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Short-Term Forecast of Ukrainian Economy Including Shadow Sector Using Causal Simulation Model

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Abstract. A new causal simulation model of economic development was created, which comprehensively in detail and fully reflects various types of legal and shadow economic activities and their interrelations.
The model is used to forecast the whole (legal and shadow) country's economy up to 2022.
The dynamics of shadow and legal indicators are different.
The biggest and most important difference is about exports and imports. Official statistics give a negative balance of the Ukrainian foreign trade of Ukraine in 2019-22. However, total export, determined by the model, considerably exceeds imports, so actually we expect a surplus.
This is very important for the National Bank: its policy based on the official (legal) negative balance of Ukraine foreign trade should be one (throw foreign currency reserves into the market or to devalue the hryvnia), but with the actual balance that includes shadow flows and is positive, - contrary one (to buy currency on the market or to revalue the national currency).
Our model calculates how the production volumes of all types of goods and services should change to ensure that supply and demand are balanced. These numbers can serve a reference for manufacturers.
We suggested that the relevant Ukrainian authorities take an active position in the implementation of the developed forecast for the economic development of Ukraine: measuring actual rates of changes in the production of these types of goods during the year, they provide recommendations to producers to increase or decrease their production.
Keywords: model of legal and shadow economic activities, forecast, active implementation of a forecast

Introduction

The shadow sector in Ukraine is very powerful, in some years the shadow GDP reached by half of the legal one, so it's modeling and forecasting is very important.

The State Statistics Service of Ukraine and the Ministry of Economic Development and Trade of Ukraine assessed the level of shadow production long ago. Nevertheless both the same Statistics Service and National Bank and Ministry of Economic Develop-

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ment and Trade of Ukraine do not use these data for analysis and forecast of Ukraine's economy. For example, officially stated that the Ukraine GDP for 1990-2013 decreased by 30 percent. But this statement is incorrect. Its legal share of GDP decreased by 30 percent, and the whole (complete) GDP, which includes the informal sector, already in 2006 rose to the 1990 level. This was due to the movement of legitimate production into the illegal sector (Vasylenko, 2008).

The general problem was to develop such a model of economic development of Ukraine (and any other country), which would reflect different types of legal and shadow economic activity in their relationship and would provide estimates and forecasts complete (legal plus shadow) result indicators: GDP, gross income, salary fund, export and import, consumption, accumulation and so on. Until now, economists around the world have only studied how the shadow sector affects the legal (official). But no one has created a model in which these sectors interacted.

We made such an attempt.

1. Analysis of publications

World literature about shadow production mostly devoted to the evaluation of its scope or share of a legal one, for example (Gutmann, 1982; Tanzi, 1983).

As for the correlation between the growth of the shadow and official economy results are different: positive was noted in Belgium and New Zealand (Giles, 1997; Lalitha, 2000), negative - in Latin America (Lasko, 2000), so the question remains open.

One of the first attempts of modeling the impact of the shadow economy on the official one made Joel F. Houston (Houston, 2000). As stated in (Enste, 2000), Joel F. Houston develops a theoretical macro model of the business cycle and relations of tax and monetary policies with the shadow economy. This model is not causal, but the regression type, which limits its analytical capabilities.

In the paper (Loayza, 1996), the author uses the model of endogenous growth, which changes in two factors affects: the quality of public policy and public institutions. Their weaknesses promote to increase the relative size of the shadow economy, which, in turn, generates a reduction in economic growth. But these two factors are not the primary economic indicators, so the impact on the economy of the shadow sector in this model is more speculative than modeling. More appropriate would develop a causal model of communication legal economy with different kinds of shady activities, purely as an object without regulation or control systems, and then to study the impact of regulatory factors such as government policies and public institutions on shadow activities.

Even such an authoritative researcher like Bruno Dallago (2003) researching of tax evasion in the small and medium business, used a statistical approach only no causal modeling. In Ukraine also a statistical approach was used, for example (Kichurchak, 2014).

In (Jakub, Taukchian, 2010) outputs of legal and the shadow sector are described by the neoclassical Cobb-Douglas model. But actually, there are many kinds of shady

activities, and only one of them (production) can be represented as the informal sector and describe by this model, but very conditional. Second, there are no relationships between these sectors in the model. The authors themselves say that "the results are, of course, only qualitative."

S. Gebauer and F. Mazelis (Gebauer, Mazelis, 2019) developed the DSGE model, which is used for shadow banks, but there are no such models for the entire economy.

Consequently, in the world there is no causal model of economic development that reflects different types of legal and shadow economic activities and their relationships in detail and completely and which would provide estimates and forecasts of complete (legal and shadow) economic results in dynamics.

To properly reflect the economy one should include in a model all the factors and all the basic real economic mechanisms: formation of the cost of products and prices, wages, incomes of business and state, taxes, and so on and trade and transfers between all actors of the economy in their relationships under the influence of devaluation and inflation and other factors and so on.

The model must be suitable for the study and forecasting of the common features of economic development, and to determine the net effect of individual factors and their groups (including different types of shadow activity), and to select the most effective factors of development, and to analyze imbalances between supply and demand (over- or underproduction), and to find safe lending limits where development will occur without "overheating", which then causes crises, and so on. Such opportunities can only provide a systemic macro model of causal type based on microeconomic mechanisms.

An attempt to create such a model was made in (Vasylenko, 2014a), which provided its description. There has been proved the high adequacy of this model to the real Ukrainian economy: results, designed on the model, coincided with the actual indicators for 2008-2013 with sufficient accuracy: legal GDP differed from the official one, provided by the State Statistics Committee, from -0.7 to +0.4 percent, legal gross profit - from -1.8 to +2.6 percent, output production - from -9 to +2.1 percent, the volume of wages - from -2.9 to +2 percent. So there is a reason to believe that model accuracy is sufficient for further analysis and multi variance calculations.

2. Peculiarity of the model

Our model reflected all shadow activities existing in Ukraine:

In private companies:

A) Except legal there is the shadow production of each product;

B) A part of wages is paid illegally; taxes on all illegal amounts are not paid (as a result of actual net revenue, which includes shadow portion, is significantly more than legal);

C) Material costs are shown too high to avoid paying VAT and income tax;

The following areas are there both in private and public companies:

D) Prices of public procurement are exaggerated;
E) State returns VAT for bogus sales both domestically and for export,
F) VAT returns not on time or not in full;
G) Companies pay bribes to officials, which reduces the profit of companies (public companies only for points D, E, F). The size of bribes is proportional to the size of shady deals.

Of course, it would be better to include organized crime, prostitution, counterfeiting, and smuggling separately in the model, but this is a matter of the future. However, much of this is already reflected in it, for example, prostitution - in the shadow part of non-tradable consumer services, counterfeiting - in the shadow part of the production, smuggling - in the shadow part of imports (see below).

2. Back in the early 60-s of the XX century, von Bertalanffy wrote: „UTS opens new horizons for us, but its compliance with the empirical data still remains scant.“ Therefore the author tried to stay away from theories and to be closer to life. He simulated real-world economic processes and mechanisms which undoubtedly exist in the economy, not forcing them into the Procrustean bed of theories and of macroeconomic hypothesis (hypothesis of monetarists, Keynes, of equilibrium), that a priori rigidly predefine the behavior of the economy and make a model inadequate real economy. In the language of control theory, all these hypotheses relate to the management of the economy, but not to the economy itself. Introduction of them into the model of an object means to mix object and control system that makes impossible an analysis of „pure“ economy (economy as a system with internal positive feedback is unstable) and correct synthesis of a control system. In our model using a priori more appropriate path (long known in the theory of control systems but have never been used in economics): displays only the object of control but not control actions, that is, the existing economy, not the ideas. By the way, it is much easier than to create and apply different theories, although more cumbersome.

3. Aggregation of goods must comply with the task. Full aggregation, as in Solow (1956) is for our task redundant (note in passing that many studies of this model - are the study of mathematical properties of the power function, but whether this function reflects real economy - a big question - deviations of the actual data of the production of the USA manufacturing industry from the Cobb-Douglas function was more than 15 percent, which does not provide sufficient reason to believe this power function adequate the existing economy).

We aggregated all products into the groups which behave equally when devaluation and inflation: goods of final consumption, intermediate consumption, export, import. This is an SNA principle. But it is barely used in known models. There are no macro models that reflect the production of raw materials. Without this it is impossible to reflect accurately the value of all goods and the value-added from intermediate goods in the total GDP.

We increased the number of products from three in the model of the dependent economy

(Frenkel and Mussa, 1985), that doesn't reflect goods sold domestically, or eight in the model ASPEN[1] (Basu et al., 1998) to 19:

1) non-tradable consumer goods and services[2] together with distribution and retail;
2) Tradable goods of final consumption (only production without distribution and retail) sold domestically;
3) Tradable goods of intermediate consumption (production together with distribution and retail) sold domestically;
4) Tradable goods of investment consumption (without housing) sold domestically (together with distribution and retail);
5) Housing sold domestically (together with distribution and retail);
6–9) import of these four goods 2-5 (produced abroad);
10-13) distribution and retail of import of these four goods; these services are included in domestic output and GDP.
14) Consumer export together with distribution,
15) Intermediate export together with distribution,
16) Consumer goods' distribution,
17) Consumer goods' retail,
18) Financial services,
19) Budget sphere.

Each product, except the 19th, is produced by two companies: private and public.

Based on the availability of 14 types of private and state-owned enterprises which produce 14 first types of goods and the general government sector, we divided households into 86 groups:

1–28) 2 8 aggregated employees of all 14 types of private and 14 state-owned enterprises which produce the above goods: non-tradable consumer goods, tradable goods of final consumption, tradable goods of intermediate consumption and so on;
29–42) 14 business owners;
43–56) 14 directors of state-owned enterprises (in Ukraine they act like owners);
57) Pensioners;
58) Public servants;
59–86) 28 aggregated officials, each of whom receives a bribe from one of 28 enterprises for the fact that he "does not notice" their shadow activities.

4. We took output (instead of GDP) as the primary outcome of production. This eliminates a lot of inaccuracies and methodological incommensurability, for example:

a) Neoclassical model of demand for money takes into account only those trade agreements that are linked to the GDP, that is, with the final product, but the sale of intermediate products does not include, and in Ukraine, it is more than 60%;
b) in the traditional regression models, export demand is mainly determined by the GDP of the importing country, but this is true only for end-use products, but the

[1] This model is most similar to ours. Of course, our model differs due to the specifics of the Ukrainian economy, and most importantly, the availability of intermediate goods and services.

[2] Next, we will say „goods", referring to „goods and services".

demand for exports of intermediate consumption goods, which is in the export of Ukraine 80-90%, depends precisely on the output of the importing country;

c) GDP, which measures only the value-added, contained in the goods, sometimes is compared with indicators that measure the whole value: exports, imports, consumption, supply, and so on. For example, in the computation of openness of the country to the outside world, this leads to the fact that the two countries with different levels of the cost of producing a unit of output (hence, with different levels of GDP per unit of output) for which this indicator has the same value, according to the existing methodology are considered equally open, whereas the degree of openness of an economy is more at the country in which the level of GDP per unit of output above. Openness to the outside world should be measured by the ratio of export value to the output. For example, a traditional indicator showed that the degree of openness of Ukraine in 1993 increased from 24 to 26%, whereas in fact, according to our indicator, it dropped from 11 to 10%. In 1996 the opposite was true.

d) The use of GDP as the model output is automatically (though implicitly) introduces the hypothesis of the constancy of economic efficiency (GDP per unit of intermediate consumption), while the simulation of output and costs reflects its changes.

e) When identifying model on empirical data, primary values in the physical dimension are probabilistically distributed according to the normal (Gaussian) law for which statistical evaluation of the significance and accuracy of the model coefficients is derived. Nonlinear conversion of primary values (in particular, the operation of multiplication rates on volumes) changes the normal probability distribution to the other, for which statistical estimates are incorrect.

Besides the author believes that the hypothesis of a balance between supply and demand (which has never been proved either theoretically or practically) has not been disproved because in all models as a result indicator was used GDP instead of output. Namely using output allowed us to detect an imbalance between consumed and produced GDP.

In our model at different levels of efficiency per unit of intermediate consumption produced different amounts of GDP. In the particular case the hypothesis of equilibrium between supply and demand, that is, between consumed and produced GDP, is performed. Now imagine that the efficiency decreased. Then each unit of product contains less added value, therefore, the whole output has less of GDP. Now households will be able to buy at the new GDP only a part of the goods produced, therefore, the balance between supply and demand is broken. It follows that the balance is carried out only for one particular subset of the values of economic efficiency, but a much more powerful set of unbalanced economy hardly comes into the view of economists.

3. Forecast for 2019-2022 years[3]

In 2019 the modeling and forecasting department of economic development of IEF NASU under the leadership of the correspondent member of the NASU M. I. Skrypnichenko

[3] The work was carried out in 2018.

developed a forecast for 2019-2022 years, but in the legal sector only. We took it as a basis and calculated the shadow sector on our model.

The overall level of the shadow economy for the period 2019-2022 is adopted by 32% (that is, the GDP created in the shadow sector is 32% of the legal GDP), as defined by the Department of Economic Strategy and Macroeconomic Forecasting of the Ministry of Economic Development and Trade of Ukraine for the three quarters of 2018. I note that the model, using the general level of the shadow economy, itself determines the levels for various goods. They turned out to be different. They almost coincided with the data of the Ministry of Economic Development and Trade: the highest level of the shadow is in the financial sector (after export, in which the Ministry of Economic Development did not evaluate the level of shadow).

My model has provided such a forecast of complete (legal plus shadow) resultative indicators (Table 1).

In 2019, whole GDP, whole wages, and whole gross profits will rise nominally by 18.38%, 17.46%, and 23.24, but due to inflation and rising prices for investment goods, their purchasing power will increase by only 4.69%, 6.07%, and 8.42.

The dynamics of shadow and legal indicators are different. So, legal GDP in 2019 should grow by 2.7%, but shadow GDP will increase more, so the whole GDP will grow by 4.89%. A similar picture is in the payroll: in the legal sector, it will increase by 4.89%, but in the shadow it will increase more, therefore, the total salary will increase by 6.07%. The same is the picture of gross profit: in the legal sector, it will increase by 2.11%, in the shadow it will increase more, so the whole profit will increase by 8.42%.

The volume of gross profits in the legal sector slightly exceeds the amount of wages - by 16%. But in the shadow sector - in times, therefore, the total gross profit exceeds the salary level by 77%.

The biggest and most important difference between legal and shadow indicators is in exports and imports. The legal volumes give in 2019 the negative balance of foreign trade of Ukraine - UAH 329 billion. However, the whole export volume, as determined by the model, far exceeds the volume of imports, so we expect a positive surplus of UAH 74 billion. This is explained by the fact that intermediate consumption is defined as strictly necessary for the production of all goods (including intermediate goods itself). Technical progress is constantly reducing the need for them. So the shadow import of the necessary intermediate goods is increasing less than shadow exports, and sometimes even decreases. And since these goods constitute the lion's share of Ukraine's exports and imports, the foreign trade balance substantially improves, that is, its deficit decreases. If, at the same time, prices are exaggerated at public procurement, then the physical volume of these purchases decreases, and, consequently, the import of intermediate consumption goods, which is necessary for production, is further reduced. Therefore, the balance improves even more. Thus, **taking into account shadow transactions significantly improves the foreign trade balance.**

Table 1. The forecast of complete (legal plus shadow) resultative indicators of Ukrainian economy[4]

Indicator	2 019		2 020		2 021		2 022	
Billion UAH	**legal**	**com-plete**	**legal**	**com-plete**	**legal**	**com-plete**	**legal**	**com-plete**
GDP	4135	5458	4675	6171	5256	6938	5903	7792
Consumption	-	3735	-	4104	-	4583	-	5125
Gross accumulation	825	-	1008	-	1094	-	1251	-
Net exports of goods and services	-329	74	-330	82	-327	97	-307	88
Payroll (volume)	1610	1963	1820	2108	2046	2361	2298	2641
Gross profit	1875	3481	2120	3562	2384	4013	2677	4511
The imbalance between produced GDP and consumed one	-	-434	-	-404	-	-378	-	-350
GDP per unit of intermediate consumption	-	0,94	-	0,98	-	1,03	-	1,04
Bribes	-	93	-	98	-	102	-	111
Shadow revenues	13*	465	14	490	13	510	12	555
Real growth %								
GDP	2,70	4,69	3,10	4,10	3,70	4,70	4,2	4,9
Consumption	-	2,91	-	0,57	-	3,11	-	-2,39
Gross accumulation	-	-0,60	-	17,52	-	6,19	-	0,05
Payroll (volume)	4,89	6,07	3,49	3,97	3,79	4,39	-1,96	-2,32
Gross profit	2,11	8,42	4,39	3,41	4,94	3,92	-1,93	-1,31
The imbalance between produced GDP and consumed one	0,00	-7,96	0,00	-6,54	0,00	-5,44	0,00	-4,49
GDP per unit of intermediate consumption	-	7,0	-	4,1	-	4,4	-	1,3
Bribes	-	3,60	-	1,05	-	1,04	-	1,09
GDP deflator (average per year)	-	110,5	-	109,66	-	108,42	-	107,78
Consumer price index (average per year for all products)	-	110,3	-	109,25	-	108,32	-	114,55
The external sector, billion dollars USA								
Exports of goods and services	64,85	96,75	70,54	90,92	76,22	96,64	82,46	102,61
Imports of goods and services	75,62	94,32	80,63	88,41	85,74	93,67	90,89	99,56
Exit currency abroad	-	20,2	-	22,2	-	24,5	-	26,9
Exchange rate, UAH / USD USA	-	30,5	-	32,7	-	34,3	-	36,4

* The share of shadow profit in gross profit

[4] Legal indicators are calculated by M. I. Skrypnichenko, complete - on our model.

This is very important for the National Bank: its policy according to the official (legal) negative balance of foreign trade of Ukraine should be one (throw currency into the market or to devalue the hryvnia), but according to the actual balance that includes shadow flows and is positive, should be the contrary (to buy currency on the market or to revalue the hryvnia).

This is exactly the picture with the foreign trade balance observed in 2013-15, so the National Bank had no economic reasons for the collapse hryvnia devaluation of at that time. And my article about it was printed exactly in 2014 in the Herald of the National Bank (Vasylenko, 2014b).

We will explain the impact of the technological progress on the reduction of GDP for intermediate goods for the domestic market, their import, and financial services, which discussed above. Due to investments in the previous economic cycle, the rates of material costs per unit of output (including intermediate goods itself) in the current cycle are reduced, consequently, net profit per unit of each product, and therefore for the whole mass of goods, increases; as a result (at a constant rate of accumulation) the consumption of investment goods increases, and hence their production (we consider the equilibrium situation when the supply of each product equals demand for it). With the growth of their products not only the mass of net profit (i.e., the income of the business owners), but also the salary of hired workers increases. This together leads to an increase in demand for end-consumption goods, and consequently, to an increase in their production. Growth in production requires more goods of intermediate consumption, but a decrease in the material costs of all products (including intermediate consumption) reduces demand for them to a greater extent. Therefore, the resulting investment effect reduces the overall demand for intermediate goods. Their production, their imports, and the volume of financial services are decreasing. Reducing production usually reduces the wage of wage earners to a greater extent than the increase in the mass of gross profits, as a result, the GDP, created in the production of intermediate goods, distribution of their imports, and the production of financial services is reduced. In Ukraine, labor productivity is small: with the consumption of one hryvnia of final consumer goods, we create only 70-72 kopecks of GDP, which means that end-use goods are produced more than consumer and investment products. Therefore, reducing their production leads to more GDP fall than its growth in the production of consumer and investment products. As a result, the total GDP of the country is decreasing. But this is a progressive reduction, which in the analysis should be separated from other types of its fall.

The model predicts an increase in the efficiency of the Ukrainian economy: the complete GDP per hryvnia for intermediate consumption will increase to 94 kop. in 2019 and up to 104 kopecks in 2022.

The whole forecast contains such indicators, which are fundamentally not in the legal sector: the model calculates the amount of bribes that the real sector pays to officials, the export of foreign currency, etc. Bribes will grow from UAH 93 billion in 2019 to up UAH 111 billion in 2022. Exports of currency abroad will also grow from $ 20.2 billion in 2019 up to 26.9 billion dollars in 2022. These figures are approximate, but the dynamics

are displayed correctly. Why are numbers approximate? Because some coefficients were determined by expert way back in 2006. For example, it has been assumed that officials receive 20% of the exaggerated public procurement prices (accounting for about 30% of all bribes) and other shadow revenues. For missed shadow production, the tax officials receive 5.9% of its volume (46% of all bribes), for converted salary - 5.6% of its volume (13% of all bribes), and for overproduction of material expenses - 20% (11% of all bribes). Today, these figures may change; therefore, bribes may range from 30 to 80 billion UAH. Similarly the volume of export of currency abroad.

The whole amount of shadow income in 2019 will reach 93 /0.2= 465 billion dollars, in 2022 - 555 billion dollars which makes up 12-14% of the total profit.

4. Active assistance in the implementation of the developed forecast of Ukraine's economic development

Active assistance in the implementation of the developed forecast lies in the fact that our model allows us to achieve an equilibrium economic development, that is, one that maintains equality of supply and demand.

The forecast of macroeconomic indicators of Ukraine, developed by the Department of Modeling and Forecasting of Economic Development of the IEF of the National Academy of Sciences, is based on the assumption of a balance between demand and supply. Note that all known models are constructed to fulfill this assumption. Several exceptions to this rule describe non-equilibrium situations only during the transition period between two different equilibrium situations.

But I do not know any model that describes the steady non-equilibrium situation, although what is loss from unrealized goods, each entrepreneur knows (in the system of national accounts, these steady non-equilibrium situations are simply converted into equilibrium because unrealized goods are credited to the balance of the following year). No model allows investigating the deviations both in terms of overproduction and underproduction of goods. Moreover, there is not even a model that at least measures GDP produced and consumed at the same time and compares them.

Our model does it. In 2018 it shows that the GDP consumed exceeds the GDP produced by UAH 461 billion, i.e. by 9.9% (due to smuggled imports). By 2019 the imbalance is expected to be reduced to 434 billion UAH (8%), for subsequent years - its further reduction. The imbalance of this type positively affects the development of the economy; the opposite picture is negative, because unrealized goods are direct losses of entrepreneurs, although salaries of wage earners may increase.

Simultaneously our model counts how the volume of production of all types of goods and services should change to ensure a balance between supply and demand, or a minimum imbalance between them.

So, in 2020 the total (shadow plus legal) production of no tradable consumer goods and services should increase by 9.2% in physical terms or by 14.9% in nominal terms at a projected inflation of 10.3% (Table 2).

Table 2. Recommendations on the gains in the total volumes of production and import of goods and services of all types for 2019-21, which ensure a balance between supply and demand[5]

The type of goods and services	The gain in 2019, %		The gain in 2020, %		The gain in 2021, %	
	in physical measure	in current prices	in physical measure	in current prices	in physical measure	in current prices
Consumer goods non-tradable	8,5	14,9	9,2	14,9	10,1	14,6
Tradable consumer goods for domestic market	5,9	11,9	8,5	13,9	8,6	12,8
Goods of intermediate consumption for domestic market	-1,7	12,6	-0,5	4,2	-2,4	1,8
Housing for domestic market	-2,5	26,3	-14,2	20,5	-18,1	15,0
Investment products for domestic market	2,1	17,4	-6,8	5,5	-4,4	5,9
Exports of consumer goods	-5,8	9,7	-0,7	15,4	-5,7	11,0
Exports of goods of intermediate consumption	-5,8	9,7	-0,7	15,4	-5,7	11,0
Distribution and sale of consumer imports	-4,2	2,4	-10,1	-4,1	-8,9	-3,5
Distribution and sale of imports of intermediate consumption	-5,0	9,8	-4,5	12,5	-6,8	7,6
Distribution and retail of housing import	-3,5	24,9	-14,2	20,4	-18,1	15,0
Distribution and sale of investment imports	1,1	16,2	-6,8	5,4	-4,4	5,8
Distribution of consumer products	5,9	13,2	8,5	14,6	8,6	14,0
Retail of consumer goods	5,9	21,9	8,5	15,9	8,6	16,9
Financial services	8,1	8,5	7,3	7,8	4,6	5,5
Budget services	6,8	23,9	11,8	24,1	11,6	24,1

The total production of tradable consumer goods and services, but sold on the domestic market, should increase by 8.5% in physical terms or by 13.9% in nominal terms.

The production of investment (without housing) goods should decrease by 6.8% and increase by 5.5 respectively, financial services increase by 7.3% and by 7.8.

The total production of intermediate goods should decrease by 0.5% in physical terms, but increase by 4.2% in nominal prices, services of the budget sphere - by 11.8% and 24.1%. The total production of export goods of both final and intermediate consumption should decrease by 0.7% in physical terms but increase by 15.4% in nominal prices.

The total volume of services in the distribution and sale of imports of consumer goods and services should decrease by 10.1% in physical terms and by 4.1% in nominal prices,

[5] Calculated on our model.

the volume of services in imports of intermediate goods - by 4.5% in physical terms but increase by 12.5% in nominal prices, import of investment (without housing) goods - by 6.8% and 5.4% respectively.

The volume of services in import of housing should decrease by 14.2% in physical terms, but increase by 20.4% in nominal prices (Table 2).

These figures can serve as recommendations for manufacturers. The Ministry of Economic Development and Trade of Ukraine, measuring actual rates of changes in the production of these types of goods during the year, may provide recommendations to producers to increase or decrease their production and imports.

These recommendations for 2019-21 provided in Table 2.

What will happen if manufacturers neglect these recommendations?

In case of overproduction and excessive import of goods, their excessive parts will exceed the demand for them and will remain unsold. This will be a direct loss, which will reduce the profits of the owners of the plants or importers.

But salaries of wage earners will increase, which will cause additional demand for consumer goods. Consequently, added value can sometimes increase.

For example, if in 2019 the production of no tradable consumption goods and services will increase physically by 2% more than it is recommended, the wage of employees in real terms will increase by 1.94 percentage points compared to the recommended equilibrium situation, but gross profit will decrease by 2.73 pp, therefore the GDP created in the production of goods and services of this type will decrease by 1.16 pp. Of course, because of this, the production of intermediate goods will increase, therefore, the salary there will grow by 0.16 percentage points, gross profit - by 0.21 pp, therefore the GDP created in the production of intermediate goods and services will increase by 0.18 pp. The decrease in gross profits for non-traded goods will be larger in absolute terms than its growth in intermediate goods; therefore, the total gross profit in the country will decrease by 0.31 pp. As a result, the production of investment (without housing) goods will decrease, the salary - by 0.24 percentage points, gross profit - by 0.37 pp, GDP, created in the production of these goods - by 0.31 pp. In general, the country's salary will increase by 0.19 percentage points, gross profit will decrease by 0.31 pp, GDP - by 0.1 pp (Table 2).

If in 2019 the same overproduction occurs in consumer goods and services tradable, the changes will be similar, only on a much larger scale, because the volumes of such goods are much larger. The salary in the country will increase by 0.04 percentage points, gross profit will decrease by 3.47 pp, GDP - by 1.99 pp.

If the same overproduction occurs on intermediate goods, the changes will be almost the same.

In the case of underproduction, both gross profits and wages are reduced, so deterioration is much higher. For example, if in 2019 the production of nontradable consumer goods and services will increase in physical terms by 2% less than it is recommended, then the salary of hired workers in real terms will decrease in comparison with the recommended equilibrium situation by 2.26 percentage points; gross profit - by 2.41 pp, hence GDP, created in the production of goods and services of this type, will decrease by 2.35 pp.

The production of intermediate consumption will also decrease; therefore, the salary there will decrease by 0.39 percentage points, gross profit - by 0.50 pp, therefore the GDP created in the production of intermediate goods and services will increase by 0.44 pp. All gross profit in the country will decrease by 0.57 pp. Because of this, the production of investment (without housing) goods will decrease, salary - by 2.27 percentage points, gross profit - by 3.53 pp, GDP, created in the production of these goods - by 2.96 pp. In general, the country's salary will decrease by 0.45 percentage points, gross profit - by 0.57 pp, GDP - by 0.5 pp.

If the change in external or internal factors will allow for higher development rates than predicted, the model will convert the equilibrium volumes of production.

5. Conclusions

1. The new causal model of economic development that reflects different types of legal and shadow economic activities in detail and completely and their relationships and which would provide estimates and forecasts of complete (legal and shadow) economic results in dynamics was created.
   To properly reflect the economy I included in the model all the factors and all the basic systems of real economic mechanisms: formation of the cost of products and prices, wages, incomes of business and state, taxes, and so on and trade and transfers between all actors of the economy in their relationships under the influence of devaluation and inflation and other factors.
2. The model is suitable for the study and forecasting of the common features of economic development, and to determine the "net" effect of individual factors and their groups (including different types of shadow activity), and to select the most effective factors of development, and to analyze imbalances between supply and demand (over- or underproduction), and to find safe lending limits where development will occur without "overheating", which then causes crises, and so on.
   There has been proved the high adequacy of this model to the Ukrainian economy.
3. To modify the model for other countries, it is necessary to reflect differences in economic mechanisms, labor and capital markets, and the country's connections with financial markets.
4. The model developed a forecast of complete (legal and shadow) economic results for 2019-2022 years.
5. The dynamics of shadow and legal indicators are different.
6. The biggest and most important difference is in exports and imports. The legal volumes give in 2019-21years the negative balance of foreign trade of Ukraine. However, the whole export volume, as determined by the model, far exceeds the volume of imports, so we expect a positive surplus.
7. This is very important for the National Bank: its policy according to the official (legal) negative balance of foreign trade of Ukraine should be one (to throw currency into the market or devalue the hryvnia), but to the actual balance which includes shadow flows and is positive, is opposite (to buy currency on the market or to revalue the hryvnia).

8. The whole forecast contains such indicators, which are fundamentally not in the legal sector: the model calculates the amount of bribes that the real sector pays to officials, the export of foreign currency, etc.
9. Our model counts how the volume of production of all types of goods and services and their import should change to ensure a balance between supply and demand or a minimum imbalance between them. These figures can serve as recommendations for manufacturers.
10. It is proposed active assistance in the implementation of the developed forecast of Ukraine's economic development: the Ministry of Economic Development and Trade of Ukraine, measuring actual rates of changes in the production of these types of goods during the year, may provide recommendations to producers to increase or decrease their production and imports.

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