# ARE THE WELL-KNOWN ECONOMIC HYPOTHESES ABOUT THE EFFECTS OF INFLATION AND DEVALUATION SUITABLE FOR UKRAINE?

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***Abstract.*** *In Ukraine, the well-known position of the Keynesian theory of the utility of moderate inflation is not confirmed. There is no such a level of price increase which would cause the improvement of the economy. Any inflation reduces the real GDP.*

*If inflation falls short of the devaluation, the real GDP index increases the more the more is the lag. If no lagging, the GDP decreases.*

*Devaluation is not always beneficial for exporters and for the country on the whole as claimed by the traditional theory of foreign trade. If devaluation has been done, exporters must lobby curb domestic prices.*

*Emission may give a positive result only if the government will manage to keep inflation.*

*The most effective direction of emission is to invest in companies and to cover the budget deficit. Additional emissions as a support of banks destroys the economy at any inflation. The IMF, providing loans or help to Ukraine, should prohibit this action because it is one of the powerful ways of thefts.*

***Key words:*** *causal model, inflation, devaluation, emission, export*

## 1. Introduction

The aim of the article is to analyze the "pure" influence of different factors on the economy of Ukraine and the clarification whether the well-known economic hypotheses, such as the position of the Keynesian theory on the utility of moderate inflation, the devaluation are beneficial for exporters and suitable for a country on the whole, and so on for Ukraine. If one wants to check some hypothesis, he cannot use the arguments and proofs based on the same hypothesis – it will be a simple tautology. Consequently, he must use another model, which is fundamentally different from the known, as Paul Krugman criticized (2009).

For a systemic analysis of the impact of various factors on the Ukrainian economy and the multivariant forecasting of its development, in the author's opinion, most suitable are the causal models "macro from micro" (Phelps, 1970, Tae-Jeong et al., 2010, etc.). The main difference between them and a new model should be not so much in a

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behavior of economic agents how to simulate the full system of real microeconomic mechanisms: formation of the cost and prices, wages and incomes, taxes, etc.; trade and transfers among all actors of the economy.

The behavior of many famous models is distorted by macroeconomic theories and hypotheses which their authors once include (including the listed above). If, however, to provide the ability to include or exclude them from the model, the model will reflect the "pure" behavior of the economy under the influence of various factors.

Such a causal model has been developed by Vasylenko (2010, 2015a). The direct external influence on the economy in the model is through foreign trade. Other impacts are indirect. For example, the war in the east Ukraine acts by reducing production and exports. All equations and assumptions are listed in Vasylenko (2010, 2015a).

The high adequacy of the model to real economy was proved in Vasylenko (2015a) where retrospective forecasts for 2008–2013 and forecasts of several options for 2014, 2015 were done. The result indicators, calculated on the model, coincided with the actual results of the Ukrainian economy with a sufficient accuracy: the legal GDP differed from the official statistics at –0.7 to +0.4%, legal gross profit – from –1.8 to +2.6%, output – from –9 to +2.1%, the sum of wages – at –2.9 to +2%. Thus, there is the reason to believe that the accuracy of calculations by the model is sufficient. Of course, if the economy is changing dramatically, no model (including our) in which these changes are not provided can be adequate.

Economic events, particularly in transition economies, belong to the class of stochastic events rather than probabilistic, so we cannot provide probabilistic characteristics (such as confidence intervals).

## 2. Features of the model

The adequacy of our model is ensured due to the features which are listed in Vasylenko (2015a).

It is particularly important that the model shows the production of inputs. This is what allows you to pinpoint changes in the value of all goods and the contribution of intermediate goods in the total GDP. The author does not know the models which display the production of inputs besides the input–output models. There are only models of intermediate goods' trade, for example, Kang, Shi and Juanyi, Xu (2010).

We note the importance of determining the total (plus the shady parts) economic indicators of Ukraine. For example, the legal balance of foreign trade in 2014 amounted to –2.7 billion dollars, while the total to +22.9 billion dollars. ***The policy of the National Bank according to official statistics must be one (throw the currency on the market), but according to the actual balance – the opposite. Thus, the policy of the National Bank and the Government should be based on the full data that take into account the shadow sector.***

The model includes illegal production by the following ways: in private companies the shade increases the production of each product, parts of wages are paid out illegally,

taxes on all illegal amounts are not paid (increasing net income), material costs are overstated to avoid the payment of VAT and income tax; in public and private companies: prices of state procurement are overstated; the state returns of VAT for fictitious sales both domestically and for export, VAT returns not on time or not fully; officials receive bribes, which reduces the company income.

Thus, our method of constructing this model is a direct description of the economic activity of each macro enterprise. The model of Ukraine's economy is 18 private and 18 public macro enterprises (including banks) plus the governance sector (GS) each of which produces one of the listed in Vasylenko (2015a) 19 goods legally, and the first 18 – else and illegally (in them, part of the wages may be paid illegally, material costs may be overestimated). The volume of the production of each consumer product initially is equal to the total demand of all 86 customers (listed in Vasylenko (2015a)). The volume of each product of intermediate consumption is equal to the total demand of all 36 companies and GS. Later you can set an over- or underproduction of any degree on any goods. As the demand of the enterprise under consideration is included in these general demands, all equations are recurrent. They are solved by successive approximations, which are implemented in Excel using developed macroses. In each economic circle, the enterprises return short- and long-term loans to banks, pay interests, wages, taxes and fees in insurance and pension funds. Their owners divide the received gross income on bribes to officials, on final consumption, on investment in the modernization of production or in housing, and on accumulation (possibly in each cycle differently). The banks' income consists of the interests and other incomes. In the next economic cycle, the 36 enterprises and the GS buy material means and labor resources possibly for new prices and at the norms which decreased in proportion invested in previous cycles' investments; the enterprise, which produces investment goods, increases (decreases) its production in accordance with the increase (decrease) in the gross profit of all companies (including itself), and so on. If payments to insurance and pension funds are not enough, the GS covers the lack from the budget. Next the GS pays the salary to civil servants, for loans and buys consumer and investment goods (perhaps overpriced, increasing profits of respective companies and bribes). If the budget is not enough, the GS issues bonds or takes loans from the National Bank, which makes the relevant emission and a possible devaluation. Because of this, prices are rising. Therefore, interest rates (by Fisher or otherwise) are increasing. Formally in detail the model is described in (Vasylenko, 2015a).

This model is discrete. It is constructed as a sequence of static models of successive economic cycles. Each cycle model is a model of transition from the previous to the current cycle under the influence of exogenous and endogenous factors. For the ease of using the existing statistical indices, it is assumed that one cycle is equal to one year. Of course, you need to figure out the size of the error due to replacing many products with the different lengths of cycles by one with a year cycle.

All parameters of the model are variable in each economic cycle. This provides a possibility to explore not just the interrelations, but also their characters, and to determine the borders to which these characters are preserved.

The model allows optimizing (the algorithm of the multi-criteria compromise Vasylenko (1983)) strategies of each of the 28 manufacturers or of the state using the major (maximum added value) and supplementary criteria (maximum gross profit, market expansion, foreign exchange earnings, trade balance which in the model is identified with the payment balance, the stability of hryvnia (for exporters and NBU), for employees – of wages; for all economy – GDP and GDP per unit of intermediate consumption, budget revenue, and many others.

The model predicts and analyses the dynamics under inflation and devaluation of the following nominal and real legal and full (with shadow parts) indices for each good and in the whole country: cost, gross and net profit, and the amount of wages, value added, output, GDP, the share of wages in the cost, rising unemployment, pensions, tax and social insurance revenues, salaries of public sector employees, emissions, foreign exchange earnings from exports of goods of final and intermediate consumption, the physical volume of exports, the volume, expenditure and currency to import goods of the final, investment, and intermediate consumption, trade balance, the structure of exports and imports, the share of imports in the final and intermediate consumption, prices, GDP production per unit of intermediate consumption, changes of the contributions of individual goods to the country's GDP, and so on.

You can change the price, salary, loans for each product, the level of de- or revaluation, in- and deflation, etc.

Thanks to these tools, this model "works" for any trade balance, for non-equilibrium, and is more appropriate for the reality.

The model can forecast for any year (now for 2021).

As you see, the Ukrainian economy peculiarities were duly accounted for in this model. However, the model can be easily adjusted to study any other country's economy.

In this paper, we analyze the effect of the following factors: the price of each product or of several / all of them, devaluation, wages, exports, emission taxes, over- and underproduction.

All conclusions in the article are made on the basis of model calculations. Below, we will not repeat each time: "The model showed that ..."

## 3. Prices

To investigate the pure influence of prices, we set in all cycles zero loans and deposits; assumed that 52.4% of gross profit (this base level of 2006) is used for final consumption, 40.9% – for short-term investments on 1 year to reduce the material costs norm, and 6.7% (this is also the basic level) goes for housing; there is no additional investment

in housing; investment effectiveness is 1 (1 means that the rate of reduction of material and / or labor costs per unit of output is equal to the rate of increase of the active part of fixed assets. If it is 2, the reduction is twice. This figure is in some sense the reverse capital ratios of Roy Harrods (1948)).

1. Let the price of the **consumer goods *2*** (this index is used in tables below), and hence of its distribution and retail, increase by 2% in each of 15 cycles. This leads to two consequences: a) the real full (with shadow) GDP, generated in the production of this product (it is equal to value added plus taxes not included in the value added), compared to the base cycle (Table 1, column 1) increases for 15 cycles at 62% instead of 41.7% without increasing the price, i.e. the index of growth is increased by 48% (Table 1, column 2); b) the GDP deflator for 15 cycles as compared to the baseline cycle comes to the level of 11.83%. This deflator reduces the real index GDP (further, under the term "real GDP" we mean a complete (with shadow) nominal GDP divided by the GDP deflator for 15 cycles as compared with the baseline cycle) of all other goods and the sum of real GDP of the country for 15 cycles – by 4.6% (the sum GDP for 15 cycles is equal to the nominal GDP for the 1st year, divided by the GDP deflator for the 1st cycle, plus the nominal GDP for the 2nd year, divided by the GDP deflator for the 2nd cycle compared to the baseline cycle, and so on), the sum for 1st–5th cycles – by 1.8%, the GDP index for 15 cycles – from + 8.2% to –8.95 (on –109%), sum of real tax revenues in budget for 15 cycles – 4%, the sum of real income to the social insurance fund and the pension fund for 15 cycles – 8%, the sum of budget and social insurance – 6% (Table 1). The model measures the sum of tax revenues in the budget and contributions to social insurance fund and pension fund for the following reason: if the funds in the pension fund or the Social Insurance Fund are lacking, the necessary funds are allocated from the budget of Ukraine.
2. If the domestic price of **imported consumer goods (*4*)** increases by the same 2%, its real GDP grows for 15 cycles by 66% instead of 31% (the index grows on 113%); indexes of real GDP of other goods (excluding housing and the capital goods for the domestic market and distribution of imports) decrease, the sum of real GDP for 15 cycles is reduced by 0.1%, the sum for 1st–5th cycles – by 0.03%, the index of real total GDP – by 2.5%, the real tax revenues in the budget for 15 cycles – by 0.24%, the real income in social insurance for 15 cycles – by 0.7%, the sum of budget revenue and social insurance – by 0.4%.
3. The same price increase on **housing (*3*$_J$)** increases its real GDP by 142% instead of 69% (the index grows on 113%) and reduces the GDP index for other goods, except investment goods for the domestic market. The sum of total GDP for 15 cycles is reduced by 0.09%, the sum for the 1st–5th cycles – by 0.03%, the index of the real GDP – by 2.4%, the real income to the budget for 15 cycles – by 0.02%, the real income in social insurance for 15 cycles – by 0.32%, the sum of budget revenue and social insurance – by 0.1% (Table 1, column 4).

4. Similar, but much stronger is the effect from the growth of price on the **investment goods for the domestic market** $\boldsymbol{3_N}$ (Table 1, column 5).
5. The simultaneous rise in prices on **all consumer and investment goods** greatly increases the index of real GDP of these goods, dramatically reduces it at other goods, and worsens the condition of the entire economy, including the real budget revenue and social insurance (Table 1, column 6).
6. The increase in prices of inputs (***3***) and of imports distribution (***5***) increases the real GDP of these goods dramatically and reduces the real GDP index for other goods besides financial services. However, the reason for the drop is not inflation, as in paragraphs 1–5, but the increasing of goods cost.

   The state of the economy improves. The reason for this is a big specific gravity of inputs in the whole country output, i.e. the low efficiency of the Ukrainian economy. If the share was smaller (i.e. the efficiency was higher), the index of the real GDP would fall. Therefore, the author believes that in countries with a high economic efficiency the index of real GDP with an increase in inputs' prices would fall. Due to the increase of total production, the real index of financial services increases (Table 1, columns 7 and 8).
7. Let the domestic prices of **all goods** increase by 2% each cycle. All indexes are reduced: the index of real GDP on all goods (other than goods of intermediate consumption, housing and investment goods for the domestic market) by 0.2–99%, the sum of real GDP for 15 cycles by 7.4%, for 1st–5th cycles by 3%; the real total GDP index of the country becomes negative (reduces by 175%). The real budget revenue and social insurance are also reduced (Table 1, column 9).

A lower price increase causes a less deterioration in the economy and a higher – a more massive. But there is no such a level of price increases, which would cause the improvement of the economy. In addition to the results presented in Table 1, investigated were many cases with the inflation of demand and supply. Thus, **the provision of the Keynesian theory about the usefulness to economy of moderate inflation in Ukraine is not confirmed in the long run.** In the short term it was proved in Vasylenko, Bazhenova (2014). Consequently, **any inflation reduces the GDP. A useful for the Ukraine's economy inflation does not exist.** As our model is of the causal type and the system of economic mechanisms (value creation, wages, incomes of the enterprises and the state, taxes, etc.; trade and transfers among economic actors) is the basis of any economy, the author believes that these results are also valid for other countries. But their models must necessarily involve the production of intermediate consumption goods.

TABLE 1. **Effect of price increase on the economy (without credit and additional investment in housing; investment effectiveness is 1)**

| Real indicators[1] (all data in all tables were calculated by the model. Database (2006 year) calculated according to the Ukraine Statistics Committee (Table (2008)) on algorithm which is set out by Vasylenko (2010) | Stable prices | Index growth (%) under raising by 2% of the price of product: index of all prices | | | | | | | | Devaluation 2% | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *2* | *4* | $3_J$ | $3_N$ | All consumer and investment goods | *3* | *5* | all | 1.02 | 1.022 | 1.0243 | 1.015 | 1.0032 |
| Sum of total real GDP for 15 cycles[4] | 12688 | -4.6 | -0.10 | -0.09 | -0.54 | -6.8 | 00.14 | -0.3 | -7.4 | -1.7 | -2.4 | -3.3 | 00.2 | 40.6 |
| Sum of total real GDP for 1–5 cycles[4] | 4091 | -1.8 | -0.03 | -0.03 | -0.,20 | -3 | 0.09 | -0.05 | -3 | -1.1 | -1.4 | -1.7 | -0.4 | 10.2 |
| Index of total real GDP for 15 cycles,% | 80.2 | -109 | -2.54 | -2.38 | -.3,8 | -160 | 9 | -7 | -173 | -22 | -40 | -62 | 22 | 131 |
| Non-tradable consumer goods[2],% | 38.2 | -34 | -1.65 | -1.26 | -7.68 | 24 | -105 | -9 | -44 | -27 | -31 | -36 | -16 | 5 |
| Consumer goods[3], % | 41.7 | 48 | -1.55 | -1.18 | -7.23 | 24 | -97 | -11 | -40 | -27 | -31 | -35 | -18 | 0.04 |
| Goods of intermediate consumption[3],% | -39.0 | -32 | -2.80 | -1.23 | -7.92 | -51 | 139 | -11 | 26 | -10 | -8 | -5 | -18 | -32 |
| Housing[3],% | 68.5 | -7 | 2.25 | 113 | 1.87 | 98 | -58 | -14 | 45 | 55 | 59 | 63 | 42 | 4 |
| Investment goods without housing[3],% | 67.0 | -6 | 2.54 | 0.32 | .134 | 116 | -77 | -17 | 55 | 63 | 69 | 74 | 48 | 0,7 |
| Consumer export | 66.8 | -26 | -4.47 | -1.34 | -8.13 | -44 | -58 | -5 | -99 | 21 | 10 | -2 | 48 | 115 |
| Export of intermediate consumption | 74.4 | -25 | -4.20 | -1.27 | -7.68 | -41 | -51 | -7 | -93 | 21 | 11 | -0.02 | 46 | 109 |
| Distribution and retail of consumer import | 31.4 | -39 | .113 | -1.52 | -9 24 | -62 | -32 | -4 | 7 | -12 | -12 | -13 | -14 | -20 |
| Distribution and retail of intermediate import | -33.7 | -37 | -3.57 | -1.79 | -11.5 | -60 | -15 | 89 | -13 | -20 | -22 | -24 | -15 | -4 |
| Distribution and retail of housing import | 34.3 | -20 | 0.66 | -61 | -0.71 | -84 | -5 | -4 | -1 | 73 | 71 | 68 | 76 | 79 |
| Distribution and retail of investment import | 34.7 | -20 | 0.66 | -0.17 | -61 | -83 | -5 | -4 | -0,2 | 72 | 71 | 68 | 75 | 78 |
| Distribution of consumer goods[3],% | 40.6 | 47 | -1..0 | -1.21 | -7.37 | 23 | -96 | -11 | -41 | -28 | -32 | -37 | -19 | 0,2 |
| Retail of consumer goods[3],% | 40.2 | 44 | -1.55 | -1.23 | -7.50 | 20 | -93 | -10 | -41 | -28 | -32 | -37 | -19 | 0.5 |
| Bank services[3],% | -26.7 | -45 | -4.42 | -1.47 | -13.4 | -74 | 14 | 6 | -63 | -63 | -69 | -76 | -46 | -9 |
| Real tax revenues in budget for 15 cycles[4] | 1861 | -4 | -0.24 | -0.02 | -0.07 | -6 | 1.1 | 0.13 | -5 | -0,2 | -0.8 | -1,5 | 1,2 | 5 |
| Real income in social insurance for 15 cycles[4] | 1006 | -8 | -0.70 | -0.32 | -2 | -13 | -0.1 | -0.02 | -15 | -15 | -16 | -17.7 | -12 | -3 |
| Sum of budget and social insurance[4] | 2867 | -6 | -.,4 | -,1.1 | -0.7 | -9 | 0.7 | 0.08 | -9 | -5 | -6 | -7,2 | -3 | 2.2 |

[2] For 15 cycles in the country (lines 1–3 and 18–20) and for individual goods (lines 4–17), %.

[3] For domestic market. For individual commodities, in the first column there is the index of real full (with shadow) GDP (percentage) in the baseline situation (at constant prices) in subsequent columns – the deviation of the index from the baseline in percent.

[4] Billion USD.

## 4. Devaluation

Let us denote the devaluation index through *(I)*. The devaluation of the $(I–1) \cdot 100 = (1.5–1)\cdot 100 = 50\%$ means that the foreign currency becomes by half more expensive. Now for its purchase it is necessary to spend one and a half time more of the national currency. If the National Bank chose to increase the amount of national currency due to the emission, then to determine the necessary volume of emissions one can proceed from the need to ensure the purchase after the devaluation of the whole volume of imports ($IM=1.5\cdot IM_0$), which before devaluation cost $IM_0$:

$$EM_D = IM - IM_0 = (I–1) \cdot IM_0^{\$} \cdot r_0 / v, \quad (1)$$

where $r_0$ – the exchange rate before devaluation (UAH / USD),
$v$ – the velocity of the turnover of money.

This whole emission goes to the purchase of currency, so it just increases a lot of money on the market without increasing the volume of goods, so it causes the inflation of monetarist type. Let us determine the rate of the inflation, based on the total of all trade agreements. Traditional models include automatically in trade agreements only the **final product,** because **GDP** adopted the final indicator in them, and inputs are not included in the GDP. In contrast, our model as the primary outcome considers not the GDP but the **output**, so the scope of trade agreements is defined on the sum of **final and intermediate products**. This amount is equal to the volume of issue $W_0$ (without exports $Ex_0$, because it is sold on the international market) plus imports:

$$I_{szD} = 1 + EM_D \cdot v/(W_0 + IM_0 – Ex_0). \quad (2)$$

Equations (1, 2) imply the following rule: **if the monetarist inflation is caused only by the emissions, what corresponds to the devaluation, then this inflation is less than the devaluation so far as the output without net exports is more than imports.**

In the base 2006, the variables had the following meanings: $IM_0^{\$} = 53307$ million USD, $r_0 = 5.05$ UAH / USD, $W_0 = 1378554$ million USD, $ob = 6.35$. At $I = 1.5$ by the formula (1) $EM_D = 21191$ million UAH, and inflation by the formula (2) is $I_{szD} = 1.0966$, i.e. 9.66%. Thus, even at a very high level of economic openness of Ukraine to the outside world, i.e. a large import, a very large devaluation causes not so much of inflation. In countries with a lower level of openness, inflation is much less.

But in Ukraine, inflation is high and without devaluation. High devaluation expectations of producers and consumers sometimes cause inflation, even more than the devaluation. Therefore, the model provides the possibility to set a different inflation and to analyze the results.

1. At the same price indices 1.02 as in Section I, we introduce the devaluation of 2%. It raises the domestic price of exports at the same 2%. This causes a chain reaction of

rising incomes, consumption, through the inherent in the economy positive feedback "profit–production–profit". The multiplier increases not only the nominal but alo the real GDP, generated in the production of final and intermediate export goods at 21%, in housing and investment goods for the domestic market – by 55% and 63%, in the distribution of import – by 73% and 72%. But on other goods and in the whole country, the GDP becomes less than the earlier inflation and devaluation, but higher than before devaluation on the same inflation (Table 1, column 10).

2. The increase in domestic prices for all products (excluding exports) is the most influential factor. If one increases prices by at least 2.2% at a devaluation of 2%, the economy worsens (Table 1, column 11). The higher inflation, the more economy worsens. At the increase in domestic prices by 2.38%, the GDP index for **consumer goods export** begins to fall. At the domestic price of 2.43%, the GDP index for **intermediate goods exports** begins to decline, and the **consumer exports** decrease by 2% (Table 1, column 12). Recall that in traditional trade models the domestic prices as a factor in the analysis of the impact of devaluation on exports are not considered. That is why traditionally of devaluation considered is the beneficial factor for the exporters and for the country on the whole. As you can see, this is correct only in particular cases where inflation is behind devaluation or slightly ahead. Consequently, **exporters are not always beneficial to lobby devaluation. If devaluation has been done, they must lobby curb domestic prices, or inflation "eats" their windfall from the devaluation.**
3. If inflation falls short of devaluation at least by 20–25%, the index and the sum of real GDP are growing for 15 cycles. Real tax revenues in the budget grow, too, while social insurance decreases (Table 1, column 13).

The greater the gap, the more the growth. Thus, the **restraint of prices, albeit non-market, is most profitable for producers, especially exporters.** But the financial position of manufacturers of intermediate consumption goods, of distributors of intermediate and consumer imports and of banks deteriorates (Table 1, column 14).

If the backlog is less than 20–25%, the amount of GDP decreases.

This implies the feasibility of such a non-market proposal: **the government imposes a moratorium on unjustified price increase and reduction of salaries on enterprises for six months or more, and in the next fiscal year it will compensate the loss to import distributors at the expense of excess profits of exporters and the budget.**

**Consequently, the National Bank may make a devaluation, but only if the government will provide the pre-containment of domestic prices or the GDP decline. The mechanisms of containment may be different. It seems that the more effective will be the one based on bonuses to those consumers who inform, say, the Antimonopoly Committee about the unjustified price increase of a specific seller.**

TABLE 2. **Effect of the dynamics of wage economy with credit, additional investment in housing (investment effectiveness is 1)**

| Real indicators [2] | Real full (with shadow) growth (%) of: | | | | | | | | | | | | $I_{V3}=1$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | wage *V* | | | | *gross profit D* | | | | *VVP* | | | | *V* | *D* | *VVP* |
| Index of wages | 1.05 | 1.1 | 1.125 | 1.15 | 1.05 | 1.1 | 1.125 | 1.15 | 1.05 | 1.1 | 1.125 | 1.15 | Other goods 1.125 | | |
| Sum of total real GDP for 15 cycles[4] | | | | | | | | | 0.85 | 2.1 | 3.1 | 4.2 | | | 3.2 |
| Sum of total real GDP for 1–5 cycles[4] | | | | | | | | | 0,99 | 2,2 | 2,7 | 3,3 | | | 2.2 |
| Index of total real GDP for 15 cycles,% | 21 | 61 | 86 | 119 | -12 | -36 | -49 | -67 | 4 | 13 | 22 | 34 | 73 | -40 | 26 |
| Non-tradable consumer goods[3],% | 24 | 78 | 125 | 195 | -6 | -25 | -51 | -96 | 39 | 109 | 141 | 169 | 121 | -56 | 113 |
| Consumer goods[3],% | 24 | 78 | 124 | 195 | -2 | -12 | -29 | -61 | 42 | 120 | 164 | 215 | 121 | -36 | 136 |
| Goods of intermediate consumption[3],% | 8 | 25 | 28 | 35 | -1559 | -4585 | -4071 | -4127 | 2 | 5 | 11 | 18 | 0,1 | 4523 | 19 |
| Housing[3],% | 78 | 250 | 182 | 187 | -12 | -37 | -41 | -53 | -9 | -25 | -33 | -45 | 198 | -37 | -27 |
| Investment goods without housing[3],% | 59 | 166 | 175 | 137 | -18 | -52 | -64 | -73 | -13 | -38 | -50 | -64 | 191 | -58 | -42 |
| Consumer export | 35 | 98 | 144 | 201 | -10 | -27 | -39 | -55 | -5 | -14 | -20 | -28 | 144 | -39 | -20 |
| Export of intermediate consumption | 35 | 98 | 144 | 201 | -10 | -27 | -39 | -55 | -5 | -14 | -20 | -28 | 144 | -39 | -20 |
| Distribution and retail of consumer import | 26 | 83 | 133 | 210 | 15 | 44 | 59 | 79 | 62 | 182 | 260 | 369 | 129 | 49 | 229 |
| Distribution and retail of intermediate import | 14 | 43 | 66 | 99 | 1 | 3 | 3 | 5 | 2 | 8 | 11 | 16 | 60 | -3 | 4 |
| Distribution and retail of housing import | 78 | 250 | 182 | 187 | -9 | -26 | -33 | -45 | -8 | -24 | -33 | -45 | 198 | -29 | -27 |
| Distribution and retail of investment import | 59 | 166 | 175 | 137 | -12 | -36 | -47 | -62 | -12 | -34 | -47 | -64 | 191 | -40 | -38 |
| Distribution of consumer goods[3], % | 24 | 78 | 124 | 195 | -2 | -11 | -29 | -61 | 46 | 133 | 182 | 241 | 121 | -36 | 153 |
| Retail of consumer goods[3], % | 24 | 78 | 124 | 195 | -1 | -9 | -24 | -52 | 42 | 120 | 166 | 222 | 121 | -31 | 140 |
| Bank services[3], % | 5 | 15 | 19 | 26 | 4 | 14 | 18 | 25 | 4 | 12 | 16 | 22 | 11 | 10 | 9 |
| Real tax revenues in budget for 15 cycles[4] | | | | | | | | | -1 | -4 | -4 | -5 | | | -2 |
| Real income in social insurance for 15 cycles[4] | | | | | | | | | 29 | 73 | 95 | 124 | | | 77 |
| Sum of budget and social insurance[4] | | | | | | | | | 5 | 13 | 17 | 23 | | | 15 |

## 5. Salary

Let the domestic prices of all goods to increase by 9.5% each cycle at the devaluation of 10%; the volume of exports and international prices is constant, additional investment in housing business owners, the volume of loans and deposits and the interest on them are at the level of the base year, and the average salary of each cycle increases.

1. The larger the index of this growth, the more increasing is the real full (with shadow) GDP. The indexes of the real GDP, generated in the production of end-use goods, their distribution, retail and import are growing particularly strongly, and that of goods of intermediate consumption, imports and banking services is growing slowly; of exports, housing, investment goods, imports it decreases (Table 2, columns 9–12). The sum of wages, of course, increases for all goods (Table 2, columns 1–4). The index of the real full gross profit (mixed income) has a dynamics not completely the opposite of the index of the sum of wages, as would be at first sight: the profit from the distribution of final goods import and intermediate consumption and from banking services increases (Table 2, columns 5–9).

   The sum of real revenues in social security funds and the pension fund for 15 cycles, of course, increase; the sum of real budget revenue decreases, but much slower, resulting in their sum increase (Table 2, columns 9–12). This is natural, because with increasing wages profits decrease.
2. If the rise in prices is ahead of the devaluation, the economy, of course, is the worst, but the impact of salary remains the same.
3. Table 2 shows that the enterprise *3*, which produces intermediate consumption goods for the domestic market, cannot raise wages at the same rate as other companies, because the profit is reduced too much, turning into a loss. If this company does not raise wages (while others increase them by 12.5%), its gross profit in the 15th cycle does not come in 42-fold and 43-fold increases, in the whole country its index is reduced not by 49% but only by 40% (Table 2, columns 13–15). The real GDP in the product *3* and in the whole country is growing.

**The growth of average wages, although reducing incomes, as a whole is a significant positive factor in the economic development of Ukraine.**

## 6. Export

1. The growth of the export volume by 2% at a constant foreign price greatly increases the GDP for all goods, therefore, for the whole country.
2. The growth of foreign price by 2% at a constant physical volume even stronger increases the GDP index for all goods, except the intermediate for the domestic market, imports and financial services; for all country it is stronger also.

TABLE 3. **Effect of emissions on the economy in the 1st cycle**

| Real indicators [2] | No emission | Emission in the amount of 5.45751% of M3 goes to cover the budget deficit 10.256 trillion UAH and causes inflation (%) | | | The same emission: going to bank | The same emission: invested in all state-owned enterprises |
|---|---|---|---|---|---|---|
| | | 5.5 | 2.75 | 1.8 | 5.5 | 2.75 |
| Total real GDP in the 1st cycle, % | 821 | -1.6 | -0.4 | 0.02 | -2.4 | 0.5 |
| Non-tradable consumer goods[3], % | 1.3 | -120 | -12 | 26 | -217 | 1.4 |
| Consumer goods[3],% | 1.7 | -82 | -8 | 18 | -148 | 9 |
| Goods of intermediate consumption[3], % | -2.4 | 81 | 56 | 47 | 53 | 90 |
| Housing[3], % | 5.1 | 125 | 99 | 90 | 54 | 293 |
| Investment goods without housing[3], % | 4.8 | 140 | 110 | 99 | 63 | 318 |
| Consumer export | 6.4 | -166 | -84 | -56 | -166 | -84 |
| Export of intermediate consumption | 6.4 | -167 | -85 | -56 | -167 | -84 |
| Distribution and retail of consumer import | 5.6 | 26 | 29 | 29 | -4 | 25 |
| Distribution and retail of intermediate import | 0.7 | 46 | 67 | 74 | -40 | 192 |
| Distribution and retail of housing import | 2.9 | 218 | 219 | 219 | 8 | 402 |
| Distribution and retail of investment import | 3.0 | 216 | 217 | 217 | 8 | 397 |
| Distribution of consumer goods[3], % | 1.6 | -89 | -10 | 17 | -158 | 7 |
| Retail of consumer goods[3], % | 1.1 | -78 | 35 | 73 | -222 | 24 |
| Bank services[3], % | -4.5 | -65 | -27 | -13 | -78 | -10 |
| Real tax revenues in budget for 15 cycles[4] | 124 | -0.6 | 0.3 | 0.60 | -2 | 1.8 |
| Real income in social insurance for 15 cycles[4] | 72 | -4.4 | -2.0 | -1.13 | -5 | -1.1 |
| Sum of budget and social insurance[4] | 195 | -2 | -0.5 | -0.03 | -3 | 0.7 |

3. If the exporter under the devaluation lowers the price in the foreign currency, as it follows from the traditional theory of international trade, he gets more foreign earnings from elastic goods, but less from inelastic ones. But the traditional theory does not consider the profits of exporters. The known models cannot accurately calculate them because they do not simulate the production of intermediate goods. Our model reflects the increase in commodity prices (especially imported) and, therefore, reflects the increase in the cost of exports. Because of this, the profit of the exporter falls. The real profit falls even more due to the inflation caused by devaluation.

Price reduction is necessary in order to expand or retain the market sectors, but the exporter pays for it by falling profits.

**From here, there follow two recommendations to exporters: 1) to hold the highest possible price in the export of foreign currency contrary to the traditional theory; 2) to lobby the containment of domestic prices. If that is not possible, they should lobby the constancy of the exchange rate.**

**Consequently, export growth, both by volume and especially by foreign prices, is a very strong factor in the economic development of Ukraine.**

## 7. Emission

In the model, emission includes also money supply or currency in circulation. For the purposes of this study, the accuracy of the model not so much reduced.

The basic situation for the further analysis we establish close to reality: domestic prices for all products increase by 9.5% each cycle, the devaluation of 10%, wages increase by 12.5%, while international prices, exports, and foreign import prices are constant, the volume of loans and additional investment of business owners in housing are absent. The effectiveness of the investment is equal to 1. The budget deficit in the 1st cycle is 10.256 trillion UAH. We consider only the results of the 1st cycle.

1. Consider the situation where the National Bank will issue 10.256 trillion UAH to cover this budget deficit. This emission *EM* causes the two mutually opposite effects: a) budget growth causes an increase in final consumption and investment of budget and pensioners, and b) inflation is 5.5% (according to the formula (2)) which, in turn, reduces accordingly all real indexes. As a result, real GDP indices on most goods and GDP across the country in the 1st cycle are reduced. If the government will manage to keep inflation at 2.75%, these declines are much smaller, and if the inflation level is 1.8%, the GDP is even growing (Table 4, columns 2–4).
2. Let the same emission be directed to banks to support them. The results will be much worse (Table 3, columns 5 and 6).
3. If the government directs this emission on all state-owned enterprises as investments to reduce material costs, general inflation continues to worsen the economy more than investment improves it, although the deterioration will be less. If the government can keep inflation at the level of 2.75%, the GDP is growing (Table 3, column 7).

As such, the emission is not very harmful to the economy, because even a very large emission causes a low level of inflation. A large devaluation of 50% causes only 9.7% (see Section 4). Big inflation in Ukraine is caused by monopolistic sellers and inflation expectations of people. However, these expectations are very large, so prices are rising at a faster pace than the emission and devaluation.

**Thus, the additional emission may give a positive result only if the government will manage to keep inflation.**

**The most effective direction of emission is as an investment in companies, next – to cover the budget deficit.**

**Emission for support of banks destroys economies at any inflation. The author thinks the IMF, providing loans or help to Ukraine, should prohibit this action because it is one of the powerful ways of thefts.**

The findings of our model agree well with empirical calculations on the vector autoregression model (Siliverstovs, Bilan, 2005).

## 8. Taxes

1. Reducing the tax norm **PIT** has the following results: 1) increases the part of the salary which remains at the disposal of the people, and 2) reduces contributions to the pension and social security funds. The first event causes an increase in the final consumption of individuals and a corresponding increase of the production of these goods. In turn, this increases the income of producers, hence their consumption and investment that runs the usual multiplier.

   The second event may not have any immediate consequences if the funds in the pension and social security are enough. If not enough, the budget allocates the necessary funds, and the final consumption and investments financed from the budget can be reduced. This leads to a decrease in the production of goods, which starts a reverse multiplier.

   Usually, the first multiplier dominates the second, resulting in increased indices of real GDP growth of all goods except the distribution of the import of inputs and financial services, the index for all country and the sums of GDP for 15 cycles and for the 1st–5th cycles. The GDP index is increasing especially strongly in investment and consumer goods, less in intermediate consumption goods, in export and in the distribution of consumer goods import. The sums of real tax revenues in budget and the contributions to pension and social insurance for 15 cycles reduce (Table 4, column 2).
2. The same reduction of the norm of income tax acts almost similar to the first tax, but it is stronger. The principal difference is that the real budget incomes decrease significantly stronger and the contributions to social insurance funds and the pension fund slightly increase. The sum of tax revenues in the budget and contributions to social insurance funds and pension funds decreased by 1.7% (Table 4, column 3).

TABLE 4. **Effect of tax cuts on the dynamics of the economy**

| Real indicators [2] | Sums, indexes (%) of GDP in the base situation | Change of GDP indices (%) at cutting tax norm on 10%: | | | | | All in the first 5 cycles | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | PIT | corporate profits | VAT | contributions to social insurance | all | for 15 cycles | for 1–5 cycles | Revival of business by 1% | |
| | | | | | | | | | for 15 cycles | for 1-5 cycles |
| Sum of total real GDP for 15 cycles[4] | 12835 | 0.4 | 0.6 | 0.2 | 0.7 | 2.5 | .0.4 | | 1.2 | |
| Sum of total real GDP for 1–5 cycles[4] | 4077 | 0.2 | 0.3 | 0.1 | 0. | 1.6 | 0.6 | 1.6 | 1.3 | 1.4 |
| Index of total real GDP for 15 cycles,% | 15.808 | 3.4 | 7.0 | 1.9 | 7 | 25 | 1.7 | 403 | 8 | 316 |
| Non-tradable consumer goods[3],% | 35.9 | 4.3 | 9.0 | 3.2 | 9 | 34 | 2.4 | 889 | 12 | 691 |
| Consumer goods[3],% | 42.0 | 3.4 | 7.7 | 2.6 | 7.4 | 27.7 | 1.8 | 1030 | 10 | 813 |
| Goods of intermediate consumption[3],% | -47.7 | 0.5 | 0.3 | 0.3 | 1.0 | 2.8 | 0.2 | 6.2 | 0.9 | 5 |
| Housing[3],% | 166.8 | 1.8 | 4.3 | 1.3 | 4.0 | 15.1 | 0.9 | 13 | 4.5 | 9 |
| Investment goods without housing[3],% | 109.1 | 3.3 | 7.2 | 2.4 | 7.2 | 26.6 | 1.7 | 176 | 7.1 | 110 |
| Consumer export | 116.3 | 0.6 | 0.6 | -0.1 | 1.0 | 2,9 | 0.1 | 4.8 | 0.2 | 2 |
| Export of intermediate consumption | 128.1 | 0.6 | 0.4 | -0.1 | 1.0 | 2.7 | 0.1 | 4.9 | 0.2 | 2 |
| Distribution and retail of consumer import | 43.0 | 2.1 | 5.0 | 1.5 | 4.7 | 17.8 | 0.8 | 33 | 3.5 | 18 |
| Distribution and retail of intermediate Import | -57.3 | -0.34 | -0.71 | -0.3 | -0.7 | -2.5 | -0.3 | -3.3 | -0.2 | 0,6 |
| Distribution and retail of housing import | 100.2 | 1.7 | 3.9 | 1.2 | 3.8 | 14 | 0.7 | 9.2 | 2.4 | 5 |
| Distribution and retail of investment import | 64.7 | 2.6 | 6.0 | 1.8 | 5.7 | 21 | 1.1 | 55 | 3.7 | 31 |
| Distribution of consumer goods[3],% | 40.7 | 3.4 | 7.7 | 2.6 | 7.5 | 28 | 1.8 | 1211 | 10 | 961 |
| Retail of consumer goods[3],% | 41.7 | 3.2 | 7.3 | 2.4 | 6.9 | 26 | 1.6 | 391 | 9.6 | 314 |
| Bank services[3],% | -69.5 | -0.2 | -0.3 | -0.2 | -0.5 | -1.6 | -0.2 | -0.7 | -0.1 | 2 |
| Real tax revenues in budget for 15 cycles[4] | 1838 | -1.1 | -2.8 | -0.9 | 2 | -2 | -0.4 | -1.6 | 0.5 | -0,5 |
| Real income in social insurance for 15 cycles[4] | 1023 | -1.0 | 0.3 | 0.1 | -9 | -19 | -1.7 | -19 | -1.1 | -4,4 |
| Sum of budget and social insurance[4] | 2861 | -1.1 | -1.7 | -0.5 | -2 | -8 | -0,9 | -8 | -0.1 | -2.0 |

3. The reduction of the **VAT** norm less increases the GDP index for all goods and for the country as a whole and even reduces exports. The sum tax revenues in the budget and contributions to social insurance funds and the pension fund decreased by 0.5% (Table 4, column 4).
4. The reduction in the social insurance contributions norm for the same 10% acts almost similar to the first tax, but is much stronger. The difference is that the tax revenues in the budget increase, though their sum with contributions to the social security funds and the pension fund have decreased by 2% (Table 4, column 5).
5. The simultaneous reduction of all tax norms acts as the first tax, only much stronger (Table 4, column 6).
6. If you reduce the norm of all taxes only on the first five cycles and then restore them to the baseline values, there is a trade-off: the indexes of GDP for 15 cycles of rising are considerably less, but tax revenues in the budget are almost unchanged, the contributions to social insurance funds and the pension funds and their sum budget reduced significantly lower: 1.7% and 0.9%, not 19% and 8% (Table 4, columns 7 and 8).
7. To get the similar effect by smaller decreasing tax norms during all 15 cycles is impossible.
8. Generally, reducing the tax burden revives business. However, in previous situations, this was not yet taken into account. If one considers that reducing the tax burden by 10% will cause the recovery of business by at least 1%, this improves all indexes significantly. In Section 6, along with the growth of the GDP index of all goods, tax revenues in the budget also increase by 0.5%; contributions to social insurance funds and the pension fund and their sum will be reduced significantly lower: 1.1% and 0.1% (Table 4, columns 9 and 10).

**Thus, reducing the tax burden in general induces positive impacts on the economy, even if the model does not incorporate additional recovery business, and GDP is growing just because of a slight increase in the revenues that are available to consumers. But tax revenues in the budget and contributions to social insurance funds and the pension fund have largely reduced, although the consumption grows, and thus the production of all goods, which is due to increase in the revenue, hinders the reduction.**

**The most influential factor is the norm of contributions to social insurance, the further norm for income tax and personal income. The government should take this into account when reforming taxes.**

**You can achieve some compromise (simultaneous, albeit small, growth and GDP, and a small decrease in tax revenues in the budget) only in one way: lowering the norms only in the first few cycles and then restoring them to basic levels.**

**If the reduction of the tax burden will cause recovery business, all indicators will improve and then we can achieve a real compromise – a simultaneous growth of the GDP, revenues of the budget, and social funds.**

## 9. Overproduction

In the world, there are models of equilibrium and non-equilibrium economies. But there are no models in which deviations from the equilibrium would be regulated. In our model, it is provided for.

First, in the model there lays the perfect market equilibrium when the output of each product is defined as the sum of demand of its all buyers. But we have provided in the model the possibility to regulate the deviation from this ideal and hence to predict and analyze the results of such deviations. For any product, you can specify any level of overproduction (supply exceeds the demand) or underproduction (demand exceeds the supply).

The effect of overproduction on economy is mutually opposite: on the one hand, being redundant, it directly reduces income and tax on it; on the other, it increases the sums of salaries and all associated taxes and charges. In addition, it increases the production and importation of inputs. The resultant effect may have the mark of "plus" or "minus", depending on which trend is stronger.

1. A small (below 12%) overproduction of **consumer goods *1* (non-tradable)** reduces the GDP index almost on all goods, and especially hard, of course, on the product *1* itself. As mentioned above, the GDP index on goods for the intermediate consumption, imports and financial services increases. But this growth is not enough to overcome the negative trend, so the sum of real GDP in the whole country for 15 cycles, for 1–5 cycles and the GDP index in the 15th cycle decreased (Table 5, columns 1 and 2). The sum of real budget income for 15 cycles decreases slightly (by 0.02%), but the contributions to social insurance funds and the pension fund increase by 0.09%, their sum increases by 0.02%.

   With more overproduction (11–15%), the GDP index created in the distribution and retail of import greatly and that created in export slightly increases. Therefore, the positive trend wins and the sum of real GDP for 15 cycles and the GDP index in the 15th cycle grows, although the sum for 1–5 cycles continues to decline. Full real revenues for 15 cycles are still decreasing (by 0.3%), but the contributions to social insurance funds and the pension fund grow by 2%, so their sum increases by 0.5% (Table 5, column 3).

   At a higher overproduction (over 15%), indexes of GDP, created in the production of all goods, except in intermediate and final consumption goods and in the distribution of their imports, reduce again. The index of GDP in the whole country and its sum for 15 cycles increases. The full real revenue for 15 cycles decrease very little (at 0.04%) and in the next cycles increases (Table 5, column 4).
2. The overproduction of **tradable consumer (*2*) and investment goods ($3_N$) and housing ($3_J$)**, unlike the previous version, acts on economy always in one direction, **regardless of its level**. Of these, the overproduction of consumer goods inhibits economy the most powerfully – the sum of real GDP for 15 cycles is reduced by 3%, while the overproduction of investments – only by 0.2%. The volume of the investment production is only 4.4 times less than consumer goods, so the difference of 15 times is explained by the multiplier effect.

TABLE 5. **Effect of overproduction on economy**

| **Real indicators** [2] | **Overproduction of goods:** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **consumer non-tradable 1 per:** | | | | ***2*** | ***$3_J$*** | ***$3_N$*** | ***$1,2,3_J,3_N$*** | ***3*** | ***$1,2,3_J,3_N,3$*** | ***$4,5,5_J,5_N$*** | **all** |
| Overproduction by: | 1% | 10% | 15% | 20% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| Sum of total real GDP for 15 cycles[4] | -0.04 | -0.1 | 0.04 | 0.24 | -3 | -0.07 | -0.2 | -4 | -4 | -8 | -7 | -16 |
| Sum of total real GDP for 1–5 cycles[4] | -0.02 | -0.2 | -0.22 | -0.21 | -5 | -0.06 | -0.1 | -6 | -3 | -9 | -8 | -17 |
| Index of total real GDP for 15 cycles,% | -0.57 | -0.3 | 1,9 | 4,6 | -11 | -0.41 | -2.2 | -16 | -40 | -62 | -39 | -107 |
| Non-tradable consumer goods,% | -7 | -56 | -94 | -161 | 14 | -0.13 | -0.5 | -46 | -16 | -63 | -19 | -86 |
| Consumer goods,% | -0.17 | 1.6 | 4 | 7 | -19 | -0.12 | -0.4 | -18 | -14 | -35 | -17 | -56 |
| Goods of intermediate consumption,% | 0.45 | 5.7 | 11 | 19 | 37 | 0.40 | 1.9 | 48 | -35 | 4 | 3 | 4 |
| Housing,% | -0.27 | -0.9 | -1 | -1 | -3 | -13 | -1.0 | -20 | -17 | -39 | -12 | -52 |
| Investment goods without housing,% | -0.43 | -1.6 | -2 | -2 | -8 | -0.46 | -19 | -54 | -28 | -81 | -21 | -97 |
| Consumer export | -0.02 | -0.1 | 0.01 | 0.01 | 4 | 0.03 | -0.06 | 4 | -0.6 | 4 | -0.4 | 3 |
| Export of intermediate consumption | -0.02 | -0.1 | 0.00 | 0.00 | 4 | 0.03 | -0.05 | 4 | -0,6 | 3 | -0.4 | 3 |
| Distribution and retail of consumer import | -0.16 | 1.2 | 3 | 5 | 12 | -0.09 | -0.4 | 12 | -11 | -1 | -106 | -111 |
| Distribution and retail of intermediate import | 0.19 | 1.6 | 3 | 5 | 15 | 0.19 | 1.2 | 20 | 27 | 50 | -34 | -1 |
| Distribution and retail of housing import | -0.29 | -0.9 | -1 | -1 | -3 | -0.25 | -1.1 | -6 | -17 | -26 | -71 | -91 |
| Distribution and retail of investment import | -0.44 | -1.4 | -1 | -1 | -6 | -0.40 | -2.1 | -12 | -27 | -43 | -94 | -125 |
| Distribution of consumer goods,% | -0.18 | 1.6 | 4 | 7 | -325 | -0.12 | -0.4 | -325 | -15 | -329 | -17 | -332 |
| Retail of consumer goods,% | -0.17 | 1.6 | 4 | 6 | -297 | -0.12 | -0.4 | -297 | -14 | -300 | -16 | -302 |
| Bank services,% | 0.11 | 1,1 | 2 | 4 | 9 | 0.00 | 0.7 | 12 | 14 | 28 | 0,5 | 27 |
| Real tax revenues in budget for 15 cycles[4] | -0.02 | -0.2 | -0.3 | -0.04 | -2 | -0.10 | -0.4 | -3 | -3 | -7 | -8 | -16 |
| Real income in social insurance for 15 cycles[4] | 0.09 | 1.0 | 2 | 3 | 4 | 0.15 | 0.4 | 6 | 5 | 11 | -2 | 8 |
| Sum of budget and social insurance[4] | 0.02 | 0,3 | 0 | 1 | 0,3 | -0.01 | -0.1 | 0,3 | -0.3 | -0.4 | -6 | -7 |

3. The simultaneous overproduction of consumer (*1* and *2*) and investment ($3_N$) goods and housing ($3_J$) by 10% reduces GDP indices by these goods to 18–54%, increases GDP indices by intermediate consumption goods by 48% and imports by 20%, but this is not enough to increase the sum of GDP. It decreased by 4%.
4. The overproduction of inputs, of course, greatly reduces the GDP index by themselves, half less on other goods and in the whole country. The greater the level of overproduction, the greater this reduction.
5. The simultaneous overproduction of inputs, investments and final consumption and housing reduces the GDP index in the whole country, for all goods, except intermediate consumption, imports, financial services, export.
6. Excessive imports greatly reduce the index of GDP by distributors, less by others and across the country.
7. The simultaneous overproduction of all goods (excluding exports) and excessive imports reduces the GDP index generated in the production of all goods, except intermediate consumption, exports and financial services, and the whole country (Table 5, column 12).

## 10. Underproduction

1. Underproduction of any goods, except intermediate, reduces the GDP index for all producers and distributors of imports and in the whole country (Table 6, columns 1–5). The underproduction of consumer goods inhibits economic development most strongly.
2. A small underproduction of inputs acts oppositely (Table 6, columns 6, 7). The reason for this reaction, at first sight paradoxical, is in the regularity, which was defined in Vasylenko (2015b): without any underproduction the technological progress, which reduces the expense of materials, has mutually opposing effects: increases the income of producers of investment and consumer goods, but reduces the production of inputs. Hence follows such a recommendation: reduce production of inputs (and therefore their fixed assets) with a rate equal to the weighted average (on volume production) rate of decrease of material costs of all goods, including inputs themselves. But their producers had never heard this recommendation before (Vasylenko, 2015b). So they continue to produce excessive inputs for which there is no demand. The result is an overproduction of inputs. If we set them at small underproduction, we thus balance supply with demand, which causes the acceleration of economic development.

   But a great underproduction of inputs (over 8–9%) leads to shortages of them, then the reaction of economy becomes normal – its development is slowed (Table 6, column 8).

TABLE 6. **Effect of underproduction on economy**

| Real indicators [2] | Underproduction of goods: | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | $3_J$ | $3_N$ | 1, 2, $3_J$,$3_N$ | 3 | | | 1, 2, $3_J$,$3_N$,3 | 4 | 5 | | | $5_J$ | $5_N$ | $4,5,5_J,5_N$ | | | all |
| Overproduction by: | 10% | 10% | 10% | 10% | 10% | 1% | 4% | 10% | 10% | 10% | 1% | 5% | 20% | 10% | 10% | 1% | 5% | 15% | 10% |
| Sum of total real GDP for 15 cycles | -2 | -4 | -0.3 | -1 | -7 | 0,2 | 0.8 | -3 | -11 | -0.7 | -0.7 | 1.4 | -0.3 | -0.07 | -0.3 | 0.2 | 0.8 | -1.2 | -11 |
| Sum of total real GDP for 1–5 cycles | -2 | -4 | -0.3 | -1 | -7 | -0.04 | -0.2 | -7 | -14 | -0.6 | -0.6 | 1.1 | -1.4 | -0.07 | -0.2 | 0.2 | 0.6 | -2.0 | -14 |
| Index of total real GDP for 15 cycles, % | -14 | -35 | -2 | -11 | -60 | 2.2 | 8 | 0.7 | -61 | -5 | -5 | 9 | 6 | -0.56 | -2.8 | 0.8 | 4 | .-4 | -58 |
| Non-tradable consumer goods, % | -60 | -21 | -1.3 | -6 | -83 | 0.7 | 2 | -7 | -89 | -3 | -3 | 5 | 3 | -0.23 | -1.1 | 0.7 | 3 | -0.9 | -87 |
| Consumer goods, % | -8 | -63 | -1.1 | -6 | -74 | 0.6 | 2 | -6 | -80 | -2.3 | -2.3 | 5 | 3 | -0.21 | -1.0 | 0.6 | 3 | -0.8 | -78 |
| Goods of intermediate consumption, % | -2 | -4 | -0.2 | -0.9 | -7 | 1.9 | 7 | 7 | -2 | -0.4 | -0.4 | 0 | -0.4 | -0.02 | -0.1 | -0.2 | -1 | -1.0 | -2 |
| Housing, % | -3 | -9 | -20 | -3 | -32 | 1.1 | 4 | 2 | -31 | -1.3 | -1.3 | 3 | 2 | -0.12 | -0.6 | 0.4 | 2 | 0.2 | -29 |
| Investment goods without housing, % | -6 | -14 | -0.9 | -30 | -48 | 1.8 | 7 | 3 | -47 | -2.1 | -2.1 | 5 | 4 | -0.19 | -0.9 | 0.7 | 3 | 0.2 | -44 |
| Consumer export | -0.2 | -0.5 | -0.1 | -0.2 | -1,0 | 0.04 | 0.1 | -0.2 | -1.2 | -0.1 | -0.1 | 0.1 | 0.01 | -0.01 | -0.05 | 0.00 | 0.01 | -0.2 | -1,3 |
| Export of intermediate consumption | -0.2 | -0.5 | -0.1 | -0.2 | -0,9 | 0.03 | 0.1 | -0.2 | -1.2 | -0.1 | -0.1 | 0.1 | 0.01 | -0.01 | -0.05 | 0.00 | 0.01 | -0.2 | -1,3 |
| Distribution and retail of consumer import | -6 | -14 | -0.9 | -4 | -25 | 0.5 | 2 | -3 | -28 | -37 | -37 | 3 | 3 | -0.2 | -0.8 | -3 | -16 | -53 | -59 |
| Distribution and retail of intermediate import | -0.1 | -0,4 | -0.05 | -0.2 | -0.8 | -1.5 | -5 | -8 | -9 | -0.1 | -0.1 | 14 | 10 | 0.0 | -0.03 | 3 | 13 | 15 | 10 |
| Distribution and retail of housing import | -4 | -9 | -0.6 | -3 | -15 | 1.1 | 4 | 3 | -13 | -1.4 | -1.4 | 3 | 3 | -19.9 | -0.6 | -2 | -8 | -30 | -30 |
| Distribution and retail of investment import | -5 | -14 | -0.9 | -4 | -24 | 1.7 | 6 | 4 | -21 | -2.1 | -2.1 | 4 | 4 | -0.2 | -26 | -2 | -10 | -38 | -41 |
| Distribution of consumer goods, % | -8 | -64 | -1.1 | -6 | -75 | 0.6 | 2 | -6 | -81 | -2.4 | -2.4 | 5 | 3 | -0.2 | -1.0 | 0.6 | 3 | -0.8 | -79 |
| Retail of consumer goods, % | -7 | -61 | -1.1 | -5 | -72 | 0.6 | 2 | -5 | -78 | -2.2 | -2.2 | 4 | 3 | -0.2 | -1.0 | 0.5 | 3 | -0.7 | -76 |
| Bank services, % | -0,3 | -0.8 | -0.03 | -0.2 | -1.3 | -0.9 | -3 | -4 | -5 | -0.1 | -0.1 | -0.04 | 0.1 | 0.0 | -0.04 | -0.03 | -0.10 | -0.1 | -5 |
| Real tax revenues in budget for 15 cycles[4] | -2 | -5 | -0.4 | -2 | -8 | 0.2 | 0.8 | -4 | -12 | -1.4 | -1.4 | 1 | -3 | -0.2 | -0.8 | 0.00 | -0.26 | -5 | -14 |
| Real income in social insurance for 15 cycles[4] | -1 | -3 | -0.2 | -1.1 | -6 | -0.5 | -2 | -6 | -11 | -0.3 | -0.3 | 0 | -0.3 | 0.0 | -0.1 | 0.04 | 0.16 | -1 | -11 |
| Sum of budget and social insurance[4] | -1.7 | -4,3 | -0.3 | -1.4 | -7.4 | -0.02 | -0.1 | -4.4 | -11.6 | -1.0 | -1.0 | 0.8 | -1.8 | -0.1 | -0.6 | 0.01 | -0.11 | -3,4 | -13 |

3. A similar situation arises when there is a lack of the import of **inputs** and the reason is the same (Table 6, columns 11–13).
4. The lack of import of other types of goods reduces the GDP index for all goods and for the whole country according to their level (Table 6, columns 9, 14, 15). The lack of import of consumer goods inhibits economic development most strongly.
5. The simultaneous deficiency of import of all kinds of goods acts differently depending on its level. For its small level (less than 8–9%) there dominates the positive effect of deficiency of imports of inputs, so the economy is accelerating. The maximum acceleration is at the level of deficiency 5%. At the level of shortage over 9%, the negative impact of deficiency of imports of other commodities, except inputs, wins, the economy slows down the more the higher the scarcity (Table 6, columns 14–16).
6. Simultaneous underproduction of all goods, except exports, together with the lack of imports always reduces the GDP index for all goods and in the whole country according to its level (Table 6, column 17).

## Conclusions

There is no such a level of price increase, which would cause an improvement of the economy. Any inflation reduces the GDP. The provision of the Keynesian theory of the need to moderate inflation is not confirmed in Ukraine either in the short or long term.

1. Increase in prices of consumer goods or intermediate imports increases the real value added for them but reduces it to all other goods and in the whole country.
2. Rising prices of housing or of investment goods or of consumer imports increase the real added value for them but reduce it for all other goods (except housing and investment goods) and in the whole country.
3. If the inflation falls short of devaluation, the GDP index increases, and the more lag, the more. If not lagging, the GDP decreases. Thus, control prices, albeit non-market, are profitable for producers, consumers and all the country except importers. For economic development, the government may impose a moratorium on unjustified price increase and the reduction of salaries in enterprises for six months or more and in the next fiscal year shall compensate the loss for import distributors at the expense of excess profits of exporters and the budget.
4. Exporters are not always beneficial to lobby devaluation. If an exporter under devaluation lowers the price in the foreign currency, as it follows from the traditional theory of international trade, foreign exchange earnings from elastic goods increase and from inelastic decrease. But exporters' profit falls.
5. If the national bank has done devaluation, exporters must: 1) hold the highest possible price in the foreign currency contrary to the traditional theory; 2) to lobby the containment of domestic prices. If that is not possible, they should lobby the constancy of the exchange rate. Otherwise, inflation "eats" their windfall from the devaluation.

6. The national bank can make devaluation only if the government will provide the predeterrent domestic prices, otherwise the GDP declines. The most effective mechanisms that will deter prices are bonuses to consumers for informing the Antimonopoly Committee about the unjustified increase of price by a specific seller.
7. The greater the increase in average wages, the more the increase of the GDP. The index of the GDP, which was generated in the production of end-use goods, in their distribution, in retail and in import, is growing particularly strongly; in the production of intermediate consumption goods, in the distribution of their import and in banking services it is growing slowly. The index of the GDP generated in the production of exports, of housing, of investment goods, in the distribution of their import decreases. The increase of the average wage, despite of the reducing income, in general is a positive factor in the economic development of Ukraine.
8. Additional emission may give a positive result only if the government will manage to keep inflation.
9. The most effective direction of emission – as an investment in the companies and to cover the budget deficit.
10. Emission for supporting banks destroys economies at any inflation. The author thinks the IMF, providing Ukraine loans, should prohibit this action because it is one of the powerful ways of thefts.
11. Export growth, both by volume and especially by the growth of foreign prices, is a very strong factor in the economic development of Ukraine.
12. Reducing the tax burden in general positively impacts the economy, even if the model does not incorporate the additional business revival. But tax revenues in the budget and contributions to social insurance funds and the pension fund largely reduced, although the consumption grows, and thus the production of all goods, which is due to the increase in revenue, decreases this reduction.
13. The most influential factor among taxes is the rate of contributions to social insurance, followed by the norm of income tax and of personal income.
14. You can achieve some compromise (simultaneous, albeit small, growth of GDP, and a small decrease in tax revenues in the budget) by lowering norms only in the first few cycles and then restoring them to the basic levels.
15. If the reduction of the tax burden will cause the revival of business, all indicators will improve, and then we can achieve a real compromise – the simultaneous growth of the GDP, of the revenues of the budget, and of social funds.
16. A small (below 5%) overproduction of consumer, investment and housing goods reduces the GDP index for all goods, except intermediate and imports, and also in the whole country.

    A higher overproduction (10–15%) greatly increases the GDP index for goods of intermediate and final consumption and import of them, and in the whole country.

Even a higher overproduction (above 15%) again reduces the GDP index for all end-use goods, and then for imports and in the whole country.

17. Excessive imports strongly reduce the GDP index of their distributors, less in others and in the whole country.
18. The character of the impact of overproduction of final consumption non-tradable goods on the sum and the index of real GDP for 15 cycles, and the index of GDP generated in the production of consumer goods for the domestic market depends on the level of overproduction: at the small level, the sum and the indices of the GDP reduces; when more – increases. The character of impact on all other indicators is not dependent on the level of overproduction. The higher the level, the index of the GDP generated in the production of housing and distribution of their imports falls more, and the GDP created in the production of inputs, capital goods and banking services increases more.
19. The character of the impact of overproduction of all other goods on all performance indicators does not depend on its level. The simultaneous overproduction of goods (excluding exports) and excessive imports reduces the GDP index generated in the production of all goods except intermediate consumption, the distribution of their imports, banking, and the whole country. The higher the level, the higher the indexes.
20. Underproduction of any goods (except inputs) or the lack of any import (except inputs) reduce the GDP index for all producers and distributors of imports and in the whole country. The underproduction of consumer goods inhibits the economic development most strongly.
21. A big underproduction of inputs or the lack of import of inputs act similarly, and a small one acts on the reverse.
22. A simultaneous underproduction of all goods (except exports) and the lack of import always reduce the GDP index for all goods and in the whole country according to its level.
23. The well-known economic statements about inflation and devaluation, listed above, are not suitable for Ukraine. As our model is of the causal type and the system of economic mechanisms (value creation, wages, incomes of the enterprises and the state, taxes, etc.; trade and transfers among economic actors) is the basis of any economy, the author believes that these results are also valid for other countries.

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