THE ECONOMICS OF PRODUCTIVE CONSUMPTION AND POSITIONAL INVESTING

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Abstract

This paper brings together the results of research in the field of economics of productive consumption and positional investing. It is based on a model of supply and demand of investment funds and investment opportunities. It extends the existing results by the aspect of generating future investment opportunities (not only of the investor himself but also of other players) in the realization of the current investment opportunities. This article defines the equilibrium of this model as the maximum of future income from the realization of investment opportunities whereas this does not depend on whose investment funds are used to realize the investment opportunities and to whom additional investment opportunities are generated. This is a substantial extension of equilibrium, conceived as the utilization of investment opportunities according to their rate of return, irrespective of who owns the investment funds. The paper contains a methodology for building the relevant models and for the calculation of the equilibrium. This enables to distinguish between prisoner's dilemma situations and situations in which players have the highest payoffs if they cooperate (KK). Based on this, KK situations can be identified at different stages of history, at present, or for which conditions exist for the future. Consequently, the causes that have led or may lead to the change of a situation from KK to NN can be revealed, which has important practical applications.

Keywords: *economics of productive consumption, positional investing, game theory, investment funds, investment opportunities, Pareto-optimum, Nash-optimum*

1. INTRODUCTION

The paper is the result of the interconnection of two areas of research:

The first area is the economics of productive consumption, which looks at the impact of current consumption on the future income of both consumers (from a microeconomic perspective) and households (from a macroeconomic perspective). For M. Friedman (1957), it was self-evident that households use their current income to build and exploit their portfolio consisting of human and non-human assets so as to maximize the present value of their future income. A number of other authors have followed a similar path in an attempt to overcome the horizon of neoclassical economics ending in "utility maximization", including J. Neumann (1945-1946). Although this is one of the most frequently cited articles, to this day not all the ideas that the author incorporated have been extracted from it. Currently, the issue of the economics of productive consumption is being addressed from various aspects by a number of theorists (Ichiroh 2010), (Psárská 2019), (Kazuo, Nishimura 2021), (Steger 2002), (Soumyananda 2014), (Suen 1994) and by us (Černík, Valenčík, Wawrosz 2020). However, this journey has failed to uncover original research tasks that would require a fundamental paradigm shift and at the same time yield insights relevant to theory development and practical application.

The second area is the issue of positional investing, i.e., the focus on the theory on analyzing the fact that consumers' incomes may not be neutral in the formation of reciprocal relationships between them. Indeed, it may be that one consumer, usually the one with the higher income, may, by investing in his position or positional goods, gain an income advantage in the next round by discriminating against the other consumer. Although this takes different forms, a common basis can be identified behind even very different cases of discrimination or segregation. A number of works have been inspired by T. Veblen (1899) and his theory of conspicuous consumption in this view of (especially microeconomic) reality. It has been followed by a number of other theorists (Hirsch 1976), (Hylland, Zeckhauser 1979), (Walasek, Bhatia, Brown 2018). Also in this area, sufficiently conclusive results relevant for the development of theory and practical applications have been and still are lacking.

If we look at the nature of the theoretical problems and their practical relevance in the case of both areas, we realize that both are interrelated. Positional investing undoubtedly affects future consumption income; part of consumption can be used for positional investing.

An important step towards linking the two areas was the model of supply and demand of investment funds and investment opportunities presented as an important theoretical starting point (Valenčík 2023). We just do not present it at this point, as it will be presented in a more developed form and in the context of new findings in the next section of the paper (Figure 5 and commentary).

This model (specifically its dual form) has played a similar role in the search for an organic link between research in the economics of productive consumption and that in the field of positional investment as the dual model consisting of Edgeworth's box diagram and the graphical representation of Nash's bargaining problem played in the development of game theory (e.g. Binmore 1994, p. 74, Figure 14). The two dual models also have similar logic: in one case, the supply and demand of goods and their exchange leading to an increase in each player's utility; in the other case, the supply and demand of investment resources and investment opportunities and their exchange allowing both players to increase their income by using one player's investment resources to realize the other player's more profitable investment opportunities.

If we recall that investment opportunities can also be some consumption opportunities (there is a smooth transition between consumption and investment from this microeconomic point of view), we can also see in this logical continuity of the two double graphs the transition from neoclassical economics to the economics of productive consumption. Recognizing this fact is also important given that it also solves one of the traditional problems of game theory - the relationship between payoffs and utility from payoffs, or how to move from payoffs in monetary or in-kind form to utility from these payoffs in some cases, see e.g.:

> *"There are obviously several possibilities to factorize a payoff vector function into an outcome function and a vector of utility functions. The two extreme cases are to take*
>
> *a) the outcome space as identical to the strategy space, choosing the outcome function as the identity map and the utility functions as the payoff functions;*
>
> *b) the outcome space to be the space of payoff vectors, choosing the utility functions as projections to payoffs and the outcome function as the payoff vector function."*

(Haake-Trockel 2008, p. 19)

From this point of view, the question arises whether the neoclassical basis of game theory has in some sense already exhausted itself and become a barrier to the further development of game theory.

The contribution of the supply and demand model of investment funds and investment opportunities has another important aspect. It raises the question: What prevents (or, conversely, what is the precondition for) investment opportunities to be utilized according to their rate of return, regardless of who the owner of the investment funds is and who owns the investment opportunities? Through this prism, the link between productive consumption economics and positional investment theory becomes even more obvious.

Whether or not a particular line of research (in our case, as outlined above) is promising is always decided by achieving conclusive results that open up new research space and answers to relevant practical questions. The search for an answer to the question of how investment opportunities arise has played a significant role in achieving this milestone. The answer is trivially simple, as it is in such cases: investment opportunities arise in a similar way as investment funds - by using (combining) existing investment funds and investment opportunities. In other words, when investment funds and investment opportunities are combined, they result in future income (which is shared between the owners of investment funds and investment opportunities), but at the same time (and this is particularly important) new investment opportunities are generated when existing investment opportunities are realised.

This, however, takes the theory focused on this area to a much higher level. It acquires a new dimension. A dimension that corresponds to the role of the economics of productive consumption as an extension

of the existing (mainly neoclassical) stream of microeconomic theory in its main direction of development. This is illustrated by the reformulation of the above question concerning why investment opportunities are not exploited according to the rate of return as a concretisation of the Pareto optimum for the field:

- At the original theoretical level, this optimum can be formulated as follows: The situation expressed by the supply and demand of investment funds and investment opportunities is Pareto-optimal if and precisely when investment opportunities (regardless of who owns them) are exploited according to their rate of return, regardless of who owns the investment funds.

- An extended definition of this optimum (which also considers the process of generating investment opportunities when the previous ones are realised) then reads as follows: The situation expressed by the supply and demand of investment funds and investment opportunities is paretooptimal if and precisely when investment opportunities (regardless of who owns them) are used and subsequently generated regardless of who owns the original investment funds, the generated investment funds and the generated investment opportunities, so that the return (which is shared by the participants in a certain way) is maximized (so that it cannot be increased by changing the order of implementation of investment opportunities both in terms of time and in terms of the continuity of the respective follow-up process).

It is clear that both the process of determining the order of realisation of investment opportunities in terms of whose investment opportunities will be realised and whose opportunities will be generated, and the distribution of the proceeds from the realisation of investment opportunities, involve the phenomenon of positional investing. Depending on whether it is involved or not, we can divide the strategies of the players into cooperative and non-cooperative, and then use models from the field of non-cooperative games to analyse each situation. The relevant analysis and its interpretation will be the outcome of our paper.

2. METHODS DEVELOPED AND USED

Since we have continuously implemented the methods in the more comprehensive introduction to the paper (in which we also defined the object of research and outlined the structure of the paper in the context of the development), we will only give an overview of them in this section (except for the methods we have not introduced so far, which are provided by the theory of design and mechanism implementation, which is a less known but important part of game theory):

- A microeconomic model of the supply and demand of investment funds and investment opportunities and its extension in terms of how investment opportunities are generated; a specification of these models in several ways.

- Defining the Pareto optimum specification for the original and extended models of supply and demand of investment funds and investment opportunities.

- Developing appropriate symbols, especially taking into account the problem of generating new investment opportunities while implementing existing ones.

- Tools for expressing equilibrium through marginal variables.

- Expression of the relationship between cooperative and non-cooperative strategies through bi-matrix games; their distinction according to the type of Nash equilibrium.

- Interpretation of the results obtained in terms of current issues and a more distant perspective.

- Adherence to the requirements of well-designed and well-enforceable mechanisms and the use of some techniques and inspirations from mechanism design theory, which is an important part of game theory oriented towards the practical application of research results in the theoretical domain. This includes in particular the results of the work of L. Hurwicz (1960, 1973, 1994, 2008), W. Trokel (2001, 2002, 2004), together with the work of R. Myerson and others contained in a comprehensive monographic treatment (Banerjee 2022).

3. PRINCIPLES OF THE ECONOMICS OF PRODUCTIVE CONSUMPTION

We will consider an economic system in which players have investment resources and investment opportunities. The use of investment funds to realize investment opportunities yields returns to the players, which turn into investment funds that can be used in the next round. At the same time, it generates investment opportunities to be used in the next round.

The use of investment funds by one of the players in the previous round generates investment opportunities in the next round not only for him but also for the other player (and, in the case of a multiplayer game, for the other players).

It turns out that it is important to consider the possibility of using the investment resources available to one player to realize the investment opportunities available to the other player, i.e. a market in which one player offers investment resources and simultaneously demands investment opportunities, while the other player offers investment opportunities and demands investment resources.

This raises an important question: Under what conditions can it occur that in a given economic system investment opportunities are allocated according to their rate of return, irrespective of how the ownership of investment funds is allocated? - This can also be understood as a certain optimum in a given system.

One of the conditions for achieving this optimum is a certain way of distributing the returns generated by the above-mentioned utilization of investment opportunities. The investment opportunities that are generated by the realisation of investment opportunities by one player to the benefit or detriment of the other player, which may be used to increase his income in the next round, but may also lead to a reduction in his income in the next round, can be seen as a kind of analogy of externalities (positive and negative spillovers of private ownership), in this case spillovers of effects that arise from the realisation of investment opportunities by a certain player and have certain consequences for the other player. These consequences can concern both the distribution of returns when one player provides his investment resources to realise the other player's investment opportunities and the possibility to realise the investment opportunities that the other player has. Investment opportunities include consumption opportunities, since most consumption activities also affect future income or take the form of investment opportunities.

We will assume that agents do not make decisions in a short-sighted way, but that they project their idea of future developments or future situations into their current decisions. We will focus on the question of decision-making according to the level of future income and not on "utilities", because we do not regard the mechanism of the emergence and functioning of experiences as goal-directed (in the sense of directed towards the maximisation of subjectively experienced utilities), but as decision-making in the sense that it allows, under given social conditions, decisions that are more or less (depending on the degree of rationality, information, appropriate calibration of subjective experiences, etc.) directed towards the maximisation of the present value of future income.

We will consider the above situation as a two-player game (with the possibility of extending it to more players if necessary) in which

- The set (profile) of each player's strategies is determined by the choice of investment opportunities (their own or the other player's) to pursue with the available investment resources (their own or the other player's).

- The payouts are determined by the return on the player's own investment opportunities realised with the player's own funds and the share of the return on the other player's investment opportunities realised with the first player's funds.

We will consider only two players (the symbolism must be such that if the problem requires more players to consider, it can be extended in this direction). Starting by expressing those situations that are at stake by playing two players corresponds to the nature of the problems we will be solving.

X, Y is the designation of the players.

x(0), y(0) is the total simultaneous income of each of these players

x(1), y(1) is the total income of each of these players after the first round of the game, i.e. their payoffs

x(i), y(i) similarly in subsequent rounds (in the problems we will solve we will be interested only in the first and the second round, we will justify why we accept this restriction)

Δx(0)1, Δy(0)1 the fraction of resources invested by each player at the beginning of the game, similarly in the subsequent rounds

x(1) = f(x(0)): x(1) is a function of x(0)

x(1) = x(1)(x(0)) which is just another notation for the previous

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Σ Δx(0)i = x(0) (and similarly for "y" or other rounds): current income (or income after i=1 of each subsequent round) is divided into the respective amounts of "Δx(0)i" etc. so that we can describe the return on each amount invested by one or the other player. Their sum is the total current income, i.e. the amount of investment funds.

Description of the investment opportunity (this is one of the key concepts):

Pxxi(0) (Δx(0)i → Δx(1)i | Pxxi(1), Pxyi(1))

Pxxi(0) denotes the initial investment opportunity of player X, its structure in brackets a subscript "x" would suffice, but because of the same symbol structure we use "xx" (the reasons for this will become apparent in what follows)

Δx(0)i → Δx(1)i means that a part of the initial investment funds "Δx(0)i" yields a part of the future income "Δx(1)i", i.e. "Δx(1)i" is the return (and at the same time the future income of player X) on the amount "Δx(0)i"

Pxxi(1), Pxyi(1) are the investment opportunities generated by realising (or using) "Pxxi(0)", i.e. the respective initial investment opportunities, while Pxxi(1) is the investment opportunity generated by player X for the benefit of player X (i.e. himself) Pxyi(1) is the investment opportunity generated by player X for the benefit of player Y (i.e. the other player)

Similar is the case for Pyyi(1), Pyxi(1) (i.e. investment opportunities generated by player Y).

| is a technical symbol that says that, in addition to the returns, there is an investment opportunity;, there is also the generation of investment opportunities in the next round (we consider this symbol as more appropriate than e.g. "^" or simply separated by a comma, because it is the effect of the realisation of the respective investment opportunity which is significantly different.

Graphical representation:

We move from a discrete to a continuous representation of quantities, specifically from

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Σ Δx(1)i = x(1)

i=1

to

$$x^{(1)} = \int_0^{x^{(0)}} f'\left(x^{(0)}\right) dx^{(0)}$$

where x(0) is a variable, etc.

First, we will assume: Pxx(1) = Ø, Pxy(1) = Ø (i.e. we do not consider the generation of new investment opportunities when existing ones are realized.

At the same time, we will (for simplicity) assume that the decreasing function of the marginal returns to investment opportunities is linear.

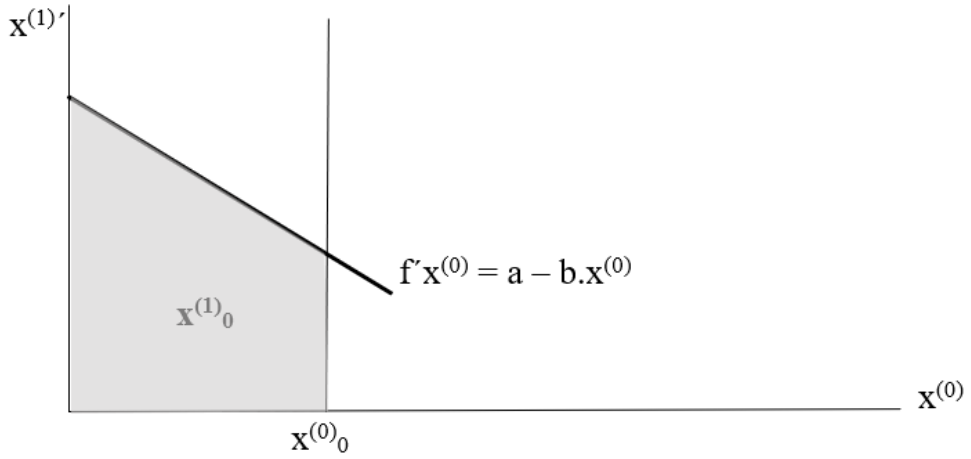

Fig. 1. Yield from the combination of investment funds and investment opportunities

Source: Own creation

$x(0)_0$ default amount of investment funds

$x(1)_0$ the yield on these investment funds

We now make a first minor extension to the baseline model

We will assume: $Pxx(1) \neq Ø$, $Pxy(1) = Ø$, i.e. that the set of investment opportunities generated for player X is non-empty.

In that case, in addition to the initial picture, we have to consider the situation in the next round.

We will further assume that player X will maximize his total income (return on investment opportunities) in the second round. This assumption has some merit:

- Neither player is thinking myopically.

- The total income in the first round is the path that must be followed to exploit investment opportunities in the second round.

- In the payoffs in the second round, the player also projects his idea of further development (in proportion to how he is endowed with information and (in the case of humans) how his experiential system is calibrated, or how the decision-making of the managers of the firm, institution, etc. works (in which the experiential mechanism of the persons involved also plays a significant role).

Should a particular task require it, the model can be extended to a three-round model, etc. We will see that in most tasks this is not necessary. However, one can also imagine a situation where it will be important. For example, when only after a few rounds investment opportunities with extremely large returns are generated and the player can visualize the path to these returns and appreciate the parameters of the path to these returns. (We don't have to go far for an example; such a situation is not, for example, the decision to start a family and have children.)

From a game theory point of view, in the case $Pxx(1) \neq Ø$, $Pxy(1) = Ø$, it is a single-player game, i.e. a simple optimization problem.

Since we extract from this simple problem the methodological basis for solving more difficult problems associated with the transition to two-player games, we make a methodological remark at this point. At first glance, it would seem that we would utilize investment opportunities in the first round according to their rate of return. This allows us (as a rule) to increase the investment funds for the second round, and in the second round we also use the investment opportunities according to their rate of return. This will give us the maximum future income in the second round.

This reasoning is not correct. A situation can arise (and usually does arise) whereby we lose out on more profitable investment opportunities in the second round. If we use the investment opportunities in the first round according to the investment opportunities they generate in the second round, the amount of investment funds available to us in the second round will be reduced compared to the previous situation. That is, we solve a standard optimization dilemma.

We need to introduce indexation of parameters a, b (because in the general case these parameters will be different from those in the first round.

We do not know the quantity $x(1)_0$, because we have yet to compute it to satisfy the maximization of the quantity $x(2)_0$, i.e., the maximization of total revenue in the second round.

We show the relevant difference in the following figures.

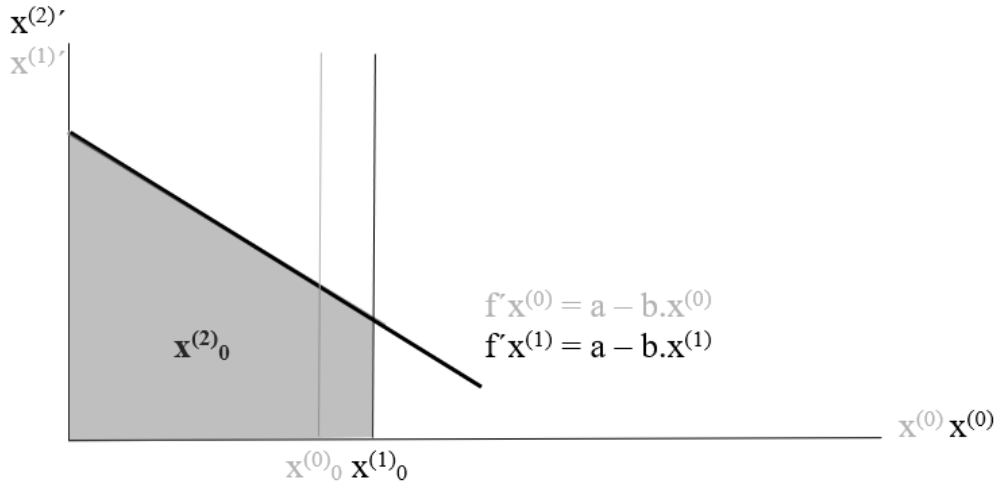

Fig. 2. Comparison of returns on investment opportunities in the first and second round

Source: Own creation

The grey lines and symbols indicate a crossing wheel for comparison. We will assume that if the investment opportunities in the first round are selected according to their rate of return, the marginal return on them in the second round (i.e. f´x(1) = a - b.x(1)) will coincide with the marginal return on the investment opportunities in the previous round. However, we can expect that x(1)0 (the return on these investment funds) will be larger than x(0)0 (the initial quantity of investment funds).

If we combine the selection of investment opportunities according to their expected return in the first and second round, we obtain the following figure.

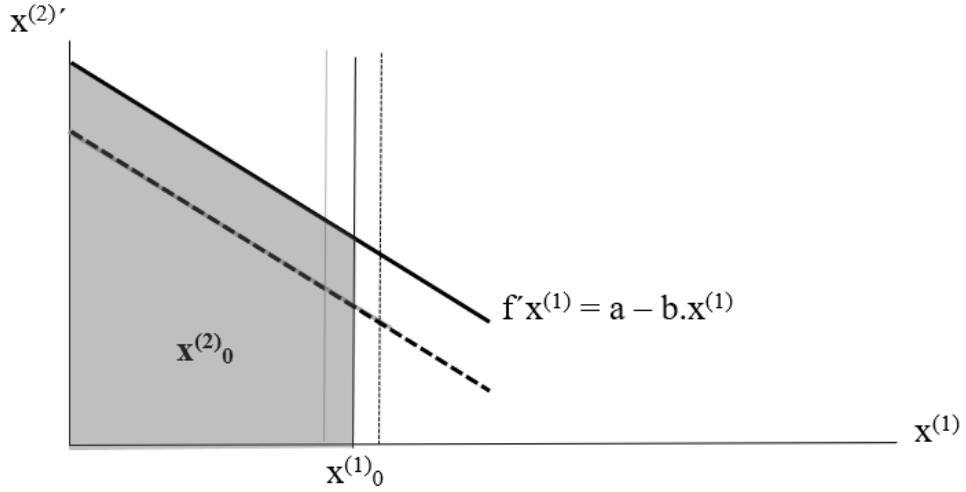

Fig. 3. Assumptions on the optimal use of investment funds and investment opportunities

Source: Own creation

It already shows how to achieve the maximum return in the second round, see the following figure.

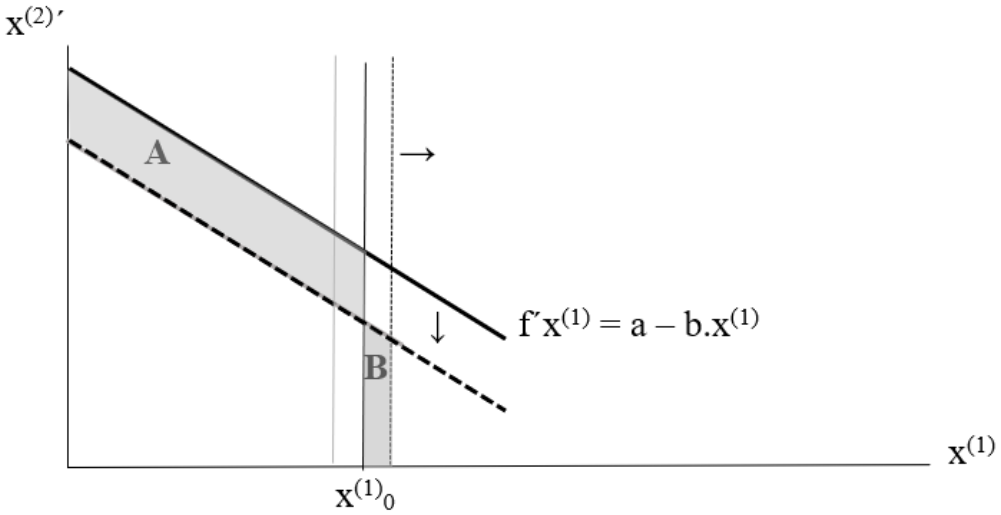

Fig. 4. Graphical representation of the optimum condition

Source: Own creation

The highest return will be obtained if the increment resulting from the higher return on investment opportunities in the second round (area A) equals the increment resulting from the increase in investment funds in the first round (area B), i.e. when A = B. This is not satisfied in Figure 4. The analytical expression of the relevant condition then follows from here. The arrows indicate the directions of the shift to the optimum.

Expressing the supply and demand of investment funds and investment opportunities as a two-player game

We now take the important step of extending the initial model. We will assume that there are two players, and only one of them can provide its investment funds to realize the investment opportunities of the

other player, so that the requirement of the optimum is satisfied, i.e., that investment opportunities that exist are exploited according to their rate of return.

The graphical representation (Figure 5) will work with a similar idea to Edgeworth's box diagram, i.e., a mirror reversal of the situation in which one player and the other are in (this time along a vertical axis formed by the constraints on the investment resources of both players.

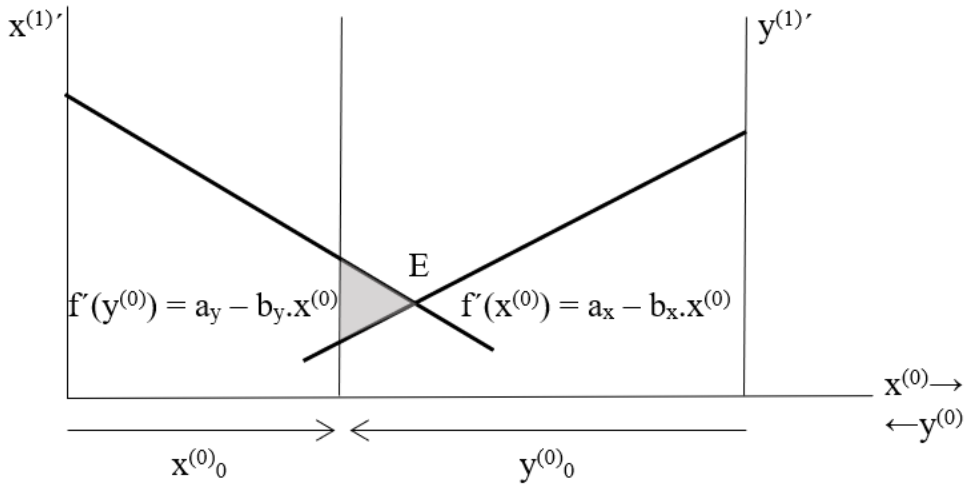

Fig. 5. Basic model of supply and demand of investment funds and investment opportunities in the two-player case

Source: Own creation

The grey area shows the Pareto improvement that results from player Y providing player X with his investment funds to pursue his more profitable investment opportunities.

A large number of extremely interesting problems are now arising (in terms of theory and the development of tools to solve them) that have important interpretations and practical applications, such as:

- How can players share the Pareto improvements that arise in this way?

- What is the optimum condition in this case?

- How to describe the optimum when the realization of investment opportunities by one player contributes to the creation of profitable investment opportunities by the other player?

- How to describe the case where one or both players use investing in a position to influence the distribution of increasing returns see Figure 5 to influence the distribution of returns in their favour?

- How to address the optimum issue when a player can increase the return on his own investment opportunities by investing to suppress the other player's investment opportunities?

- What dilemmas arise in terms of the positive and negative consequences (suppression or generation of profitable investment opportunities) of realising one player's investment opportunities in relation to the other player?

- What Nash equilibria exist in terms of the previous point in the given situations?

The case of two players when $Px(1) \neq Ø$, $P\ xy(1) \neq Ø$, $Pyy(1) \neq Ø$, $Pyx(1) \neq Ø \wedge xy(1) > 0$, $yx(1) > 0$

This is the case where the realization of investment opportunities by one player yields positive investment opportunities for the other player.

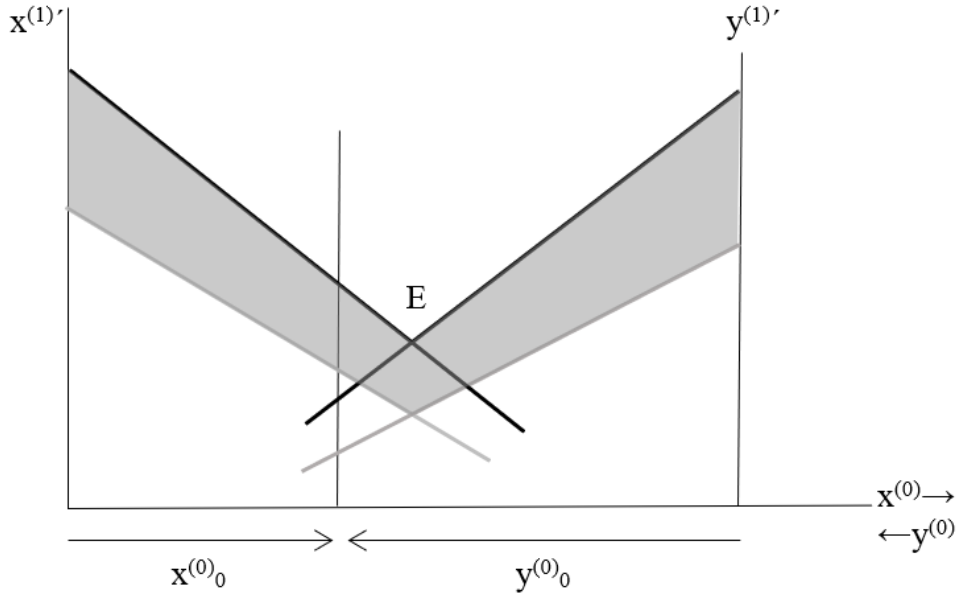

Fig. 6. Reciprocal generation of investment opportunities while exploiting existing investment opportunities

Source: Own creation

Figure 6 is based on Figure 5. The original marginal revenue lines are in grey, the new ones in black, can be expressed:

$fx'(x(0)) = (a_x - b_x.x(0)) + (a_{xy} - b_{xy}.x(0))$

$fy'(x(0)) = (a_y - b_y.y(0)) + (a_{yx} - b_{yx}.x(0))$

In both cases, we assume that players realize investment opportunities according to the maximum of the sum of the returns in the second round.

The grey area is the improvement brought about by the mutual exploitation of the investment opportunities generated by the other player in realizing his investment opportunities.

The case of two players where P xy(1) ≠ Ø, P xy(1) ≠ Ø, Pyy(1) ≠ Ø, Pyx(1) ≠ Ø ∧ xy(1) < 0, or yx(1) < 0

This is the case where the realization of investment opportunities by one player suppresses the investment opportunities of the other player.

There are a number of other important interpretations.

If we want to investigate these cases in more detail, we must consider the case that is symmetric in some way with respect to the previous one. We note preliminarily that this case is very sensitive to the way in which the distribution of the gains from the exploitation of investment opportunities generated by one player to the other in the pursuit of its own investment opportunities. In particular, it is a question of where the whole system is headed, since discriminations in the initial state that are almost imperceptible can have significant consequences. We present just one of several cases of positional investing (an overview of the other options is provided in the next section).

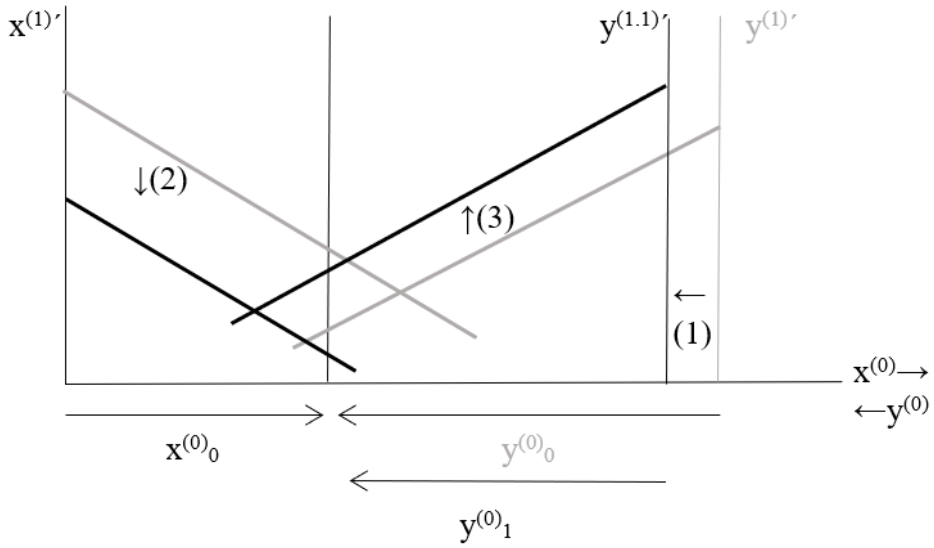

Fig. 7. Positional investing to suppress the investment opportunities of the other player

Source: Own creation

The original situation is highlighted in grey.

(1) Player Y sacrifices part of his investment funds to suppress the investment opportunities of player X (see arrow showing the shift from line y(1)´ to line y(1.1)´

(2) This suppresses the investment opportunities of player X, see the corresponding arrow

(3) At the same time, the return on investment opportunities of player Y increases, see the corresponding arrow

In this case, there is usually also a case where the debtor turns into a creditor (creating savings that are available to the other player) due to the loss of investment opportunities, in which case the debtor appropriates most of the return.

The difference in the efficiency of systems that succumb to the pressure of positional investing and systems that do not succumb to this pressure is so pronounced that a more specific form of the above question is in order: Why in reality do we not observe a number of systems at the local level that are dynamic and efficient by virtue of the fact that they generate and utilize investment opportunities according to the rate of return, regardless of to whom these investment opportunities are generated and from whose resources they are realized?

The question is legitimate and urgent for another reason: systems based on creative complementarity (i.e. generating investment opportunities that interconnect) can (and modelling will probably show) have a very strong tendency to interconnect horizontally and to form a network that is self-sustaining and thus stable in the sense of Nash equilibria (generating states in which no one would be better off by changing strategy to non-cooperative behaviour). These equilibria can even be assumed to be stable in the case of a large number of players, even when a certain percentage of players abandon the cooperative strategy.

The only explanation may lie in the fact that initiatives towards the formation and linking of creative complementary teams:

- Are disposed of relatively early.

- They are not liquidated within the framework of mutual relations but from a position of higher authority.

This is a non-trivial and rather unexpected explanation (which will have to be tested by modelling, simulation, analysis of specific situations on suitable historical material). Recall that traditional design

and implementation theory of mechanisms seeks precisely in the "higher authority" the protection of rules that must be followed if well-designed mechanisms are to work; among other things, this is what L. Hurwicz's Nobel Prize speech in 2007, which he aptly called Who will guard the guardian? (Hurwicz 2008).

4. CONVERSION OF A MODEL BASED ON SUPPLY AND DEMAND OF INVESTMENT FUNDS AND INVESTMENT OPPORTUNITIES INTO A NON-COOPERATIVE GAME IN NORMAL FORM

We will only consider situations of two players with two strategies. This simplification corresponds to the focus and scope of our paper. However, for large number of participants in the game it is possible to reduce it to two players either by dividing them into two groups (as used in applications of the Prisoner's Dilemma game) or (as in the modeling of the Tragedy of the Commons game, for example) to the relationship between one player and the other players.

Before moving on to dilemma models, we give a brief overview of the basic revenue (positive and negative) functions and their brief characteristics. We will (also for the sake of better imagery) refer to them in marginal (i.e., incremental) quantities, in our symbology as the respective derivatives of the function, i.e., "f´", with appropriate differentiation of each function through indices:

fxx´(x(1)) the marginal return of player X on the investment opportunities generated by player X in the first period realized from player X's investment funds

f_{xx}´(y(1)) the marginal return of player X realised from the investment funds of player Y

f_{xy}´(x(1)) player X's marginal return on investment opportunities generated by player Y in the first period realised from player X's investment funds

f_{xy}´(y(1)) player X's marginal return on investment opportunities generated by player Y in the first period realised from player Y's investment funds

-f_{xy}(X)´(x(1)) the marginal cost (therefore with a negative sign) of player X of investing in position (X) relative to player Y

These costs can be distinguished into:

-f_{xy}(XA)(x(1)) type A marginal cost, i.e. the cost of redistributing the proceeds of generating foreign investment opportunities to player Y

-f_{xy}(XB)(x(1)) B marginal costs, i.e. the cost of reallocating the proceeds from the use of player X's own investment funds to realise player Y's foreign investment opportunities

-f_{xy}(XC)(x(1)) C marginal cost, i.e. the cost of suppressing player Y's investment opportunities in order to increase the return on own investment opportunities

f_{xy}(X)´(x(1)) player X's returns from investing in position (X) relative to player Y

These returns can be distinguished into:

f_{xy}(IA)(x(1)) marginal returns of type A, i.e. the returns from the reallocation of returns from the generation of foreign investment opportunities by player Y

f_{xy}(IB)(x(1)) B marginal returns, i.e. the returns from the reallocation of returns from the use of player X's own investment funds to realise player Y's foreign investment opportunities

f_{xy}(IC)(x(1)) C marginal returns, i.e. returns from suppressing player Y's investment opportunities in order to increase the return on own investment opportunities

- f_{xy}(Y)´(x(1)) the impact on player X of investing in position (Y) relative to player X

These returns can be distinguished into:

$-f_{xy}(YA)(x(1))$ A-type impacts, i.e. negative returns from the reallocation of returns from the generation of foreign investment opportunities by player Y

$-f_{xy}(YB)(x(1))$ B-type effects, i.e. negative returns from the reallocation of returns from the use of Player X's own investment funds to realise Player Y's foreign investment opportunities

$-f_{xy}(YC)(x(1))$ C marginal returns, i.e. the negative returns from suppressing player Y's investment opportunities in order to increase the return on own investment opportunities

In most cases, it is not necessary to consider all cases, but only some. Graphical representations help significantly to improve clarity and to identify what is most important in a given case. It can also be arranged in a clear table or give a methodology for application. A further simplification in specific applications is related to the fact that some of the marginal revenue functions are mutually dependent (you cannot have one without the other) or, on the contrary, mutually exclusive.

Expressing the above type of games in normal form

Normal form is a way of describing a game by a model where we know the players, their strategies, and the payoff matrix (i.e., what each player gets when using each of the different, all possible, combinations of strategies).

We can take a 2x2 matrix (two players, each with two strategies, four payoff combinations) as the basis for our reasoning.

		Player Y	
		Strategy 1	Strategy 2
Player X	Strategy 1	$x_{11} : y_{11}$	$x_{12} : y_{12}$
	Strategy 2	$x_{21} : y_{21}$	$x_{22} : y_{22}$

Table 1. Initial scheme

Source: Own creation

x_{ij}, y_{ij} are player payouts

In general, there can be more players, more rounds, more strategies.

In our case, we start from two extreme positions:

Full cooperation strategy (K)

Full non-cooperation strategy (N)

Ad K: The full cooperation strategy is very easy to define in terms of supply and demand of investment funds and investment opportunities. It is a case where players utilize existing investment opportunities according to the rate of total return of the generated investment opportunities, irrespective of which of the players these investment opportunities are generated for and from which of the players the investment opportunities were generated. It is useful to recall Figure 6. It is a generalization of the default concept of the optimal state, where the optimal relationship in the supply and demand model of investment funds and investment opportunities occurs if and when the investment opportunities of the players are exploited according to the rate of return, regardless of who owns these investment opportunities or investment funds (see Figure 5). In the expanded definition, we stress that this is the maximum return from the players' investment opportunities, regardless of which player's investment opportunities were generated when they were realised (recall Figure 4 for this).

Ad N: The strategy of full non-cooperation is also easily and clearly defined in terms of supply and demand of investment funds and investment opportunities. A player uses investment funds to maximize his return through (taking advantage of) positional investing, given the other player's expected choice of strategy. First, we investigate the case where the player using positional investing chooses the same strategy as if the other player chooses a cooperative strategy or a non-cooperative strategy, i.e. we assume that the other player will also choose a non-cooperative strategy). Investigating the case where the player assumes a cooperative strategy (or, more generally, assumes the other player uses a cooperative or non-cooperative strategy with some probability, i.e., chooses a mixed strategy) is a more challenging problem that need not be opened at this stage of the interpretation.

We can rewrite Table 1 as follows for this case:

		Player Y	
		K	N
Player X	K	$x_{11} : y_{11}$	$x_{12} : y_{12}$
	N	$x_{21} : y_{21}$	$x_{22} : y_{22}$

Table 2. Cooperative and non-cooperative strategies expressed in the form of a payoff pair.

Source: Own creation

We have 4 combinations of strategies KK, KN, NK, NN.

This corresponds to the 16 possible payout orders of the players, e.g.:

KKx > KNx > NKx > NNx

KKy > KNy > NKy > NNy

and 32 possible payout combinations.

This is enough for a detailed case-by-case analysis. However, we can distinguish two basic types of payoff distributions:

Case One: Both players will have the highest payoff if they cooperate (the above case).

Case Two: The payoff distribution is similar to the Prisoner's Dilemma game, i.e. From the perspective of player X: NKx > KKx > NNx > KNx; translated into more understandable language - I will have the largest payoff if I double-cross the other player and he does not double-cross me, I will have a slightly smaller payoff if we both cooperate, I will have an even smaller payoff if we both do not cooperate, I will have the smallest payoff if I choose the strategy of cooperation but the other player double-crosses me. Recall that in the case of the Prisoner's Dilemma, the NN strategy is Nash optimal for both players.

An important conclusion can be formulated: the cases where both players have the largest payoff if they cooperate, while:

- Often both parties are aware of this and try to maintain mutual trust.

- The logic and interpretation of the marginal payoff functions imply that this payoff tends to be very large and tends to increase in subsequent rounds (this is the case when the Pareto and the Nash optimum merge and the system is self-sustaining and self-enforcing in the Nash sense while preserving the existing initial conditions).

Such "upsurges" of efficiency (and, consequently, of humanity, serving, among other things, to preserve ethos and trust) can be observed in a number of historical episodes. It is usually associated with the following attributes:

- The development of trade and business (crafts, later industry).

- Emphasis on rationality (the role of knowledge, education, science, the rejection of prejudices, especially those associated with arousing all kinds of animosities between various groups of people).

- Moderate (i.e. not demonstrative or ostentatious) consumption, subordinated to the accumulation of physical and human capital, directed towards the development of technology and the human mind.

- Efforts to address the problem of wealth and poverty.

In analyzing such periods, it is possible and worthwhile to distinguish cases where there have been:

- For some internal reasons, the destruction of effectively functioning horizontal relations between competing entities;

- the exhaustion of available investment opportunities and the failure to discover and exploit growth space (the system is 'stuck');

- expanding the space for cooperative expansion and conflict with the external environment;

- the destructive role of a higher authority, or the entry into the game of an authority of an even higher level than the original one, one that felt threatened by the expansion.

In the conditions of the Czech Republic, the use of the apparatus presented above is proving useful, for example:

- When analysing the reasons for the success of JZD Slušovice, which before the Velvet revolution in 1989 had achieved extremely significant success on a market basis, it began to have some followers. After the Velvet revolution in 1989, it was the victim of systematic attacks, as a result of which it gradually disappeared.

- When analysing the possibilities offered by a reform of the pension insurance system that would be oriented towards the voluntary extension of a person's productive working life.

- In monitoring and analysing the causes of the successes and problems experienced by creative complementary teams working in the field of combining scientific or technical research with social practice.

(We list only those areas of application that our team has addressed.)

5. RESULTS

We have shown that by extending the model of supply and demand of investment funds and investment opportunities, it is possible to provide important tools to link the theoretical foundations of the economics of productive consumption with the theoretical foundations of the analysis of positional investment. A very important role is played by defining the specificity of the Pareto optimum for this area and including in the models the fact that new investment opportunities are generated when existing investment opportunities are realised (which is less obvious than in the case of investment funds). The relevant models can be converted into the form of non-cooperative games, in the assumptions we consider, two-player two-matrix games with two strategies and a non-constant sum of payoffs. Games in which it pays for both players to cooperate and not to use positional investing to split returns or suppress the other player's investment opportunities in order to increase the return on their own investment opportunities play a very important role. The theoretical tools that we have developed through this process allow us to identify cases in which, in past or recent history, games in which both players cooperate have established themselves as dominant and when they have proliferated. It is also possible to use these tools to analyse the reasons for the recession of these situations. From a contemporary perspective, the same tools allow us to analyse the assumptions behind the current dominance of these games and the potential risks that limit their spread.

6. DISCUSSION

The above summary of the results allows the following questions to be put forward for discussion:

- Can historical developments, including current developments, be understood as a certain clash of situations in which games in which it pays both players to cooperate (referred to by us as KK games) are generated and subsequently suppressed, and situations in which these games (as a result of the evolution of the internal and external environment of these games) are limited or suppressed by games in which the determining Nash equation is in the form of non-cooperation of both players (referred to by us as NN games)?

- Can we expect the further development of tools linking the theoretical foundations of the economics of productive consumption with the theoretical foundations of the analysis of positional investment to justify the fact that the natural historical tendency is the gradual dominance of KK games, which also has a specific interpretation?

With these questions we formulate further lines of research and related hypotheses.

7. CONCLUSIONS

The question concerning the relationship between some research results on the interrelation between the theoretical foundations of the economics of productive consumption and the theoretical tools of the analysis of positional investment on the one hand, and on the other hand the historical tendency towards the prevalence of games where players find it profitable to cooperate with each other, where the role of positional investment is significantly eliminated and where the efficiency of economic systems is significantly increased, seems too ambitious. We therefore consider it appropriate to conclude by pointing out that this is only one aspect of the view of social agency. The explanatory power offered by our approach cannot therefore be overestimated. In formulating practical conclusions, it must always be placed in the context of other theoretically informed approaches to the analysis of social events at different levels, in different times and in different parts of the world. At the same time, however, it is also appropriate to make use of a well-known phenomenon that all disciplines encounter in addressing theoretical and practical questions, namely that even research in a seemingly distant area can provide explanations of some of the relevant phenomena in the area that the discipline deals with. From this perspective and in this sense, the results of our research may inspire and possibly find wider application.

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