 10.05.2013.
4. Savenco L., Ganciucov V. Modelul balanței interramurale de prognoză a dezvoltării economiei naționale. În: Evoluții şi politici economice: Culegere de lucrări științifice / Inst. Naț. de Economie şi Informație. Chişinău, 2004, pag.39-48. ISBN 9975-9654-8-2.
5. www.statistica.md

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