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## **FOREIGN ECONOMIC IMPERATIVE FOR MODELING OF COMMODITY INNOVATION**

### **Abstract**

The problems in working out the innovative strategy for Ukraine are analyzed, such as necessity and ways to apply the method of differential approach in description of national macroeconomic system as the means to resolve internal and external economic contradictions while implementing present-day innovative state policy. Foreign economic imperative for modeling of commodity innovation strategy is substantiated.

### **Key words**

Strategy of commodity innovation, European imperative of strategy for commodity innovation, commodity groups of complementary, contradictory and indifferent type, coefficients of multiplication of import and export, commutative effect, coefficient of general and branch-wise commutativity.

Strategy of innovative development in general, and of commodity innovation in particular – when Ukraine is more and more oriented to join the EU - will succeed only if it can link, i.e. find common ground for national interests and economic interests of the European Union countries.

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We proceed from the notion that the EU countries pursuing their interests perceive commodity flows and industries of Ukraine is economy differentially. From this angle it is pertinent to distinguish three groups. The first group would comprise industries producing **goods of complementary type**. We refer to commodity groups capable to integrate integrally into European commodity markets. Certainly, for some European businesses appearance of new producers and competitors on a rather balanced and **saturated** commodity market is not desirable, but from wider aspect considering international and common to the whole world strategic interests we ought to acknowledge that there is a number of branches of economy where Ukraine could be contributive for the countries of the European Union. We mean those groups of Ukrainian goods that would complement and serve better the consumers' needs on the EU markets, would ensure reduction of gross and average costs, increase productive efficiency of all productive factors, optimize employment of natural resources, and improve the structure of consumption and ecological environment.

The second group comprises **contradictory goods**, output expansion of which in Ukraine would contradict the interests of the EU and upset general balance on European commodity markets, would confuse the price strategy of the EU companies commencing or intensifying dumping procedures, and aggravate ecological situation in Europe.

To the third group we refer the commodity flows and industries of **indifferent type**. Indifferent goods are those Ukrainian goods or commodity groups the production of which does not affect economic interests of the EU countries.

At the same time, the strategic model of commodity innovation, taking into account foreign economic factors should be oriented to satisfy internal and national economic interests. Consequently, differential approach to describe various commodity groups of national production is needed. From our viewpoint, it is expedient to distinguish within the whole Ukraine's macroeconomic system the industries of the initial level, which define strategy of Ukraine's economic development, i. e. so called 'transmission' industries.

Differential approach in strategy elaboration of innovative development of the country, that provides for finding common grounds and defining contradictions between national and international interests, has already been acknowledged both in the world and national economic science(1), (4). The problem is to convert theoretical generalization into practical recommendations. A real step to advance in this direction could be modeling of strategy for innovative development of Ukraine. To ground this model we need to answer the following questions:

- What industries and sectors of national economy should be offered financial, credit, tax, customs and other preferences to ensure innovative orientation?
- Would it be reasonable to stimulate groups of industries (airspace, aircraft construction, military, and instrument making construction) that are usually regarded as innovative leaders only due to their capability

to produce high technology goods? It should be noted that these industries became technological leaders because of and due to the command economic system. Could their innovative elaborations compete on the world markets?

- Are there industries and types of production that are currently in embryo to become determinant for successful entrance into the global economy in future?

Elaboration of strategy for innovative development allowing for foreign economy impact needs macroeconomic modeling. We will try to devise approximate model based on aggregate indices using not so much statistical data but mostly indicators of trends. Selection of the approximate model is not accidental. Approved in the world models of Dornbusch – Fischer–Samuelson, Krugman, and Heksher–Ohlin that are based on genuine information on export-import activity could not be efficiently applied in the current stage of Ukraine's development (5), (6), (3), (7). Firstly, they are immanent exclusively within the formed economic systems that are developing in conformity with objective logic of market behavior of all subjects. In our country these models are replaced with co called «manual management», incessant and often inconsistent in rules of play. Secondly, statistic base for foreign economic activity analysis is far from perfect. Data calculated employing the methods of Ministry of Statistics and State Customs Committee disagree so utterly, that their application in macroeconomic models may lead to absolutely opposite conclusions as for preferences in certain commodity flows in exports and imports of the country.

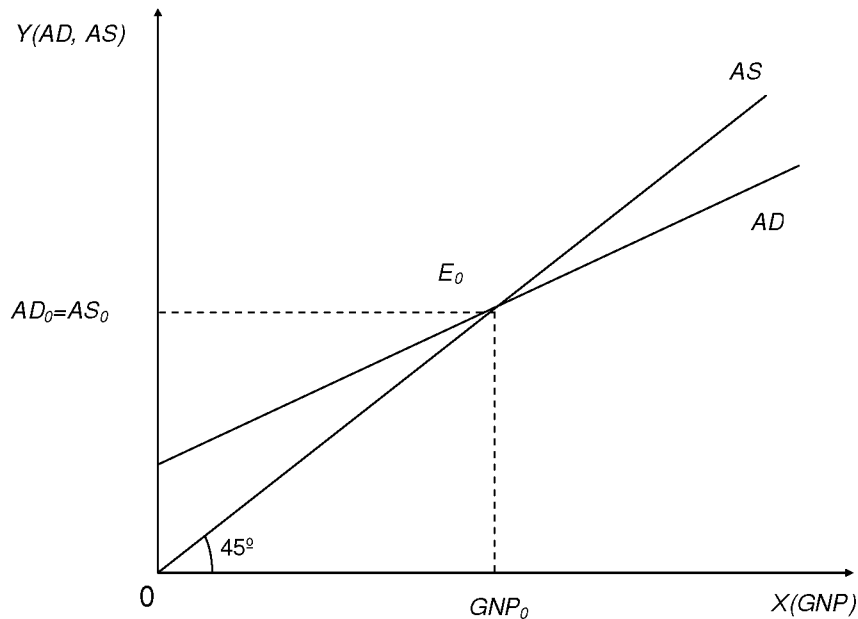
We suggest that conclusions of Keynesian theory of general macroeconomic equilibrium (2) should serve as the basis of this model. The active regulatory function of the state, the essence of Keynesian ideology, and this very idea are applied in designing the model of external economic factor affecting the strategy of innovative development of the country. At first we will graph the so called «Keynesian cross» (Fig. 1). It illustrates that under condition of total employment when GNP equals  $GNP_0$ , aggregate supply of goods ( $AS$ ) and aggregate demand ( $AD$ ) within the whole macroeconomic system is balanced:  $ASg_0 = AD_0$ . In other words, macroeconomic equilibrium is achieved.

Proceeding from these generally known principles we will propose some additions. Volume of aggregate demand, as is known, is quantitatively limited by the following:

- the volume of household incomes are used for consumer spending ( $C$ );
- volume of incomes of managing subjects used as the companies' investments ( $I$ );
- volume of state incomes used as state expenditures ( $G$ );
- volume of net export ( $NEx$ ), hence,  $AD = C + I + G + NEx$ .

Fig. 1.

Macroeconomic equilibrium by Keynes.



The line  $AD$  (Fig. 1) starts from the point above the zero point (on the ordinate). It can be accounted for the demand taking place when  $GNP$  is marginally small approximating zero. The line  $AD$  will not parallel the line  $AS$  and it will slant more ( $< 45^\circ$ ) because it is affected by the law of marginal propensity to save. Net export ( $NEx$ ) is a structural component of aggregate demand. We will focus our attention on it as it exactly serves as foreign economic factor in this model.

Net export volume, as is known, is defined by the difference between annual exports ( $Ex$ ) and annual imports ( $Im$ ) of the country. Let us first consider the nature of the import effect, and on this ground try to interpret more precisely the basic macroeconomic model. For that aim we will introduce the concept of marginal propensity to import ( $MPI$ ). It can be presented as the ratio of import growth ( $\Delta Im$ ) to growth of gross national product ( $\Delta GNP$ )

$$MPI = \frac{\Delta Im}{\Delta GNP}.$$

Thus, marginal propensity to import shows what share of  $GNP$  growth is used to enlarge import.

Import brings about reduction of *GNP* and *AD*, and it acts as a saving factor in J. M. Keynes model. Relationship between *GNP* growth and increase of aggregate demand due to fluctuations in import volume is reverse - the larger is the increase of import the smaller are volumes of  $\Delta GNP$  and  $\Delta AD$ . But the main thing that we would like to stress that impact of import fluctuations on changes in *GNP* and aggregate demand are followed by multiplication effect. It is to be defined and taken into consideration in our model. The essence of import multiplication is in the fact that the initial import change always brings about the chain reaction which while decreasing its volume in each successive link eventually provides for the effect of repeated amplification of initial change.

Based on reverse nature of *GNP* growth dependency on import enlargement, and applying the formula of marginal propensity to import, we argue that:

$$\Delta GNP = \frac{1}{MPI} \times \Delta Im,$$

or

$$\Delta GNP = \frac{1}{\frac{\Delta Im}{\Delta GNP}} \times \Delta Im,$$

or

$$\Delta GNP = \frac{\Delta GNP}{\Delta Im} \times \Delta Im.$$

The above statements could be interpreted as different formulations of import multiplication coefficient. The higher it is the less capable to grow are *GNP* and aggregate demand. On this ground we can chart the macroeconomic equilibrium (Fig. 2) more specifically.

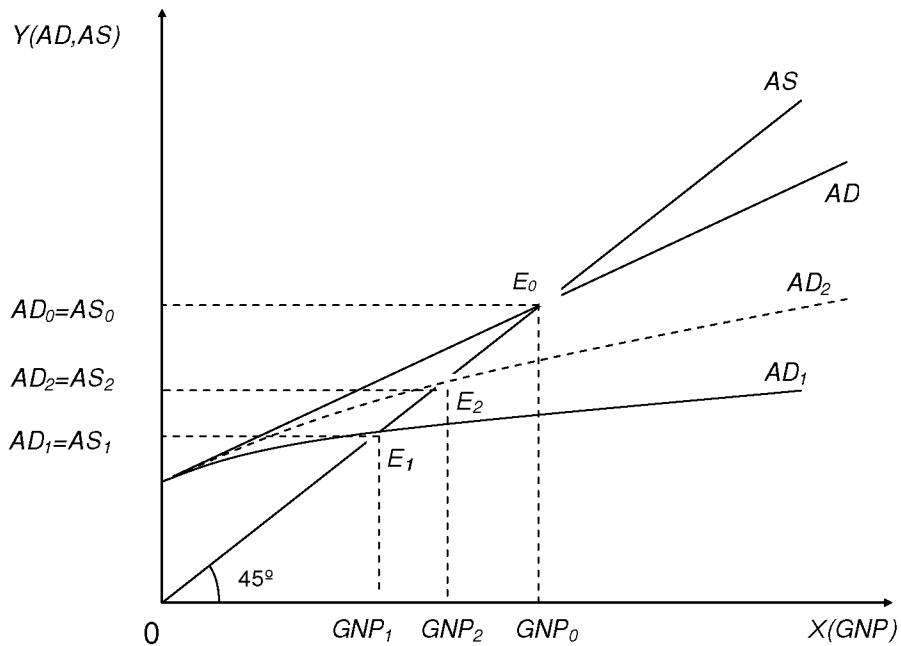
The line of aggregate demand now is incurved ( $AD_1$ ) and caused by import multiplication effect. Though with growing *GNP*, the aggregate demand is increasing, its increase is fading and, therefore, will influence negatively macroeconomic dynamics and equilibrium.

Macroeconomic equilibrium from now on will be ensured with gross national product being less than  $GNP_0$  and equal to volume of  $GNP_1$ . This circumstance directly relates to foreign economic aspects in the strategy for country's economic development.

Taking into account the import effect it has to be grounded what specific commodity groups are preferential. If they are selected regardless of import multiplication effect, then, firstly, bigger and bigger share of export proceeds we will have to take away from industries and manufacturing businesses that provide for the country's innovative break-through and advance of «cutting edge» technologies on the world markets.

Fig. 2

Macroeconomic equilibrium with allowance for import multiplication effect.



Secondly, with high coefficient of import multiplication the *commutative effect*<sup>1</sup> will also work. In particular, the enterprises of initial level whose functioning guarantees required capacity of domestic market indispensably will suffer from shortage in investments, and that will necessarily lead to the fall in demand on the markets of consumer goods. In addition, disproportion between domestic and foreign sectors of economy will intensify, national currency will become disproportioned on foreign and domestic markets as well.

Thirdly, ignoring coefficients of differences in import multiplication of various commodity groups, and on this ground the wrongly chosen import policy will mean creation of extra barriers for positively trended macroeconomic dynamics. From now on, aggregate macroeconomic equilibrium – balanced aggregate demand and aggregate supply – will be ensured with less volumes of surplus in GNP. Any GNP

<sup>1</sup> The relations between two (or more) economic phenomena having not only certain correlation, but causing also some transformations and modifications of even one of the phenomena, are considered to be commutative. Thus, commutative effect represents the rate of such modifications.

(achieved, for example, at the account of other factors) will distort the macroeconomic equilibrium and cause severance in unemployment (see Fig. 2).

Thus, in 1990-s Ukraine purchased much imported machinery, especially grain combine harvesters. Initial import purchases induced chain reaction, that brought about multifold increase in imports (trailed implements, component and spare parts, etc.)

The effect we propose to name as **commutative** manifested itself. In the given example it appeared to be too powerful, and it negatively affected the volumes of aggregate demand and prospects for dynamic development of a great number of national producers in metallurgy, metal rolling, machine building, electric appliances building, etc. And that happened because the very import policy was wrong in principle. It was not taken into consideration that that commodity group has one of the highest **import multiplication coefficient** in Ukraine, and indices of **general and industrial commutativity** considerably exceed the average.

General commutativity coefficient (*GCC*) can be calculated with the following formula:

$$GCC = \frac{\Delta GNP}{GNP_0} : \frac{\Delta GNP(i)}{GNP(i)_0},$$

where:  $\Delta GNP$  – absolute growth of *GNP* for examined period (one or five years);

$GNP_0$  – volume of *GNP* in a base year;

$\Delta GNP(i)$  – absolute volume of value-added growth achieved during the examined period in *i*-industry;

$GNP(i)_0$  – value-added volume *i*-industry gained in a base year.

To eliminate effects of price fluctuations in the examined period, all four components of the formula should be corrected with deflator applied. To eliminate the short term effects unrelated to the effect of commutativity the calculations should be made considering changes within five or more years.

Calculated this way coefficient will allow to define how total GDP changes in response (changes can be presented in percentage) to each point (percent, permille) of changes in *GDP* by value added volume created in a certain (e. g. *i*-th) industry. The higher it is, the closer and more radical in terms of changes is the relation of the industry with the whole macroeconomic system.

Coefficient of industry's commutativity (*CIC*) can be calculated as:

$$CIC = \frac{\Delta GDP(j)}{GDP(j)_0} : \frac{\Delta GDP(i)}{GDP(i)_0},$$

where:  $\Delta GDP(j)$  – abs.growth of added value created in *j*-th industry within the examined period.

$\Delta GDP(j)_0$  – volume of added value in *j*-th industry created in the base period.

If the coefficient of general commutativity reflects limits, degree of impact and the nature of changes in volume of production of a certain industry on general macroeconomic effect (*GNP*), then the coefficient of industry's commutativity allows to define quantitatively the degree of change effect in volumes of production variations of *i*-th industry on changes on volume of *GNP* *j*-industry (or certain industrial complex).

Negative value of coefficient means that when volume of *i*-industry increases (or its part in percentage) of *i*-industry, the growth of production volume growth (or absolute value off effect) of *i*-industry or particular industrial complex decreases. And vice versa, when it falls, the growth increases. If the numerical value of the coefficient (minus or plus) is approximating zero it signifies extremely weak commutative degree of the industries. The higher the degree of commutativity is, the more firmly the industry is tied to the whole macroeconomic system, and the more profound transformations and changes are. Changes in volume (or rate of growth) of production in one industry will bring about similarly considerable changes in an other industry or industrial complex.

Therefore, when elaborating upon foreign economic aspects of innovative development the import policy should be based on selection of those commodity groups which produce minimum commutative effect and have the lowest coefficient of import multiplication.

Only if these conditions provided, it is possible to make the aggregate demand curve straight and approximate maximally its path ( $AD_2$ ) to straight line ( $AD$ )<sup>2</sup>.

It should be noted that equilibrium in point  $E_2$  corresponds the larger volume of *GNP* ( $GNP_2$ ), and balanced  $AD_2$  and  $AS_2$  at larger *GNP* volume will stimulate positive macroeconomic dynamics.

While modeling the processes of foreign economic effect on the strategy of innovative development, defining the character of the export factor behavior is less important. The main problem is to choose righteously what industries, types of production and commodity groups to bolster on the state level in order to ensure effective promotion of innovative goods on the world markets.

From the viewpoint of innovative development strategy, it is erroneous to state that any innovative elaboration – if it makes innovative breakthrough – is to be considered a priority only due to this sole reason. This condition alone is not sufficient. That is why in order to substantiate selection criteria it is essential to consider the nature of export effect on designing efficient innovative policy. For that purpose we will introduce the concept of *marginal propensity to export* (*MPE*).

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<sup>2</sup> The path of aggregate demand curve can not coincide with the straight line  $AD$ . This would mean that impact of import factor on aggregate demand and on gross national product is not taken into account at all. To choose the right import policy implies to «straighten» the curve  $AD_2$  and to approximate maximally to straight line  $AD$ .



The *MPE* level can be calculated on the basis of relationship between the growth of export ( $\Delta Ex$ ) and the growth of gross national product:

$$MPE = \frac{\Delta Ex}{\Delta GNP}.$$

Marginal propensity to export indicates what share of *GNP* growth is used to ensure the growth of export. It should be noted that in contradiction to import factor, changes in volume of export, in volume of *GNP* and aggregate demand are directly related. Moreover, this relationship is followed by export multiplication effect. It implies that initial export orders determine income growth of an individual, company and state. Under condition of certain level of marginal propensity to consume, the part of income is spent on additional complementary consumer goods, additional means of production and additional state purchases effecting the growth of production potential of export-oriented industries. The volume of export will effect the second (though lesser) growth resulting in additional growth of income; the situation will develop by the same scenario.

Thus, initial changes in export similarly to investment changes in multiplication model of J. M. Keynes) will produce the chain reaction, which, while narrowing with each successive cycle, yet will ensure the effect of multifold enhancement of initial changes. Considering direct dependence of *GNP* from export and available multiplication effect, the growth of national product can be formulated as:

$$\Delta GNP = MRC \times \Delta Ex,$$

where *EMC* – export multiplication coefficient.

In general, this multiplication coefficient will be equal to the ratio of *GNP* growth to export growth  $\frac{\Delta GNP}{\Delta Ex}$ . It is a value adverse to export marginal propensity to export and, hence:

$$\Delta GNP = \frac{\Delta GNP}{\Delta Ex} \times \Delta Ex,$$

or

$$\Delta GNP = \frac{1}{MPE} \times \Delta Ex.$$

While designing the model of foreign economic effect on strategy for innovative development it is necessary to specify the coefficient of export multiplication so that it comprises as many factors as possible. For that, we will use a generally known formula of gross national product:

$$GNP = C + I + G + NEx.$$

Within the structure of *GNP*, the component characterized by amount of incomes of households, businesses and state ( $C + I + G$ ) can be presented (indirect taxes, activities of national companies operating abroad and foreign compa-

nies operating in the country) as domestic product. Applying Keynes' methodology it can be regarded as the sum of current consumption ( $Cc$ ) and set for a later time consumption, or investments ( $In$ ). Consumption and investments in this case differ in principle compared with that presented in formula of GNP. Now consumption (after Keynes) is regarded as current consumption by households (personal consumption of food, clothes, durables, etc), firms (current employment of available means of production), and by state (current public consumption of certain services and material values provided by the state).

Investments ( $In$ ) are set for a later time consumption that enable their increase in the future. One part of investments is consumption of goods that belong to households and the state during the current period and are saved as reserve (investments and accumulation of reserves). The other part of investments is the resources allotted to expand production (capital investment into buildings, facilities, machines, etc.).

On this basis the *GNP* formula can be formulated as:

$$GNP = Cc + In + NEx,$$

or

$$GNP = Cc + In + Ex + Im.$$

If this is right, then

$$\Delta GNP = \Delta Cc + \Delta In + \Delta Ex - \Delta Im.$$

Thus:

$$\Delta Ex = \Delta GNP - \Delta Cc - \Delta In + \Delta Im.$$

Substituting value  $\Delta Ex$  into the base formula of export multiplication coefficient we get:

$$EMC = \frac{\Delta GNP}{\Delta GNP - \Delta Cc - \Delta In + \Delta Im}.$$

Dividing numerator and denominator of the given fraction into  $\Delta GNP$  value we will acquire:

$$EMC = \frac{1}{1 - \frac{\Delta Cc}{\Delta GNP} - \frac{\Delta In}{\Delta GNP} + \frac{\Delta Im}{\Delta GNP}}.$$

In this case:

$$\Delta GNP = \frac{1}{1 - \frac{\Delta Cc}{\Delta GNP} - \frac{\Delta In}{\Delta GNP} + \frac{\Delta Im}{\Delta GNP}} \times \Delta Ex.$$

Expression  $\frac{\Delta Cc}{\Delta GNP}$ , as is known, denotes marginal propensity to consumption. Obviously, by modeling the strategy for innovative development

should be based on industries and commodity flows that provide the highest *marginal propensity to consumption*. The larger value of fraction  $\frac{\Delta Cc}{\Delta GNP}$  is (with other indices being constant), the larger export multiplier becomes, and consequently, the higher is the growth of GNP and of aggregate consumption.

Expression  $(1 - \frac{\Delta Cc}{\Delta GNP})$ , defines quantitatively *marginal propensity to save*.

Conforming to this, innovative policy will attain success if it facilitates preferential development of industries and commodity groups characterized by minimum values of marginal propensity to save.

Equation  $\frac{\Delta In}{\Delta GNP}$  denotes *marginal propensity to invest*, and in fact can be identified as reverse value of investment multiplication coefficient developed by Keynes. It is known that the larger value it has (if other parameters are constant) the higher indices in growth of public product and aggregate demand are. Consequently, the selection of commodity flows in modeling strategy for the country's innovative development should be determined by industries and high technology productions whose preferential development would maximize  $\frac{\Delta In}{\Delta GNP}$ .

In the end, economic sense of the expression  $\frac{\Delta In}{\Delta GNP}$  should be known.

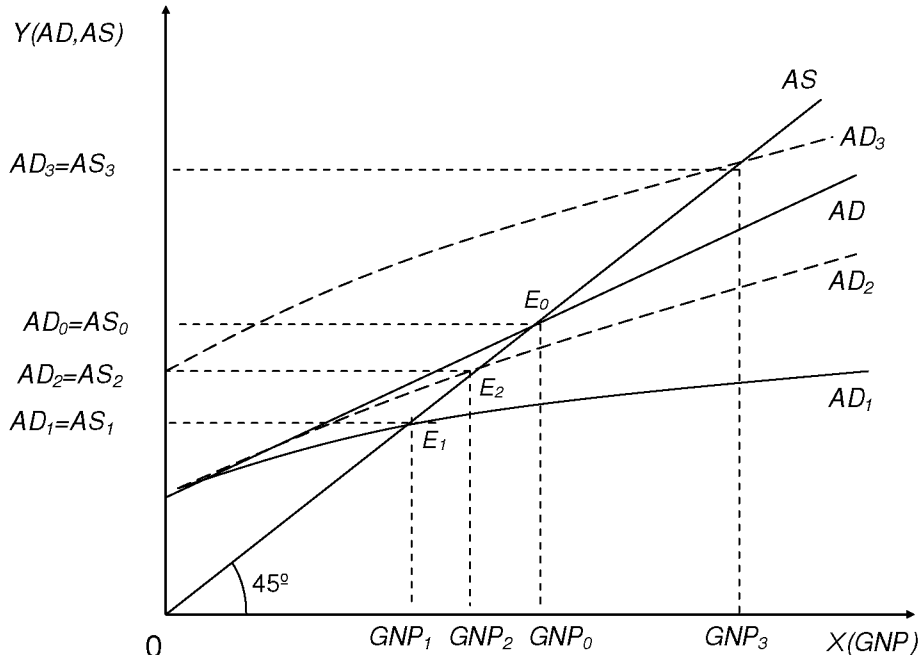
How changes in marginal propensity to import effect the innovative policy have been already defined. On this basis it becomes possible to further specify and graph macroeconomic equilibrium. On the previous phase of converting from abstract to concrete (Fig. 2) the Keynesian graphic base model of macroeconomic equilibrium («Keynesian cross») was specified with added effect of import. Now it will take more concrete form with allowance for effect of export (Fig. 3).

Analyzing the effect of import factor we found out that with proper import policy (minimum values of general and branch-wise commutativity, the lowest values of import multiplication coefficient) the aggregate demand curve is straightened (as far as effects of multiplication and commutativity allowed) and attained the form of curve  $AD_2$ .

Under these conditions the equilibrium point shifted from  $E_1$  to  $E_2$ , and that signified that macroeconomic equilibrium with efficient import policy was ensured by  $GNP$ , larger in volume than  $GNP_1$ . Balanced functioning of macroeconomic system ( $AD_2 = AS_2$ ) was achieved when gross national product conformed with value of  $GNP_2$ .

Fig. 3

Macroeconomic equilibrium with allowance for import and export multiplication effects, and for commutativity effect.



Now, to specify the graph model of macroeconomic equilibrium we will sustain it with export factor effect. With efficient export policy based on high indices of general and branch-wise commutativity, and maximum values of export multiplication coefficient, the curve of aggregate demand will shift up and to the left.

It will attain the form of curve  $AD_3$  in conformity to higher index of aggregate demand volume. It is very essential that equilibrium at point  $E_3$  corresponds larger than earlier the volume of gross national product ( $GNP_3$ ), and balanced  $AD_3$  and  $AS_3$  at larger value of  $GNP$  will become additional impetus for positive changes in macroeconomic dynamics.

Summing up approximation model of commodity innovation strategy we come to conclusions:

- modeling strategy for the country's innovative development will be conducive only if it allows to integrate internal and foreign economic factors.

- modeling of foreign economic effects first should foresee analysis and then synthesis of import and export effects. As a result, both the essence and methods of quantitative definition of commutative effect and import and export multiplication effect are determined. It allows to substantiate the calculation method for coefficients of general and branch-wise commutativity and coefficients of import and export multiplication;
- modeling of import effect on innovative strategy should be based on sound selection criteria and import preferences for some industries and commodity flows. The sectors that guarantee minimum commutative effect and lowest values of import multiplication should be given preference;
- modeling of export effect allows to prove that industries and high technology productions that ensure maximum commutative effect are to be preferential. They have the highest values of export multiplication, guarantee maximum index of marginal propensity to consumption, provide for lowest values of marginal propensity to save, and have maximum coefficient of investment multiplication.

In sum total, by integrating foreign and internal effects, it provides for not only to ensure positive trend in macroeconomic dynamics but also to maintain guaranteed general macroeconomic equilibrium overcoming current disproportions and structural deformations of our economic system.

### Bibliography

1. Аналітична записка П'ятої міжнародної конференції «Проблеми економічної інтеграції України в Європейський Союз: європейські студії» // Вісник ТАНГ. – Тернопіль, 2000. – № 15.
2. Кейнс Дж. М. Общая теория занятости, процента и денег. – М.: Гелиос, 1999. – С. 89–130.
3. Савельев Є. В. Міжнародна економіка: теорія міжнародної торгівлі і фінансів: Підручник. – Тернопіль: Економічна думка, 2001. – С. 116.
4. Шніцер М. Порівняння економічних систем. – К.: Основи, 1997. – С. 290–319.
5. Dornbusch R., Fischer S., Samuelson P. Comparative Advantage, Trade, and Payments in a Ricardian Model with a continuum of Goods. – *Economic Review*. 1977. – P. 823–839.
6. Krugman P. The Narrow Moving Band, the Dutch Disease and the Consequences of Mrs. – Tratcher, *Journal of Development Economics*, 1987. – P. 41–55.
7. Ohlin B. *International Trade*: N.-Y., 1995. – P. 98-126. Cambridge: Harvard University Press, 1933.