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AS A RESULT  
OF ECONOMIC CONTROVERSY**

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THE PHENOMENON OF INFLATION AS A RESULT  
OF ECONOMIC CONTROVERSY  
(COGNITIVE CANONICAL MODELS)\*

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**Abstract**

*The article describes the inflationary process in the two self-contradictory sections: as a consequence of the uneven development of economic sectors, and in relation to comparable countries with different amounts of gross product. The proposed cognitive canonical model of economic relations as a closed system, possible to prove the theorem at that: 1) there is a form of inflation, which follows directly from the fact of uneven development of industries and to a fair distribution of goods between producers and 2) an increased rate of inflation in the country lagging behind in comparison with the best results from the differences between the levels of unit of GDP in these countries, with the assumption of equal velocities (the first derivatives with respect to time) of their growth both in real and nominal terms.*

*The results of the study - a way of certain economic relations, fully manifest themselves only in the framework of our model, and partly - in the real world, it is the extent to which it reflects the model.*

**Keywords:** *money, inflation, the methodology of economics, uneven economic development, cognitive model, the canonical model, closed system, open system, equitable distribution, the theory of money, the theory of value, money issue, the growth speed, the pace of growth.*

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## Introduction

Subject inflation (including the designated angle) in economic theory, generally speaking, is not new. It is difficult to find a job where she would not rise: whether at the level of generalities, whether at the level of logical constructs, or presented in the form of mathematical formulas. It is usually dominated by a modal approach, that is, inflation is considered as something beyond a conceptual system is open (not self-sufficient) character when the factors of influence on pricing remain outside of the study. In contrast, approaches that show the need for inflation in a closed economic system, when explicitly asked certain conditions are not known.

The objective of this study is to move from generalities to the evidence at the level of mathematical theorems and calculations.

This research is aimed at clarifying the nature of economic relations and disclosure of features to describe them, but does not involve advice business, government or legislative body. In this sense, refers to the study of fundamental categories (Vugalter, 1995).

To indicate the place that it occupies in the most extensive study of monetary developments in general and inflation in particular, we have to let a very schematic way, to dwell on this subject.

*The issue price* - this question of the relation of the subject to market itself as a commodity producer and the consumer at the same time. In general, the price - not the cause, but a secondary manifestation of a variety of reasons, and in this sense, the pricing in general - an objective process. Although subjective (i.e., arbitrary, random) and pricing may be found everywhere, but this price is short-lived, unstable. Although the price is not the original one, the independent variable of commodity relations, but through a complex (non-linear) feedback mechanism, can have an impact on the economic process, and the change in the price - this is one of the manifestations of changes in the economic structure as a whole, namely:

- The cost structure of commodity circulation (consisting of cash flows);
- The purchasing power of income;
- The purchasing power of savings;
- Money in circulation;
- The volume of commercial production;
- Productivity of non-renewable sources of raw materials, etc.

In different economic theories, the concept of inflation is interpreted in different ways, but traditionally under-inflation understand the process of increasing the value stream, which causes changes in the structure of production, consumption, thereby affecting the redistribution of wealth between the subjects of economic relations. However, most inflation is considered as the process of depreciation of money, which manifests itself through price increases. Thus there is an overflow channel monetary mass of surplus money, the exchange rate depreciation, the decline in real wages and other changes related to this phenomenon.

Understanding inflation as a special phenomenon in the field of monetary differently refracted through the well-known economic theory (Mishkin, 2006), such as:

- The quantity theory of money: the leading cause of inflation - an increase in real money supply (corresponding to the statistical concept of "monetary base");
- The labor theory of value: the leading cause - reduction of labor costs in gold production;
- Nominalist theory of money: the denial of the role of gold as a monetary commodity;
- Keynesian theory: inflation as a result of full employment;
- Marginalist theory: the leading cause of - the excess of demand over supply of commodity;
- Monetary theory, in common with the quantity theory of money: the leading cause of - the excess demand for money over their offer;
- The theory of the real business cycle: the lack of a causal link between the amount of money in circulation and the amount of GDP, etc.

By setting a relatively narrow in comparison with the general theories, the problem, we will not describe any of these theories, nor to give them a detailed assessment. Suffice it to say that, in contrast to the present study, used in some models of inflation are:

- As an open system, which depends on the uncertain external factors, which reduces the attempts of researchers at the level of opinion, conjecture or hypothesis;
- As directly (as opposed to the canonical) reflection of reality, when "information noise" drowns out the pure tones the nature of things;
- As a teleological principle of managing inflation (as opposed to the search started).

In this paper we consider two types of economic contradictions and cut two of the inflationary process related to each other as the ergodic problem (relationship of space and time):

1. Internal time-dependent - the uneven development of economic sectors that produce end-products as a source of consumer inflation.
2. External, spatially-dependent differences in the effect of the economic level of the compared countries in the GDP deflator.

We are not talking about how they are the only or the main factors of inflation, but it is, as will be clear from what follows, special factors limited phenomenon.

As a heuristic method we use mental (cognitive) modeling of the processes under study (Vugalter, 1999). The method consists in the construction of the canonical model of a certain economic phenomenon as a closed (self-contained) system, the behavior of which will try to identify those (are) relationship, which is usually obscured by the complexity of the real world. In other words, the model of the system must be properly all the necessary and required only for research purposes. If you submit a closed system in the form of a graph, then all of its "inputs" and at the same time serve as a "way out" of him (Ore, 1963).

Thus, the results of the study - a way of certain economic relations, fully manifest themselves only in the framework of our model, and partly - in the real world, namely the extent to which it reflects the model.

## 1 Inflation as a result of uneven development of branch of the economy

Cognitive construct a canonical model of inflation, which is based on the following statement. The growth of the economy, due to the introduction of innovations can not occur uniformly in all sectors (otherwise advancing activities would have to wait until there will be corresponding opening in the other species) (Vugalter, 2007).

So, let the economy of the country consists of two generalized self-sufficient enterprises with a full cycle (from extraction of raw materials), producing a use-end products. One, called the «B», producing bread, another called «P» - pencils.

Bread production is  $Q_B$  kg/month, pencils -  $R_P$  pcs/month.

The enterprise «B»  $h_B$  people working and on the «P» -  $h_P$  people, and all:

$$h = h_B + h_P \text{ (people).}$$

In our model (!) every company shall issue currency (coupons) *of the same nominal value*, which pays its workers. The company «B» emits  $M_B$  monetary unit/month, «P» -  $M_P$  m.u./month, and the total:

$$M = M_B + M_P \text{ (m.u./month).}$$

The volume of the issue is the amount of revenue from the sale of the final product by each of the companies. Currency proceeds enterprise consumes, and the cycle is repeated in the money supply unabated.

(Note that businesses are really able to issue its own currency, in rare cases, a severe financial crisis. To us this abstraction is needed to escape from the complexities of the real monetary, not related to the topic under discussion. Idea is not to present banknotes circulating, and will facilitate our renewable Later in the transition from abstract design to the realities of the central bank of issue).

According to the definition of prices:

- The price of bread:

$$C_B = M_B/Q_B \text{ (m.u./kg);}$$

- The price of a pencil:

$$C_P = M_P/R_P \text{ (m.u./pieces),} \quad (1)$$

where  $Q_B$  - volume produced (baked) bread, kg/month;

$R_P$  - the amount produced pencils,  $m.u./month$ .

According to the definition of *compensation of employees*:

- Compensation of employees any employee of the company «B»:

$$w_B = M_B/h_B \text{ (m.u./person-month)}$$

- Company «P»:

$$w_P = M_P/h_P \text{ (m.u./person-month)}. \quad (2)$$

We introduce the *main restrictive condition* of the distribution of commodity (MRC): any employee buys (consumes) the same set of commodities in the same amount, namely:

- The amount of grain in kind:

$$q_B = Q_B/h \text{ (m.u./person-month)};$$

- The number of pencils in natural dimension:

$$r_P = R_P/h \text{ (pcs/person-month)};$$

- The bread of grain in terms of value:

$$v_B = C_B * Q_B/h \text{ (m.u./person-month)};$$

- The number of pencils in terms of value:

$$v_P = C_P * R_P/h \text{ (m.u./person-month)}.$$

*Task:* In what ratio should be the volume of money supply as to provide MRC?

To do this, obviously, must be performed:

- The condition number 1. Compensation of employees of both companies is the same:

$$\begin{aligned} w_B &= w_P = w; \\ w &= M_B/h_B = M_P/h_P = M/h; \end{aligned}$$

- The condition number 2. Compensation of employees each employee is the sum value of the purchased goods produced by both companies:

$$w = v_B + v_P = C_B * Q_B/h + C_P * R_P/h.$$

After completing the conversion, we get the equivalence of the two conditions are met:

$$w = M_B/h + M_P/h.$$

Now consider the *work of the canonical model* in its simplest form: increase the production of pencils through the creation and innovation, while maintaining unchanged price of a pencil. (Note that, according to the concept of a generalized enterprise reproduction of fixed assets, including the creation of innovations carried out by the same company).

So, we define:

$$C_P = \text{const}; h_B = \text{const}; h_P = \text{const}; Q_B = \text{const}; \\ R_{P1} = k * R_P, \quad k > 1,$$

where  $R_{P1}$  - a new (higher) production of pencils in the next period (1);  
 $k$  - coefficient of proportionality (the multiplier).

Then, substituting in (1) and (2) the new values, we get:

$$M_{P1} = C_P * R_{P1} > M_P; \\ w_{P1} = M_{P1}/h_P.$$

Since, by assumption, compensation of employees bread producers remained unchanged ( $w_{B1} = w_B$ ) and a manufacturer of pencils rose, there was imbalance compensation of employees violating the requirement of MRC:

$$w_{B1} < w_{P1}.$$

To restore the balance:

$$w_{B1} = w_{P1},$$

it is obviously necessary *to raise the price of bread*, which the new value ( $C_{B1}$ ) is defined by the following conversions:

$$M_{B1}/h_B = M_{P1}/h_P; \\ M_{B1} = C_{B1} * Q_B,$$

from:

$$C_{B1} = M_{P1} * h_B / (h_P * Q_B) = k * C_P * R_P * h_B / (h_P * Q_B); \\ C_{B1} = k * C_B; \\ C_{B1} > C_B.$$

Finally, we obtain:

- An index value ( $s$ ) found to be cartoonist ( $k$ ):

$$s = M_1/M = (C_{B1} * Q_B + C_P * R_{P1}) / (C_B * Q_B + C_P * R_P) = k,$$

- And the inflation index ( $i$ ) identify the following fractional-linear function:

$$i = M_1/(M_B + M_{P1}) = (C_B * Q_B + C_P * R_P)/(C_B * Q_B/k + C_P * R_P).$$

In other words, *the requirement* to maintain a uniform (*fair*) distribution of the final product, in the event of an increase in production of one product in natural terms (*at constant prices*), leads to the need for an increase in the price of another commodity, production of which has remained unchanged. This implies that the usual permanent alternate growth of commodity production is the source of inflation.

In contrast, the proposed model, monetary emission is typically not the company-producer of commodities, but the Central Bank (CB). Therefore, the order of approximation of the *canonical model* to reality, additionally consider a *model of the emission of the loan*. (Note, that the crediting of enterprises through non-equity - deposit - revenue is unable to increase the amount of money in circulation and is suitable only for relatively smooth out fluctuations in output through the mechanism of an overdraft).

Since the Central Bank allowed to tend to lend to the economy only through commercial banks, for our purposes, we introduce the concept of *generalized Bank* (GB), which issues the cash and loans to enterprises at the same time.

From businesses there may be different reasons for a loan: the price increase of raw materials, increase in purchases of semi-finished products in bulk compensation of employees increase as a result of competition of labor, the existence of a time lag between the time of payment and receipt of proceeds, and the like.

Here dwell only on the last motif of credit both on a regular basis of available and explain in a closed economic system.

So, according to the theory, when the company "P" should receive an additional amount of the loan in anticipation of the additional revenue from the sale of more pencils, company "B" must also obtain an additional loan in anticipation of the additional revenue from *the increase in the price* of bread. In such a case, if you follow the above relationships, the supply of goods is equal purchasing power.

Assuming that the rate of interest on the loan is equal to zero (Mishkin, 2006) state that the repayment of the loan, aimed at labor is always possible provided unrestricted access to getting another loan of the same size, as described in (Vugalter, 2007).

If the rate of interest is more than zero, the return of loans is carried out of the funds received as a result of the continuous growth of enterprises by refinancing GB (for the real sector is not able to bring back more than he received), as described in (Vugalter, 2009).

From the model, it follows directly, that the state's economy, growing at a higher rate requires a higher level of inflation. On the other hand, the lagging economy of the state tends to rise more rapidly than the best for a reason:



- A relatively small value of GDP (which is the denominator in the formula for determining the rate of growth);
- The accelerated growth of labor productivity through the introduction at the relative number of innovations that have been introduced long ago in advanced countries, while the latter can only develop at the expense of truly new discoveries
- the process is much more gradual and long-term (Vugalter, 2008).

Other causes of inflation depending on the economic level of the comparator countries listed in the following section.

## 2 The influence of differences in the level of economic countries compared to the GDP deflator

Here we are going to present evidence that at *equal growth speed* of GDP growth (both in real and nominal terms) in a country with a *lower* level of economic inflation rate should be *higher* than in a country with a higher (Vugalter, 2011).

To further explain the concept of presenting the *growth speed* as a derivative by GDP with respect to time or (in the discrete representation) as the ratio of the absolute rate of GDP to the value of the relevant time period. In contrast to the non-dimensional growth rate, the *growth speed* of GDP is measured in *money unit/ unit of time*<sup>2</sup> ( $m.u/u.t^2$ ).

*The construction of the canonical model.*

We will compare the two countries, with low (subscript 1) and high (subscript 2) the specific level of gross domestic product (SGDP). We assume that SGDP given to a single base for comparison of purchasing power parity (PPP). Consider the dynamics of the nominal and real gross of specific products (SGDP<sub>N</sub> and SGDP<sub>R</sub> respectively) and their ratio - the GDP deflator. We assume that the specific products gross change in time the simplest way - in a linear fashion, and, the growth speed of nominal values SGDP<sub>N1</sub> and SGDP<sub>N2</sub> are equal, and the same growth speed of real values SGDP<sub>R1</sub> and SGDP<sub>R2</sub>. Then:

- For a low SGDP write:

$$\begin{aligned} W_{R1} &= at + W_{01}, & W_{01} &= \text{const}; \\ W_{N1} &= bt + W_{01}; \end{aligned}$$

- For those with high SGDP:

$$\begin{aligned} W_{R2} &= at + W_{02}, & W_{02} &= \text{const}; \\ W_{N2} &= bt + W_{02}, \end{aligned}$$

where  $W_{R1}$  and  $W_{R2}$  - SGDP<sub>R1</sub> and SGDP<sub>R2</sub> respectively,  $m.u./prs-u.t$ ;  
 $W_{N1}$  and  $W_{N2}$  - SGDP<sub>N1</sub> and SGDP<sub>N2</sub> respectively,  $m.u./prs-u.t$ ;

$a$  and  $b$  - the growth speed  $\text{SGDP}_R$  and  $\text{SGDP}_N$  respectively,  $m.u./\text{prs}-u.t^2$ ;  
 $t$  - current time,  $u.t$ ;  
 $W_{01}$  and  $W_{02}$  - initial values  $\text{SGDP}_{R1}$  and  $\text{SGDP}_{R2}$ ,  $m.u./\text{prs}-u.t$ .

Introduce more proportionality coefficients ( $r, k$ ) as follows:

$$b = r*a; M_{02} = k*M_{01}; \quad r, k > 1.$$

Now the formula of the GDP deflator can be written as a linear fractional functions:

- For a *low* SGDP:

$$I_1 = W_{N1}/W_{R1} = (r*a*t + W_{01})/(at + W_{01});$$

- For those with *high* SGDP:

$$I_2 = W_{N2}/W_{R2} = (r*a*t + k*W_{01})/(at + k*W_{01}).$$

*Statement of the problem* is to compare the largest deflators of the two countries:

$$I_1 >? < I_2.$$

*Work model.* Comparing the corresponding linear fractional functions when  $k \gg r$  and  $W_{01} \gg a$ , (which usually corresponds to the substance) deflator in low SGDP deflator is certainly larger than those with high SGDP:

$$I_1 > I_2.$$

Since, however, the output of the model in the algebraic representation gives a degree of uncertainty, we turn to a *numerical example*.

Taking as a base in 2006, will take as a virtual lagging countries such as Ukraine, (the initial value corresponds  $\text{SGDP}_{R1}$   $W_{01} = 4000$  from PPP), and as a forward - a country like Denmark (initial  $\text{SGDP}_{R2}$  matches  $W_{02} = 24000$  from PPP, its growth speed  $a = 465$ ; growth speed of  $\text{SGDP}_{R2}$  is expressed by the formula:  $b = 2.4a$ ).

*Although the actual growth speed* SGDP Ukraine in 2006 - the year of sustainable development - was significantly less than that of Denmark (at the higher *rate* of growth than that of the latter), to take a *virtual* Ukraine, in accordance with the terms of the model, the same speed as the for Denmark.

Then, the raw data:

$$\begin{aligned} a &= 465 \text{ USD/person*year}^2 \\ W_{01} &= 4000 \text{ USD/person*year}; \\ k &= 24000/4000 = 6; \\ r &= 2.4. \end{aligned}$$

Hence, the growth *rate* of prices (GDP deflator) in 2006-2007 for virtual Ukraine and Denmark make up accordingly:

$$I_1 = 1.145; I_2 = 1.0266;$$
$$I_1 > I_2.,$$

which is close to reality.

Thus, in this model, the *difference* in indices interstate inflation have as essentially economic, sow and a purely mathematical nature.

In most cases, the actual growth speed SGDP hopelessly *lagging* countries are lower than the best, and catch-up - should be higher.

The method of comparison deflators enables real calculations and make specific findings on the condition that:

$$b_1/a_1 = b_2/a_2.$$

## Conclusions.

Proved the possibility of the existence of two factors causing inflation: due to the uneven development of industries and due to differences in levels of economic development.

The principle of uniform (fair) distribution of complete range of use of the goods of their products may serve as a third component of the general theory of value (price theory), along with the labor theory and the theory of utility.

These results are confirmed (or rather - do not contradict) the known facts: the lowest level of inflation is the case in countries such as Japan, USA, Canada and Western Europe.

There is, other than those considered, a great many other economic and non-economic phenomena that is acceptable to treat the causes of inflation. The proposed methods of analysis will allow interested researchers to move in that direction.

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