# SOME CONSIDERATIONS REGARDING THE SUPPLY FUNCTION AND THE PRODUCTION OF GOODS

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**Abstract**

*The main objective is to demonstrate that supply is the essential element that can contribute to the achievement of production efficiency. It can contribute, first of all, in that a supply linked to the structural elements of the production function also ensures an efficient, complete use of them.*

*In this presentation, I highlighted the main aspects involved in the rhythmic and balanced supply in achieving an efficient production of goods and services. We presented a series of production functions, adapted to the specifics of such an analysis, and we also sought to adapt some production functions, well-known, to the requirements involved in balanced development, based on correlations and macroeconomy proportions, the only ones that give macroeconomic macro stability.*

*We used a complex methodology, logical analysis, analysis based on statistical-econometric and mathematical equations and functions, trying to highlight the role involved in the correlation of a correct supply in order to predict production of goods and services under competitive conditions.*

**Keywords:** *production, goods and services, efficiency, correlations, macro stability.*

**JEL classification:** *C10, E20*

## Introduction

The behavior of enterprises is characterized starting from the fact that the production is somewhat premeditated, that is, it is forecast. The forecast of such production must take into account the factors of production, meaning that the functions of production, after conversion, are the instruments for generating factors of production.

More understandably, this implies that you do not have a production function that constitutes a model on the basis of which we can calculate the parameters of the factors influencing the production and obtain satisfactory results.  Thus, an important question is that which relates to the size and mobility of the capital capacities used and, if they are not fully used, to constitute an analysis to highlight the need for other factors of production to ensure efficient evolution.

The production function may be extended and may include other elements, but we believe that, although it is not only fixed capital and labour that are the determinants, the other variables, such as energy, raw materials and materials, and, above all, the ability to have resources to be usable in the projected activity.

Using the Cobb-Douglas production function, we find that there is a certain elasticity and this allows us to use some transformations that define, first of all, labor productivity and fixed capital efficiency. The two factorial elements of output are particularly important, in two senses. On the one hand, there is a need to hold, in correlated proportions, the two factorial variables, and the way in which they are consumed, to be based on the exploration of the possibility of increasing labour productivity, in particular the increase in efficiency of the use of fixed capital.

After all, in the current conditions, there is a need to modernize the economy through digitization, robotization, introduction of innovation conquests, invention and research and development, so as to fully use (fully) the production capacities (capital) and the labor force resource, which must be closely in line with the requirements that the economic evolution implies in the future. Only such analyses can lead to likely effects of economic growth, which can lead to increases in production, efficiency, yield and profitability in the future.

It should be noted that sometimes production capacities and estimates of the elasticity of production in relation to fixed capital are insufficiently explored. Even if they are explored, they are not added or correlated in close interdependence with labor resources and, above all, the specialization of the workforce.

## Literature review

Through this article we also want to highlight the fact that the impact of real domestic R&D spending is an effective way to increase the development of economic relations in the economy. A number of researchers have referred to this, suggesting the ways and how a model analysis can be carried out, by adapting the known models so that the resulting parameters ensure a definite perspective of the efficiency of the economy. Thus Alba, L. (2007) makes an analysis of the impact that foreign direct investment has on the labour market and, implicitly, on economic development. Angel, M.G. and others (2018) present a statistical-econometric model of structural analysis of final consumption and its component elements. Backes-Gellner, U. (2004) has an econometric approach to human resource management. The study by Badal, A. (2010) is directed in the same direction. Chong-En Bai, Yijiang Wang (2003) are concerned with specific investments in human capital and labor productivity. In 2003, Klein, R.L, Wolfe, A. and Woife, W. publish a paper that is based on the principles underlying economic modeling, and Mandel, M., Tomsik, V. (2003) consider the function of consumption and its influence in the case of a small open economy.

**Methodology, resources, results and discussions**

The proportion of enterprises is characterized on the assumption that the demand for their production has been predetermined. This means that their decisions to adjust supply to the given demand for production influenced their decisions to generate a demand for inputs so that their supply ensures that production is carried out at the expected level. The production functions, after conversion, were the tools for generating the demand for inputs.

However, the question that can be raised for market economies is whether the expectations of the producers are sufficiently accurate and, therefore, whether the production offered corresponds to the actual expectations.

But the most important question concerns the size and mobility of fully unused capacities, that is, fixed capital and labour, when existing unemployment allows for the employment of additional staff. Therefore, in the process of building the model, the level of potential production must be defined, estimated, assuming the full use of the factors of production. This makes it possible to estimate the utilization rate of potential output that has a significant impact on short-term adjustments.

In supply-driven economies with chronic product shortages, especially in economies with persistent imbalances in commodity and services markets, in some periods in centrally planned economies, domestic production is usually insufficient to meet final demand. Supply and not demand is made in transactions. In order to correctly describe these situations, it is necessary to specify the extended production functions, including the probable sources of shortages of factors of production, not only fixed capital and labour, but also of energy and raw materials, in particular from imports.

Domestic enterprises that use fixed capital and employees to deliver goods and services, given the technology described by the relevant production function, can build appropriate models.

This function, specified for value added (GDP of the national economy), has the following general form:

$$X_t^* = x_t(K_t, N_t, A_t, \varepsilon_t) \quad (1)$$

The most commonly used are the double log function, i.e. the Cobb-Douglas function and the constant elasticity of substitution (CES) function.

The time series-based estimation of the function parameter series involved many problems to which no satisfactory solutions were found. First, explanatory variables, fixed capital and employment, are collinear, so it is assumed that there are no yields at scale.

Using the Cobb-Douglas production function we have to find that the elasticities. This $\alpha + \beta = 1$ aspect allows us to use transformations that define either the productivity (efficiency) of fixed capital:

$$x_t - k_t = b + a_t + (1 - \alpha)(k_t - n_t) + \varepsilon_t \quad (2)$$

either labour productivity:

$$x_t - n_t = b + a_t + \alpha(k_t - n_t) + \varepsilon_t \quad (3)$$

The next aspect is that the observed actual production data ($X_t$) represents outputs of production demand, while the production function (1) defines potential production, i.e. production capacities that are usually not fully utilized.

Based on the definition of the capacity utilization rate $WX_t = X_t$ /, the modified production function $X_t^*$, commonly called short-term, which explains the actual output $X_t$ will take the following form:

$$X_t = WX_t X_t^* = \omega(K_t, N_t, WX_t, A_t, \varepsilon_t) \quad (4)$$

Macro econometric models used various procedures to estimate $WX_t$ capacity utilization rates. The major approaches will be listed below.

In the first models, the Wharton capacity utilization index was widely used. The index was generated by comparing current actual production with output in the peak quarters of the business cycle. In many European countries, summary indicators based on data on capacity rates relative to business activity or firm statistics are used. Partial information on shift use or working time of employees was used less frequently. Special indicators were applied to model inflationary processes.

According to the typology of DSGE models, they are components of the sector of domestic manufacturers of intermediate goods. These were based on production deviations from the general trend, treating them as measures of the capacity utilization rate being rather unjustified.

There are problems measuring fixed capital and employment. Several model researchers rely on statistical information about the stock of fixed capital at the end of the period (usually year). The average stock is obtained as a simple arithmetic mean for quarterly periods. In the models, the stock at the end of the period is calculated using the equilibrium equation:

$$K_t = K_{t-1} + I_t - \delta K_{t-1} \quad (5)$$

where is the scrapping rate $\delta$ used where necessary.

$$I_t = \sum_{i=1}^{J} \omega_j J_{t-j} \quad (6)$$

where $\omega_j$ being the parameters of the distribution of investment expenses.

Many researchers have frequently criticized the use of fixed capital statistics because of their low reliability. Instead, they preferred to generate time series independently, gathering more reliable data on the level of investment, allowing fixed capital to be amortized. Although it offers greater accuracy, this technique is not entirely satisfactory. Both techniques require further adjustments to take account of changes in the services provided by fixed capital.

In most cases, fixed capital is treated as homogeneous. This hypothesis is abandoned in many models in which machines and equipment, as well as buildings and structures are distinguished to a minimum, which perceive different functions in the production process.

In many macro models, attempts have been undertaken to distinguish fixed capital, which represents different technological levels, that is, different generations of machines and equipment, assuming greater productivity of the new equipment. A simple approximation of this approach is the attempts to separate the impacts of the latest generation, for example the equipment used for less than 5 years.

The specifications applied in particular in the models of developing countries to distinguish imported machinery and equipment likely to have higher productivity than domestic ones had a similar significance.

Recent, the tendencies to separate computers, software and telecommunications equipment from total fixed capital, so that the impacts of computerized production processes can be quantified, have become stronger.

The above extension of the specification of production functions was meant to help isolate the effects of computer-aided production and management processes. It should be noted that the extensions have reduced the spectrum of likely effects of increasing TFP (Total Factor Productivity).

Many macro econometric models use the working time of work ($H_{t)}$ as an explanatory variable. However, in several countries these statistics are not available, especially for quarterly periods, so employment data are mainly applied for this purpose

It is also necessary to note some aspects with regard to the total conductivity of the factors. Thus, it is the effects of technological progress represented by the total factor productivity (TFP), that is, the variable $A_t$ in equation (4), were initially considered exogenous and presented largely as exponential functions of time:

$$A_t = \lambda_0 e^{\lambda_1 t + \xi_t} \quad (7)$$

The hypothesis that the effects are constant over time and with a constant growth rate, usually exceeding 1%, is often used in recent years, especially in long-term analyses and forecasts.

The growing role of knowledge capital in economic growth, surpassing the impact of investment, has contributed to studies measuring the effects of technological progress and its sources over the past fifteen years.

Total factor productivity is an unnoticed variable. Its dynamics, following widely accepted opinions, may be represented by Solow's residue. The TFP will be obtained as the difference between the rate of increase in production generated from the production function and the rate of production growth generated from the same production function, but ignoring technological progress.

Given the Cobb-Douglas constant-returns-to-scale production function for the capacity utilization rate *WX*, it can be shown in the logs:

$$\Delta x_t = \Delta \omega x_t + [\alpha \Delta k_t + (1-\alpha)\Delta n_t + \Delta a_t] \quad (8)$$

Once we have neutralized the effects of technological progress, that is, assuming, we will have: $\Delta a_t = 0$

$$\Delta x^0 = \Delta \omega x_t + [\alpha \Delta k_t + (1-\alpha)\Delta n_t] \quad (9)$$

Making the difference in both members results:

$$\Delta a_t = (\Delta x_t - \Delta x^0) = \Delta x_t - \Delta \omega x_t - [\alpha \Delta k_t + (1-\alpha)\Delta n_t] \quad (10)$$

In order to estimate the growth rate of TFP we need to know the rate of utilization of productive capacity and the estimates of the elasticity of production in relation to fixed capital. We emphasize that many macro-models ignore this variable, which leads to non-compliant estimates of TFP dynamics. Specifically, production growth rates are declining during recessions. If a decrease in capacity utilization is then ignored, the increase in TFP will be underestimated. On the other hand, ignoring rising rates in capacity utilization during recovery with rising rates causes the increase in TFP to be overestimated.

The elasticity of production to fixed capital can be estimated directly if the function explaining TFP is specified, i.e. whether the variable $A_t$ depends on the factors that determine technological progress. This procedure is quite complex and rarely used in the practice of macro modelation. As for the Cobb-Douglas function, the values of the elasticities are calibrated.

Conclusions derived from the neoclassical theory of production, which states that the parameters for estimating the function of production are also equal to the respective shares of profit and labour cost in GDP, can be used. Because the actions are not uniquely defined, the estimates of the parameters differ between macro models.

TFP dynamics have recently been introduced, especially in long-term models, as an explanatory variable associated with the intensification of attempts to explain this dynamic. It is rational to decompose the dynamics of TFP representing the dynamics of knowledge capital into three factors, which are related to the dynamics of fixed capital (investments) $A_t^K$, the dynamics of employment, that is, of widely understood human capital $A_t^N$ and the dynamics of unincorporated knowledge capital $A_t^W$.

Based on the Cobb-Douglas production function, this decomposition looks as follows:

$$\Delta a_t = \Delta a_t^W + \alpha \Delta a_t^K + (1-\alpha)\Delta a_t^N \qquad (11)$$

In general, it is assumed that the dynamics of the unincorporated knowledge capital, available for free, is stable over time and that it can be represented by an exponential trend:

$$\Delta a_t^W = \mu_0 + \mu_1 t \qquad (12)$$

Sometimes it is related to employment dynamics or patent data. The dynamics of the effects of technological progress incorporated in fixed capital are linked to the dynamics of the cumulative R&D real expenses, both internal and external, transferred to the country concerned. It is represented by the following equation:

$$\ln A_t^K = \beta_1 \ln S_t^k + \beta_2 \gamma \ln S_t^m \qquad (13)$$

where: $S_t^k$ are the cumulated real domestic expenditures for research and development,

$S_t^m$ represents the cumulated actual foreign expenditure on research and development,

$\gamma$ it is a share that represents the role of imports, i.e. the opening up of the economy.

For the first time the impact of real domestic R&D spending was introduced directly into production functions in the DRI models of the US economy. The above concepts for the use of cumulative R&D expenses have been widely applied in research projects based on data from the international time series.

Cumulative internal R&D expenditure is obtained by summing current R&D expenditure deflated $SB_t$, after taking into account the depreciation of knowledge capital:

$$S_t^k = S_{t-1}^k + SB_t - \delta S_{t-1}^k \quad (14)$$

where $\delta$ is the depreciation rate of knowledge capital, frequently assumed at the level of 5%

Specifying the transfer of knowledge capital from abroad is more complicated. It is represented by the cumulated actual external expenditures for research and development. It is usually limited to the spending of large industrialized countries.

Direct transfer involves telecommunications lines, the technological proximity of the country, the availability of knowledge contained in patents and licenses, etc., and indirect transfer occurs through imports.

Alternative variants use either imports of intermediate goods (new technologies) or imports of investment goods (new cars). The latter proved to be more effective. Most recently, attempts have been developed to use weighted imports of goods classified according to their technological level. Ponds grew with the increase in technological maturity.

The indirect transfer of foreign capital of knowledge will be represented by the weighted sum of the current real R&D expenses, namely:

$$SB_t^m = \sum_j \omega_j SB_j \quad (15)$$

where $0 < \omega_j < 1$ the share defined above, remaining with the knowledge capital transferred from country j.

The cumulative actual expenditure transferred from abroad is derived from the balance sheet equation:

$$S_t^m = S_{t-1}^m + SB_t^m - \delta S_{t-1}^m \quad (16)$$

In recent years, it has been stressed that the economy to which foreign knowledge capital is transferred must be adequately prepared to absorb it. This justifies the extension of the above equations by introducing variables representing the maturity of the economies concerned, such as the minimum level of actual internal expenditure on R&D or the level of capital. The impact of FDI, an important channel for knowledge transfer in emerging markets, is also analyzed.

The empirical results of the above investigations are commonly described as elasticities TFP in relation to the actual cumulative expenditure of internal research and development, and External. The results of estimates based on data from the international time series do not show any considerable differences. Industrialized countries had the greatest elasticities in terms of domestic knowledge capital. Knowledge capital incorporated into the workforce is typically represented by human capital per employee.

## Conclusions

Following the study made and presented in the article *Some considerations regarding the supply function and the production of goods*, we can draw some theoretical conclusions with practical applicability. Thus, at the microeconomic level, one must always start from the need to correlate an appropriate structural supply, rhythmic and in close accordance with the technology used. Based on it we can highlight, through a mathematical equation, the trend that the production of goods and services will have.

Another conclusion is that always, in the desire to prospect market requirements, the prospect of increasing production, we must also start from this correlative element, the supply of the production of goods and services. This is because there are possibilities to envisage increases in some categories of products and resources that are not anchored in the realities of domestic and international life cannot be obtained and then the investments in the capital factor become ineffective, that is, they affect the profitability of the production obtained.

The capacity utilization rate should lead to the possibility of extending the analysis and analyzing, as far as possible, the situation on the labour market, the market for materials and materials and, at the same time, the disposal market. That is why a macroeconomic analysis, with the possibility of implementation and microeconomic analysis, is particularly important and ensures the maintenance of the correlations that give the macro-stability trend of the national economy.

The use of fixed capital and labour statistics is sometimes criticized by some researchers, but this is wrong because only knowledge of equity resources in particular and those that can be attracted has the essence of the viable forecast outlook.

At the same time, making a forecast only on fixed capital (capital) is insufficient, because in the production process we can meet with insufficiencies of the labor force capital, necessary in the structure and in the way in which the complex technological aspect is achieved.

Not unimportant is also the expectation of an analysis on the third factor, resources (raw materials, materials, etc.) from internal sources and import possibilities.

It is technological progress that must be taken into account because it contributes to the improvement of the national economy in the sectors concerned and, at the same time, also ensures the possibility of increasing production at the expense of the efficiency of the use of factors of production.

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