The European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com
e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2020.10.03.15

ICEST 2020

International Conference on Economic and Social Trends for Sustainability of Modern Society

PRICING MICRO MARKET TRADING NETWORK IN SOLVING THE PROBLEMS OF EVOLUTIONARY ECONOMICS

A. S. Dulesov (a), T. G. Krasnova (b), I. A. Gimanova (c), D. J. Karandeev (d)*
*Corresponding author

(a) Katanov Khakass State University, 92, Lenina ave., Abakan, Russia, dulesov@khsu.ru
(b) Katanov Khakass State University, 92, Lenina ave., Abakan, Russia, admeconom@mail.ru
(c) Katanov Khakass State University, 92, Lenina ave., Abakan, Russia, gimanowa@gmail.com
(d) Katanov Khakass State University, 92, Lenina ave., Abakan, Russia, deniskhsu@bk.ru

Abstract

The actual problem of determining prices in the micro markets of the trading network of the logistics system is considered. The prerequisites for a possible solution of the problem are presented, provided that the price is not a direct participant in considering the balance between supply and demand. It is determined as the unit cost of the product multiplied by the markup coefficient set by the manufacturer (seller) of the product. The solution of the problem of distribution of material flow in a trading network involves the modification of mathematical methods through the use of a distribution coefficient for which prices are determined. A mathematical expression for determining the price is given: (profit)=(markup)× (unit cost) × (sales volume for the period). The advantage of the pricing process in the micro markets of the network over other methods is shown. A generalized formula for determining prices is proposed, taking into account the markup rate set by the seller. The importance of the proposed pricing is indicated, when the price in the market is constant and its change is primarily due to the improvement of production technologies within the framework of the evolutionary economy, which directly affects the efficiency of the functioning of trading networks.

Keywords: Evolutionary economics, trading network, theory of value.

https://doi.org/10.15405/epsbs.2020.10.03.15
Corresponding Author: D. J. Karandeev
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

Effective management of the logistics system is one of the pressing issues of modern socio-economic development of the world economy. Among the logistics systems, the trading network can be singled out in particular, one of the tasks of which is the optimal distribution of commodity flows from manufacturers to end consumers. Such a problem is not easy when a solution using classical optimization methods may be the best among the alternatives. The reason for this is a lot of factors that are not taken into account in practice due to the lack of sufficient resources to ensure the search for an adequate solution to the problem. Thus, when distributing material (commodity) flows, agents of the trading network are forced to have the capacity to store quite large stocks in warehouses. Therefore, it is not possible to avoid additional costs for storage and transportation of goods. Taking into account a number of shortcomings in the management of material flow doesn't exclude the use of a modern scientific approach, which is presented below.

2. Problem Statement

The trading network, despite its apparent simplicity in the form of structure, is a complex system of interconnected agents (manufacturers, intermediaries, consumers), the relationship between which in the form of prices and sales volumes is reflected in the micro markets.

The participants in these markets don't have sufficient information, which indicates that it is uncertain, and therefore they carry out their activities on the basis of limited knowledge that they can obtain from their own perspective. The agent relies on the availability of final demand, since the average flow of demand changes "slowly" over time. In fact, managers have the ability, based on the past, to operate with data about the flows of purchase and sale of their products. This information is not sufficient for effective analysis and subsequent management. In this process, prices are not the determining factor, which is not tied to the equality of supply and demand for the sale of products. Therefore, a new approach to determining prices in micro-markets is needed, which would meet modern requirements for the efficient distribution of commodity flows.

3. Research Questions

Manufacturers directly and intermediaries indirectly regulate the material flow so that the supply of a product is almost equal to its demand. However, these network agents cannot know the future demand accurately enough. They consider it expected, without having sufficiently precise mechanisms to determine it. For this reason, intermediaries are required to keep inventory and regulate them in order to avoid possible non-covering of demand, while trying to keep inventory for as little time as possible. Thus, there is a contradiction, which indicates that there are no optimal solutions to inventory management problems.

Considering the prerequisites for solving the problem, price (as noted earlier) isn't a direct participant in the consideration of the balance between supply and demand. In fact, prices are determined by manufacturers and intermediaries of the network (Shiozawa, 1989). There are different methods for determining and setting prices. The main one is the method of pricing at full cost (cost + profit). Here the product price is determined as the unit cost of the product multiplied by the markup coefficient $(1+m)$, where m is the markup rate. Having determined the price using this method, we assume that there are no

https://doi.org/10.15405/epsbs.2020.10.03.15
Corresponding Author: D. J. Karandeev
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

agents in the network who claim to change it. In this case, prices on micro markets are considered constant for a certain period of time, but they may change in the subsequent period. This approach to price determination is consistent with the Arrow–Debreu) model, which is focused on price stability.

As noted in (Shiozawa et al., 2019), prices are considered constant if two conditions are met:

1) there is enough labor and material resources to produce/sell the product according to the final requirements;
2) the set of production methods remains unchanged and the markup rates *m* remain constant.

The focus on price stability is the result of creating a good base for changing methods and technologies that will serve as the basis for applying research programs of the evolutionary economy. Evolutionary Economics, in its classical sense, is a new direction of economic science, in which economic processes are considered as spontaneous, open and irreversible; they are generated by the interaction of external and internal factors and are manifested in changes in the structure of the economy and the agents acting in it (Hicks, 1976; Shiozawa, 2004).

The search for opportunities to generate new technological changes is one of the main directions of the evolutionary economy, as confirmed by Nelson and Winter (2002), who highlight an important aspect in the evolutionary economy: the understanding of technical and economic growth is largely due to technological progress. The role of mechanisms aimed at changes in production technology stimulate economic growth (Nelson, & Winter, 1974). This statement does not raise any noticeable doubts. However, there are no significant theoretical justifications or they are of a particular nature. However, this article can be considered as an attempt to fill a small gap in the theory of economic growth, using, in our opinion, an approach to determining prices in the micro markets of a trading network (Nelson & Winter, 1982).

Since the solution of this problem involves the theory of value, we will first define the role of the traditional theory of prices. The founder of this theory can be considered Ricardo (1951), who identified a trend in the rate of profit under conditions of free competition and developed the ideas of Adam Smith about the value of goods determined by the amount of labor. Ricardo's idea that price values are determined by production costs, and not by the proportionality of supply and demand was practically isolated due to the impossibility of its implementation in practice in the XIX century. Subsequently, the traditional theory of prices has undergone changes (Kohn, 1986) and in the XXI century has acquired the modern form of the theory of value (Lee, 1998). This theory was explained in the work of Shiozawa (2019), which the author kindly provided to us by sending us an E-mail.

The following are considered as fundamental assumptions of the new Shiozawa's theory:

1) the assumption of independence between prices and quantity in determining them;
2) the price theory doesn't exclude the theory of production cost from analysis;
3) the process of quantity adjustment is provided

4. Purpose of the Study

The methods for determining the price and quantity presented below don't guarantee the high accuracy of the desired result. Nevertheless, the basis here is the Shiozawa's theory, as applied to the task

https://doi.org/10.15405/epsbs.2020.10.03.15
Corresponding Author: D. J. Karandeev
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

we have set ourselves. The solution of the problem of the distribution of material flow in a trading network involves the modification of mathematical methods, where the distribution coefficient is *R* (coefficient of transfer or promotion of the commodity flow through the network) (Dulesov et al., 2017):

$$R_{ij} = \frac{p_i - p_j}{Q_{ij}}, \quad (1)$$

where p_i and p_j are prices on micro markets *i* and *j*, and Q_{ij} is the quantity of goods transferred from micro market *i* to micro market *j* by the network agent.

Since we are interested in this coefficient, then we will answer the question: How to predict the price in the micro market? Manufacturers/intermediaries independently set the price for their products. This assumption corresponds to the market for a single product or product that is considered homogeneous. Such a product is a product that is produced and distributed as a final product. If we assume that the prices of products remain unchanged, therefore, then we must be talking about the distribution of large volumes of goods.

Setting the price of a product by the manufacturer has a long history. At the same time, prices are set by both supermarkets and small stores. Therefore, taking into account the presence of a monopoly or oligopoly in the market, its perfection or imperfection doesn't give any serious reason for setting the price.

Pricing technologies are known and simple. Prices are set on the "cost plus markup" principle: $p=(1 + m)\cdot c$, where *m* is the markup rate, and *c* is the unit cost of production (Shiozawa, 1978). There are many approaches to determining "*m*" based on a number of factors that affect the markup. If there are two agents in the micro market, the seller and the buyer, then according to the theory of value, it is possible to apply standard cost accounting. In it, depreciation and other indirect fixed costs per unit of production are calculated based on the normal volume of production for the period. This cost accounting assumes that the unit price of the product remains constant, even if sales and sales volumes deviate from the expected standard value.

However, there is a different point of view of setting the price. It is related to the fact that buyers in the micro market are guided by how many products they can buy at the offered price. In solving this problem, the buyer takes into account the "Marshallian cross" (in Economics-the graphical ratio of supply and demand curves relative to the price factor in a situation of market interaction) and therefore the question of the quantity of purchased goods is not immediately determined by the price level (Bowles, 2003).

The pricing offered here has an advantage over traditional methods:

1) it is quite simple to theoretically determine the actual prices that are applicable in the micro markets of the network. Thus, we are freed from the double system of natural and market prices;
2) constancy and stability of prices is provided before any of the significant factors that have a low probability of occurrence;
3) the price will change if the manufacturer or intermediary switches to using new production and sales technologies.

https://doi.org/10.15405/epsbs.2020.10.03.15
Corresponding Author: D. J. Karandeev
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

5. Research Methods

Another issue related to setting the price in the micro market is the following: how to set the price in the micro market when there are more than one seller. Let's explain this fact in the following example. Let's assume that there are two manufacturers, each of which has determined and set its own price for a product of the same type. There are two possible ways of structuring the network:

The first option – if there are different prices for the same product, assumes the existence of two micro markets. Each of them has a manufacturer/seller with its own price. In this case, depending on, for example, geographical conditions, buyers (intermediaries and end users of the product) are attached to each of the micro markets in the structure.

The second option – if prices match (in the absence of geographical and other conditions that separate micro markets), both manufacturers enter a common micro market. Their set prices will be decisive for the search for the quantity of goods sold. If in this case the prices don't match, then such a micro market can be divided by the number of set prices with the addition of intermediaries to each of them, who are satisfied by certain characteristics of the price. Such a market cannot be called stable based on the condition of economic benefit in purchasing a certain amount of products. Price differentiation will lead to a situation where buyers will begin to move from a higher-price market to a lower-price market, which in fact can lead to an equalization of prices between manufacturers. To eliminate the disparity in prices, manufacturers obviously should pay attention to the markup rate m when setting the price. Its determination is possible empirically, without excluding, for example, the application of the theory of preferences, utility functions and indifference.

The options considered for the consequences of setting prices by manufacturers and sellers indicate how much of the product buyers will purchase at the set price. Thus, when building the network structure and determining prices in micro markets, decision-making on purchase/sale transactions is divided between two parties: manufacturers (or sellers), who determine the sale price, and buyers (intermediaries), who determine the quantity of purchased goods. The execution of the auction is not provided for in this setting of the question of price formation in the market. Therefore, the manufacturer who has set a price for its products doesn't prioritize demand in the micro market. On the other hand, this doesn't mean that manufacturers or intermediaries don't take into account demand. The quantity of goods sold or demand is important for manufacturers and intermediaries, since the profit from sales of products is calculated using the formula:

$$(\text{profit})=(\text{markup})\times(\text{unit cost})\times(\text{sales volume for the period}). \quad (2)$$

Considering (2), it can be observed that if the markup is constant, then the profit increases nonlinearly with an increase in sales volume. In the case of calculating the rate of return, the profit should be divided by the total capital, however, such a calculation cannot be called unambiguous.

6. Findings

Next, we will move on to the issue of determining the markup rate. It is well known: the unit cost of production is determined by the production technology. The markup rate is unique and its arbitrary setting by the management doesn't guarantee that the price is adequate for the market. A significant role is played

https://doi.org/10.15405/epsbs.2020.10.03.15
Corresponding Author: D. J. Karandeev
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

not only by a technologically verified solution, but also by information related to the concept of uncertainty or information entropy (Dulesov et al., 2019). What causes entropy? Considering any product, even if it is differentiated, it is in competition with other differentiated products. This degree of differentiation can be determined through the value of entropy. If a high price is set for a product, intermediaries or buyers will choose the product based on the lower price and satisfactory quality of the products of other sellers. Equation (2) indicates that the profit is related to the markup and increases non-linearly. In other words, the seller is focused on multiplicative growth of the profit that he can get during the period under review. However, it doesn't make sense for the seller to hope for an excessive increase in the markup due to a decrease in the number of products purchased by customers. Thus, the seller, represented by management, sets the price of the product at a reasonable level, taking into account all agents of the competitive environment.

The pricing policy that we are considering in a trading network runs into difficulties: it is difficult to predict the cost of a product in the future and sell it at a set price. If we rely on the conventional economic calculation aimed at finding the maximum profit, we should not expect an adequate solution to the realities, since the sales volume isn't a simple function of the product price (Shiozawa, 2019). Shiozawa gives the following explanation. If the sales volume is a function of the price, then you can calculate the optimal price of the product. In the theory of imperfect competition, the calculation is based on the assumption: "marginal revenue = marginal cost". This assumption indicates that sales volume is a simple function of price. In this case, the price of the product is not invalid, since a simple formula in this case is not effective and is of little use. The reason for this is as follows. In fact, the volume of sales depends on many factors: the pricing policy of competitors and their products, product design, structure and logistics policy of the sales network, advertising activities, purchasing power depending on the general economic climate, the level of income and lifestyle of consumers and other factors. The experience of sales is important in this task. If management has identified a "good level" of the markup rate, it doesn't seek to change it. This feature is often expressed in the fact that the markup rates are determined by agreement, that is, "conditionally determined".

When determining the "good level" of the markup rate, the multiplicative form $(1+m)\cdot c$ is preferable to the additive form $c + M$, where M is a fixed amount of costs plus markup that don't depend on the cost of unit c. If we assume that the product share is simply a function of the price ratio, then profit maximization implies the use of the multiplicative form with m (Shiozawa, 2016).

Further, based on function (2), when the markup rate m is known, the price of the product set by the seller is determined by the expression:

$$p = (1 + m)\ \{w\cdot u + a\cdot p_0\}, \qquad (3)$$

where m is the adjusted markup rate, w is the wage rate, u is the coefficient of labor costs (labor intensity), a is the coefficient of material costs of purchasing products for the production and sale of the final product and p_0 is the price of the purchased product.

All input coefficients are determined by well-known methods that are used in calculating production costs.

https://doi.org/10.15405/epsbs.2020.10.03.15
Corresponding Author: D. J. Karandeev
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

7. Conclusion

One of the important issues in the development of logistics should be considered technological evolution in the field of trading networks, in which price setting and distribution of commodity flows occupies a special position. Considering economic processes as dynamic, generated by the interaction of many factors, management decisions are processes that lead to the economic growth of the logistics system.

The existing prerequisites for solving the problem of setting prices in the micro markets of the trading network are due to the presence of an environment that is radically different from the traditional "economy with equilibrium" (Cartelier, 1991). It is aimed at identifying a set of conditions that ensure efficient resource allocation. One of the conditions is considered to be the maintenance of the balance between supply and demand, and the search for the equilibrium point was carried out on the basis of analysis of process statics (Hahn, 1984).

The search for solutions aimed at implementing evolutionary processes is associated with the choice of simple but effective methods that take into account the degree of production and technological changes that affect the price of production. Thus, prices are determined by manufacturers and intermediaries in the micro markets of the trading network.

The proposed formula for determining the price in the micro market cannot be called complex. It includes components, the calculation of which is based on known methods for calculating the cost of production and services. The effectiveness of the proposed approach to price determination is due to the need to take into account dynamic processes. They are related to the implementation of technological improvements that make logistics more productive and mobile.

Determining prices in micro markets using the proposed formula refers to the preliminary stage of obtaining the parameter "transfer/promotion coefficient", which will be used as the basis for calculating the distribution of product flow over the network.

Acknowledgments

The study was carried out with the financial support of the Russian Foundation for Basic Research (RFBR) and the Republic of Khakassia in the framework of the scientific project No. 19-47-190001 and with the financial support Program of the Russian Foundation for Assistance to Small Innovative Enterprises in Science and Technology by the grant "UMNIK" №13138GU/2018, code № 0040353.

References

Bowles, S. (2003). *Microeconomics: Behavior, institutions, and evolution*. Princeton University Press.

Cartelier, J. (1991). Monnaie et système de paiement: le problème de la formation de l'équilibre. *Revue française d'économie*, *6*, 3–37.

Dulesov, A., Gimanova, I., & Litvin, N. (2017). Simulation of economic agents interaction in a trade chain. *IOP Conf. Series: Journal of Physics: Conf. Series*, *803*, 1-5. http://iopscience.iop.org/article/10.1088/1742-6596/803/1/012047.

Dulesov, A. S., Karandeev, D. J., Bazhenov, R., Khrustalev, V. I., & Kochetkov, V. P. (2019). Entropy approach to the evaluation of the integration processes in agro-industrial complex. In *Earth and Environmental Science:* vol 315. (pp. 1-6). IOP Conference Series. https://doi.org/10.1088/1755-1315/315/3/032007

Hahn, F. (1984). *Equilibrium and macroeconomics*. Basil Blackwell.

Hicks, J. R. (1976). *Revolution in economics*. Cambridge University Press.

Kohn, M. (1986). Monetary analysis, the equilibrium method, and Keynes's "general theory". *Journal of Political Economy*, *94*, 1191–1224.

Lee, F. S. (1998). *Post Keynesian price theory*. Cambridge University Press.

Nelson, R. R., & Winter, S. G. (1974). Neoclassical vs. evolutionary theories of economic growth: Critique and prospectus. *The Economic Journal*, *84*(336), 886–905.

Nelson, R. R., & Winter, S. G. (1982). *An evolutionary theory of economic change*. The Belknap Press of Harvard University Press.

Nelson, R. R., & Winter, S. G. (2002). Evolutionary Theorizing in Economics. *Journal of Economic Perspectives*, *16*(2), 23-46.

Ricardo, D. (1951). *On the Principles of Political Economy and Taxation*. Cambridge University Press.

Shiozawa, Y. (1978). *Non-simultaneous markup pricing processes*. Springer Japan. https://doi.org/10.13140/RG.2.2.19413.63207

Shiozawa, Y. (1989). The primacy of stationarity: A case against general equilibrium theory. *Osaka City University Economic Review*, *24*(1), 85–110.

Shiozawa, Y. (2004). Evolutionary economics in the 21st century: A manifesto. *Evolutionary and Institutional Economics Review*, *1*(1), 5–47.

Shiozawa, Y. (2016). *Chapter 1: A guided tour of the backside of agent-based simulation*. Springer Japan.

Shiozawa, Y. (2019). *A new framework for analyzing technological change*. Springer Japan.

Shiozawa, Y., Morioka, M., & Taniguchi K. (2019). *Microfoundations of Evolutionary Economics*. Springer Japan. https://doi.org/10.1007/978-4-431-55267-3