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Savez republičkih i pokrajinskih samoupravnih interesnih zajednica za naučni rad u SFRJ učestvuje u troškovima izdavanja ovog časopisa.

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THE INVESTMENT BEHAVIOUR OF THE LABOUR-MANAGED FIRM: A PROPERTY-RIGHTS APPROACH

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1. THE STATEMENT OF THE PROBLEM

In two recent papers (1978 and 1980), Frank H. Stephen argues that the amount of self-financed investment undertaken by the labour-managed firm will not be significantly reduced by the availability of credit. The contrary position, held by the Texas School (Furubotn and Pejovich), is based on the divergence which exists — when the firm's assets are not privately-owned — between return to the firm (as a whole) and return to members of the firm taken individually. The problem may be stated with the help of Figure 1.

The SS schedule gives the workers' willingness to save and make *placement* in owned assets (say, bank deposits) at alternative rates of return.[1] The ro's' schedule shows the amounts workers are ready to save and invest in *non-owned* assets when the ruling bank deposit rate is i_0. Finally, i_1 is the cost of credit, and II the usual *mei* schedule. The Texas School holds, Stephen argues, that the labour-managed firm will use credit-finance first (up to the point G) and will then self-finance the amount GC.[2] In Stephen's view, the optimal sequence is exactly the reverse. The firm should self-finance *first* the amount OF and then borrow FS. Furubotn's sequence is illogical because

> "it implies utilizing resources with the higher opportunity cost (i_1) in preference to those with the lower (r_0). Analytically, in terms of Marshallian surplus, Furubotn's rule implies sacrificing the area r_0BLi_1 in order to obtain the area B'PJ. The latter can-

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[1] The word *placement* is, I think, more appropriate than investment because it refers specifically to investment in *financial* assets. See also Kahn (1978, p. 549).

[2] Point C is the point of intersection of the II with the r_0S' schedule shifted horizontally to the right for the whole amount of credit-finance. Alternatively, the amount of self-financing may be obtained by drawing the JI portion of the investment schedule from point i_1 on the ordinate until it intersects the r_0S'.

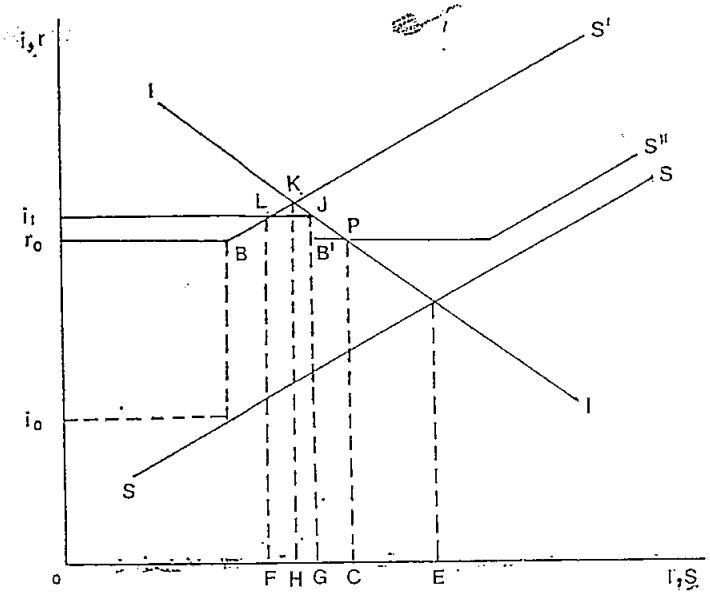

Figure 1

not, under the assumptions made by Furubotn, be greater than the former" (Stephen, 1980, p. 798).

Studying the same issue in another paper, Stephen (1978) takes exception to Furubotn's statement that "strong incentive exists for the collective to utilize bank credit to the fullest degree *before* employing any of the firm's own saving ... because only by such a strategy can the collective attain the greatest level of capital accumulation and maximize welfare" (Furubotn, 1974, p. 269; emphasis in the text). By such a process, Stephen argues, the collective "may attain the greatest level of capital accumulation (but) *it does not maximize welfare*" (Stephen, 1978, p. 230; emphasis in the text). Stephen then proceeds with the above-mentioned comparison in terms of Marshallian surpluses which is destined to dispose of Furubotn's contention.

The purpose of this paper is twofold:

> first, to show that although Stephen's analysis in terms of utility is correct, the cooperative will fail to use the resource with the lower *social* opportunity cost, and second, to explore further the importance of property rights for investment.

2. SOCIAL OPPORTUNITY COST

Looking back at Figure 1 we can readily see that the opportunity cost of self-finance for the *workers* to the right of point L is greater than the opportunity cost of credit. To make a self-financed investment in non-owned assets at point such as H would involve giving up an increase in utility equivalent to utility derived from the consumption of that unit of income. The latter, expressed in terms of *required* return on non-owned assets is equal to HK.[3] Since this exceeds the cost of credit, self-finance will not be undertaken. Yet if we look at the *social* opportunity cost of the resources that could have been used for self-finance, we see that it is equal only to HH'. The alternative use of that resource is only immediate consumption.[4] Consumption may be regarded as a specific form of investment (the one without the time lag between the commitment of the resource and its yield, ie., as a limit case of investment) in an owned asset: in oneself. Its contribution to utility is exactly equal to that of a (normal) investment in owned assets yielding HH'. The social opportunity cost of consumption is consequently given by the supply price of private saving. The social opportunity cost of credit is, of course, given by i_1, the rate by which output would increase if credit were used elsewhere in the economy. The firm would thus utilize in the whole range LJ a resource with a higher social opportunity cost.

This can be also ascertained if we suppose for the moment that the firm's assets are owned by workers who are also stock-holders. We then have a capitalist labour-managed firm, as described by Berman and Berman (1978) and Furubotn (1980). Evidently, the S'S' schedule disappears and investment is pursued up to the point E. All of the investment will be self-financed. The opportunity cost of the resource is given by the supply of saving (SS) schedule.

The fact that the labour-managed firm does not use resources with the lowest social opportunity cost stems, as it has been pointed out in a somewhat different context by Dubrovčić (1970) and Meade (1972), from the definition of the maximand in terms of the non-neutral (to use Dubrovčić's terminology) factor of production. Generally, a business firm will use resources with the lowest social opportunity cost if the economic agent which decides on the combination of resources thus maximizes his level of utility. Efficiency of the firm and maximization of utility of the decision-maker will only then be interdependent. The correspondence between the two is realized precisely in the neoclassical construct of entrepreneurial firm, provided indeed prices represent true indices of the social opportunity cost. In an entrepreneurial firm, the entrepreneur employs the factor with the lowest opportunity cost since he thus maximizes his own profit and, presumably, his level of welfare. The entrepreneur's own interest is thus made to coincide with the efficient operation of the firm, although the latter is, strictly speaking, outside his purview.[5] In a labour-managed firm this correspondence no longer prevails. If the firm's assets belong to the State, while workers are allowed to own

[3] The alternative to self-finance is consumption. Utility derived from consumption is equal to utility derived from an investment in owned assets yielding HH'. And the latter is equal to utility derived from an investment in non-owned assets yielding HK rate of return.

some financial assets (like saving deposits), it may happen that workers (and each worker separately) maximize their level of utility by selecting in production such a combination of resources which is, when assessed in terms of the social opportunity cost, suboptimal. That these resources do not represent the lowest social opportunity cost combination for the firm is, however, immaterial for the decision-makers since they are not activated by that objective.

In essence, the argument rests on the difference in cost or return to workers of respectively a utilization of, and investment in, owned and non-owned resources (assets). Workers may optimize by investing rather in owned assets whose *social* yield is less, but can be fully appropriated (internalized), than in non-owned assets whose *social* return may be greater but cannot be wholly captured.[6]

3. IMPORTANCE OF PROPERTY RIGHTS

Suppose now that the property rights over the assets (machinery, plant, etc.) of the firm no longer belong to the State[7] but to the workers. Each worker enjoys full legal claim over the net cash flow generated by the assets whose purchase he financed out of his earnings, regardless of his future association with the firm. This implies the existence of a market in which workers can freely sell their claims as they can do with any other owned asset.[8] The need to convert return received on (owned) saving deposits into an equivalent return on non-owned firm's assets disappears. The S'S' schedule vanishes. Workers still face the same two options as before: an investment can be either self-financed, or financed out of borrowed funds with money thus freed (possibly) used to buy financial assets. By comparing Marshallian surpluses from the two alternatives, it can be easily established (see Figure 2) that self-financing *only* will be chosen if $i_1 > i_e > i_o$, where i_e is the rate of interest for which II and SS intersect. Workers will self-finance amount ON, and nothing will be borrowed or invested in financial assets.[9]

If assets are not owned by the workers, the level of investment will be less than ON. How much less depends on the time horizon t. If t is small, the S'S' will be significantly above SS, as $S'_1S'_1$ in Figure 2, and total investment would be OG out of which OM will be self-financed and MG will be financed by credit. If t is yet smaller, as shown by the line $S'_oS'_o$, r_o will lie above i_1, and the amount OG will be wholly financed by borrowing, while workers will buy OH saving deposits. If t is great, the S'S' may intersect the *mei* schedule between points G and N (schedule $S'_2S'_2$): total investment will then only slightly fall short of ON, and will be completely internally financed.[10]

[4] Saving in the form of bank deposits is excluded since i_o is less than HH'.

[5] We mean that it is not efficiency *per se* that is aimed for by the entrepreneur. For example, policy measures (e. g. taxation) may lead him to maximize his profits at a less efficient point. The same is also true if we somewhat alter the concept of the entrepreneur, that is let other considerations enter his horizon (e. g., profit, not *in toto*, but per unit of his work effort, maximization of the entrepreneur's utility which includes also non-pecuniary elements) or assume that there are several entrepreneurs.

[6] It should be apparent that, in our example, when we compare the use of the resource for either consumption or self-finance, consumption must be regarded as an activity whose social yield is less but is wholly captured by the decision-maker.

[7] The legal question as to whether assets in a socialist labour-managed market economy can be said to belong to the State, "society", or represent, on the contrary, "the negation of all property-relationship" is quite immaterial for our purpose. It suffices to state that workers enjoy — so long as they stay with the firm — solely the *usus fructus* right over the assets. Workers cannot freely dispose of them (e. g., by selling them). For them, these are clearly *non-owned* assets.

[8] This is the idea that Berman and Berman seem to enunciate under their Assumption 1 (1978, p. 702). Furubotn (1976, p. 122, and 1980, p. 632), on the other hand, apparently regards the limitation of the claims over the proceeds only to those currently employed by the firm as a feature inherent to all labour-managed organizations. There can accordingly be no free market for such shares. (The market which may under some circumstances, e. g. when a worker leaves the firm, be allowed will be, as Furubotn (1980) shows, heavily imperfect and characterized by high risk, and search costs. This will tend to depress net present value of the shares.) If one considers the labour-management on the shop-floor level as being only a logical outgrowth of a comprehensive *Weltanschauung* that places

emphasis on things like "industrial democracy", "disalienation" and so forth, Furubotn's position is fully justified. The theory of general social transformation — which such a view of the world implies — loses its *raison d'être* (and its appeal) if workers are, akin to present-day stockholders, permitted to engage in exchange of shares in the din of the stock-market. This view is held by most socialist writers. According to Michael Young's (1981, p. 397) account of a conference on cooperatives in the OECD countries, Branko Horvat, for example, "claimed that only where there was collective ownership would permanent worker-management be possible. Individual ownership within a cooperative creates too many tensions, for instance between members who want to take out their full stake when they leave, or even from year to year while they remain in it, whether or not this is at the cost of collective capital. The individual owners ... are also liable to restrict entry, and take on new people as employees rather than full members." A similar view is advanced by the Yugoslav philosopher Svetozar Stojanović (1973, p. 210): "In its radical version, this [unsocialist] orientation has the goal of transforming social ownership into shareholding by working collectives, and even of clearing the path for the private ownership of "small factories" and of "small business" in general. Beneath the rhetoric of self-management and rational, effective economic conduct, it is not difficult to discover a petty-bourgeois conception". But if one looks upon labour-management from a more pragmatic perspective, viz., considers it merely as an alternative form of business-firm organization, the existence of the capital market, or any other capitalist institutional arrangement, is not excluded.

[9] The wedge betwen i_1 and i_e explains why self-finance will always be preferred to credit. In the self-finance case, the worker captures the whole distance between II and SS, whereas his decision to borrow at the rate i_1, and then buy a saving account that pays i_o, means that he would lose the portion between i_1 and i_o.

[10] Note, however, that labour-managed firms with private and non-private property rights may have not only different saving, but also investment, schedules. The argument may be made that non-private ownership facilitates planning, and by reducing the risk element, raises the marginal efficiency of investment. The *mei* schedule consequently shifts upwards.

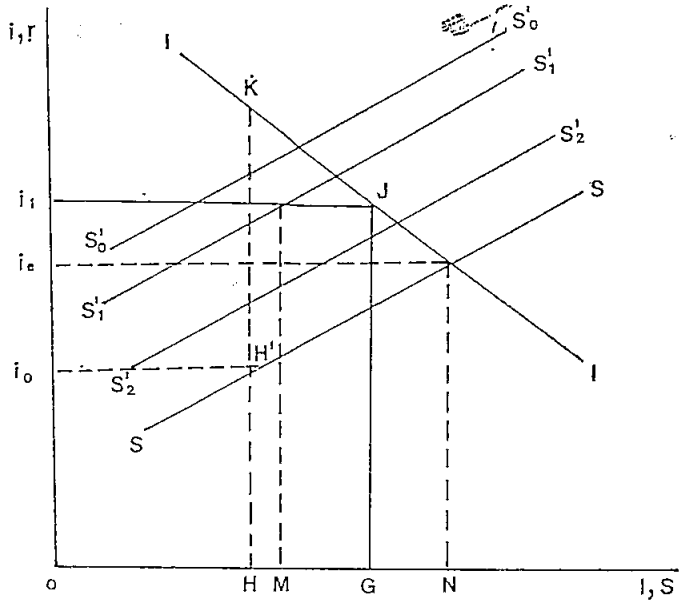

Figure 2

Consider now the case such that $i_1 > i_o > i_e$. Applying the same reasoning as in the previous case, it can be easily shown that if property rights are private, workers will save the amount OH (Figure 3): OM will be utilized for self-finance, and MH will be utilized to buy saving deposits. No money will be borrowed. Total investment in the firm (OM) will be wholly self-financed and will again be greater than under non-private property rights. In effect, under the latter arrangement, total investment cannot exceed some point between G and M. If $i_1 < r_o$ overall investment (OG) will come out of borrowed funds. Workers will find it more profitable to buy owned assets, and they will do so until they reach point H. If $i_1 > r_o$ (which is quite unlikely), self-finance will be preferred up to a point of intersection of r_o and i_1 somewhere between G and M, whereafter only *placement* in saving deposits will take place. Total workers' saving accordingly will not be affected by the structure of property rights, but the form it takes will. Note that if $i_1 > r_o$, no credit will be demanded, while in the opposite case self-finance will be nil.

Finally, Figure 4 illustrates the case where $i_e > i_1 > i_o$. If property rights are private, the amount OC will be self-financed and CG will be borrowed. The total saving of the workers will be OC and there

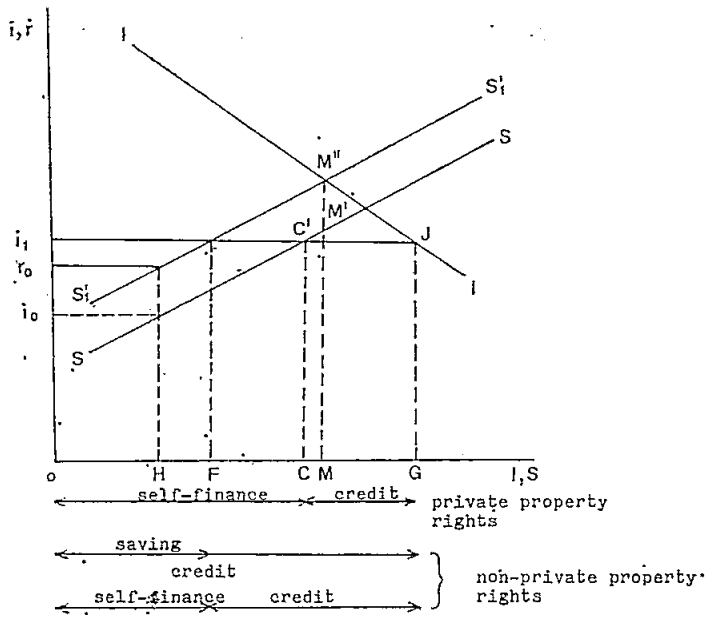

Figure 3

will be no *placement* in financial assets.[11] Total investment OG will be the same regardless of the form of ownership. Its structure, however, will be different. With non-private property rights, there are again two possibilities. If $i_1 < r_o$ (not shown in the Figure), credit will be used throughout. OG of credit will be invested in the firm, while workers will save OH in the form of saving deposits. If $i_1 > r_o$ (shown in the Figure), OF will be self-financed and FG credit-financed.

The last case we consider is the one where $i_1 = i_o$. Under non-private property rights, investment will be wholly financed through borrowing.

If property rights are private, investment up to point H (Figure 5) can be indifferently self- or credit-financed, whereas the amount HL will be financed from the borrowed funds. If the cost of credit and, by implication, the rate paid on saving deposits rise to the level i_o

[11] The available returns are not sufficient to elicit greater saving. For example, in order to save the marginal unit at the distance M from the origin, workers require at least a return MM'. Yet the rate paid on saving deposits is only i_o. Investment in firm's assets indeed yields MM'', but the surplus thus realized (M''—M') is less than surplus realized when investment is financed out of credit (=M''—i_1). Workers will thus decide to borrow, but will not save anything in the form of saving deposits.

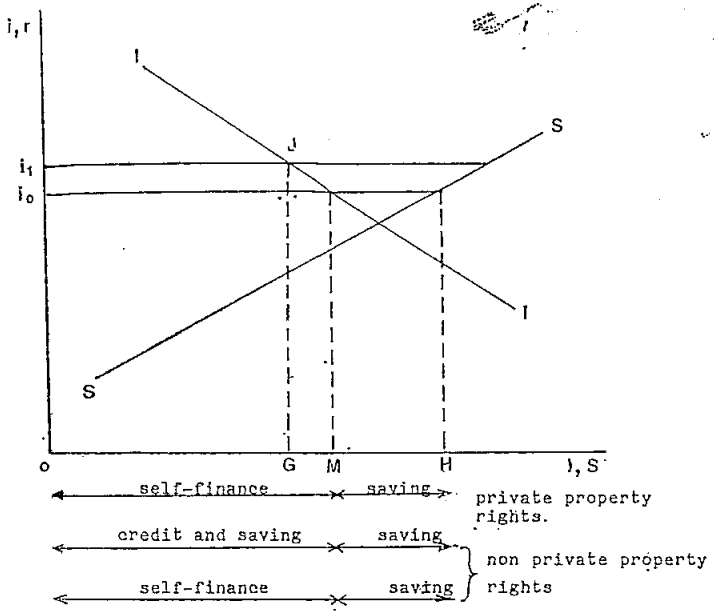

Figure 4

or greater, workers would find it, when property rights are private, perfectly equivalent whether they resort to credit or self-finance.

Table 1 summarizes our findings. It contrasts the behaviour of a socialist labour-managed firm with a twin labour-managed firm in which property rights over the assets are private, i. e., they belong to the workers as individuals. »Greater« (»smaller«) signifies that the corresponding variable takes greater (smaller) value when property rights are non-private.

TABLE 1. Non-private (NP) vs. Private (P) Property Rights

	case 1 $i_1 > i_e > i_o$	case 2 $i_1 > i_o > i_e$	case 3 $i_e > i_1 > i_o$	case 4 $i_1 = i_o$
Level of investment	smaller	smaller	same	same or smaller
Self-finance	smaller	smaller	smaller	
Borrowing	greater or same*	greater or same*	greater smaller	(0 if NP) greater or same
Total workers' saving	smaller	same	greater	same
Placement in saving deposits	greater or same*	greater	or same* same	greater or same

* 0 if P.

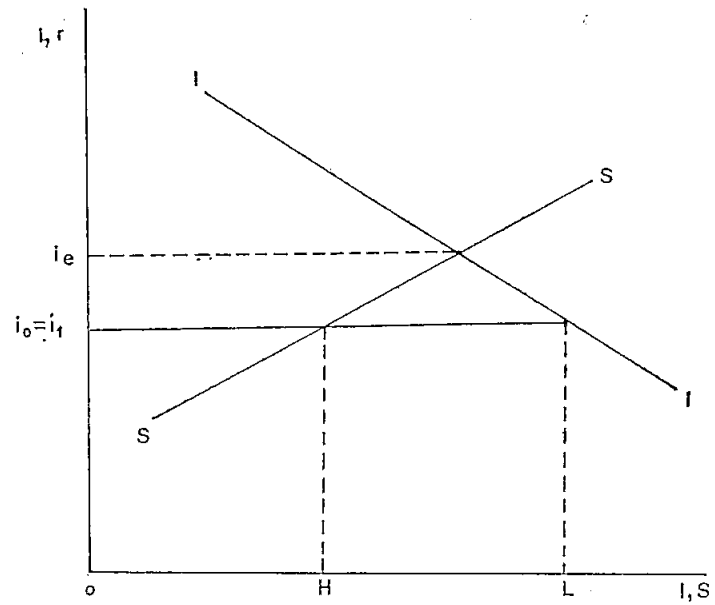

Figure 5

Two conclusions emerge. First, non-private property rights *must* entail a retardation of self-financed investment, and second, they will probably also reduce total investment. In all cases but one, self-finance must be less when property rights are non-private. And in that one case, self-finance is zero: it may be, therefore, equal to self-finance under private property rights only if the latter is also nil. As for total investment and total workers' saving, the property rights structure will not matter only when i_1 and i_o are equal. Total investment will also be the same when the two interest rates are less than i_e (case 3). In all other cases, total investment will be smaller when property rights are non- private.

An inspection of Table 1 points also to the conclusion that — if property rights are non-private — the best policy is to *do nothing*. In effect, market forces will by themselves tend to produce a close equality between i_1 and i_o. And this, by a happy coincidence, is the situation in which the investment behaviour of the socialist labour-managed firm approximates most nearly that of its private property-rights counterpart. When $i_1 = i_o$, it is true, no self-finance is undertaken. But this has the advantage of producing a clear-cut situation in which all of the workers' saving flows toward the owned assets, while all investment is externally financed. The same rule as usual (*mei* > i_1) applies to this investment. Accordingly, both the level of investment and total workers' saving (since the latter is channelled to

owned assets only) must be the same as under a private property-rights arrangement.

An economy composed of socialist labour-managed firms will be thus in the somewhat paradoxical position that workers' demand for owned financial assets will therein be greater than under the private property-rights structure, and that the optimal policy will be to let all of workers' saving take the form of *placement*. Yet this is paradoxical at first sight only. For when some lines of investment are *de facto* closed, by being rendered unattractive, like investment in (non-owned) physical capital assets, it is only natural that saving and investment will tend to flow elsewhere.

The wedge which the existence of non-owned assets drives between the social and private return of an investment in the firm's assets is responsible for the fact that investments with a smaller *social* return may be preferred to investments whose social return is greater. This conclusion suggests that the theory of the socialist labour-managed firm may be regarded as an instance of a broader class of problems characterized by a discrepancy between social and private returns. And, as in all activity where social returns are not wholly captured by the individual decision-makers, the activity will be discontinued sooner than is optimal. Here, this is particularly obvious when we assume that all investment is self-financed: the level of investment *must* then be less than in a twin labour-managed firm with private property rights.

The socialist labour-managed firm, operating in a setting where other (financial) assets may be privately owned, displays two sorts of allocational defects: first, utilization of resources whose social opportunity cost is unnecessarily high or, which is conceptually equivalent, investment in less than socially most profitable projects, and second, failure to proceed with investment up to a socially most advantageous point. The first of these two defects disappears if *all* assets are made either State — or privately — owned.[12] The second, however, disappears only if all assets are privately-owned. Therefor it follows that the cause of the first defect must be sought in the simultaneous existence of more than one type of asset (in terms of ownership), and the cause of the second in the existence of non-owned assets as such.[13]

[12] This statement must be somewhat qualified. When all assets are either State — or privately — owned, *ranking* by the *private* rates of return, and hence choice between the assets, is not affected. If all assets become non-owned, the rate of return on each asset changes but assets' ranking is invariant. Yet when assets are State-owned, the following problem may occur. Suppose that in order to forego present consumption workers require a rate of return of 3%. Now, as soon as social return on some investment falls below, say 10%, i. e., the rate which — with a given time-horizon — corresponds to a private return of 3%, the workers will decide to consume income, not to invest it. This cannot occur when assets are privately owned. Consequently, we see that the Furubotn-Pejovich effect is present even when all assets are non-owned. (It would not be present, however, if workers too could be treated as State property. A decentralized, market organization would then be replaced by a centralized one wherein central authorities would not allow workers to consume their income so long as there are projects whose social yield exceeds the workers' rate of pure time-preference.)

4. THE REAL WORLD

The most important question is this: how likely is it that the optimal policy of *laissez-faire* will be effectively pursued in a country where labour-managed firms with non-private property rights are dominant in most sectors of the economy?

If the existence of an extended labour-managed sector cannot be conceived without a simultaneous prevalence, in the political sphere, of an ideology (with a corresponding political system) which aims at a *general* reorganization of the society along socialist (or Marxist) lines, the answer to our question must be in the negative. From such an ideological perspective, labour-management can only be viewed as an *integral* part of the process of social transformation whereby capitalist institutions are superseded. The available historical evidence also suggests that labour-management in the economic arena cannot be introduced without a concomitant transformation in the overall political and social environment. In other words, labour-management on the level of the firm, and *a fortiori* in the whole economy, cannot be regarded, as more pragmatically-minded writers on the theory of labour-management implicitly do, as merely one among many possible forms of business-firm organization compatible with different ownership structures and social systems. If so, it is evident that a policy that would encourage workers to acquire owned financial assets would tend to make them *rentiers* in all but name. Such a policy is conceivable in "people's capitalism", but is unacceptable in a Marxist-inspired labour-managed system. It is therefore more likely that in such a system (which still remains decentralized and market-oriented), emphasis will be placed on self-financing and policy measures will be designed to this effect. They must include a significant distortion between the cost of credit and rates paid on owned saving deposits. Limits on the range and convertibility of assets that can be privately owned may be also expected. These measures — while stimulating self-finance — would produce other attendant effects: reduction of total investment undertaken by the firms and of the workers' overall saving. The economic-policy-induced reliance on self-finance may be reinforced by non-economic pressures and an atmosphere of high risk

[13] Different policy measures may be tried to make private returns reflect more accurately social returns: premia that increase with the number of years a worker stays with a given firm, limitations upon labour mobility, some participation in the returns of the firm the worker retains upon his withdrawal, etc. Some of the schemes display obvious drawbacks (e. g., limits upon mobility of labour), whereas others represent a covert attempt to introduce some elements of a *de facto* private ownership over the proceeds. Social and private returns may be brought more in line, not only by an extension of the time-horizon, but — in a circuitous way — by the firm's selection of quick-yielding projects.

borne by the lender which may easily develop when assets are not privately owned, and yet the State is not the ultimate guarantor. The growing importance of self-finance will tend to displace the capital market, eventually dispensing with it altogether, which cannot but be ideologically appealing.

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INVESTICIONO PONAŠANJE SAMOUPRAVNOG PREDUZEĆA: ANALIZA POMOĆU PRAVA VLASNIŠTVA

Branko MILANOVIĆ

Rezime

Članak analizira investiciono ponašanje (a) samoupravnog preduzeća sa društvenim vlasništvom nad sredstvima za proizvodnju u kome radnicima pripada dohodak posle odbijanja za amortizaciju i kamatu, i (b) samoupravnog preduzeća u kome vlasništvo nad sredstvima za proizvodnju takođe pripada radnicima. Razlika u investicionom ponašanju pojavljuje se usled Furubotn—Pejovichevog efekta. U prvom slučaju (a), radnikova odluka da investira datu sumu novca u proširenje osnovnog fonda preduzeća znači da će radnik biti u stanju da poveća svoj dohodak u budućnosti, ali mu se glavnica koju je investirao, zbog društvenog vlasništva nad sredstvima, ne vraća. U drugom slučaju, s obzirom na karakter vlasništva i glavnica i porast dohotka usled investicija pripadaju radniku. Da bi radnik bio indiferentan između ove dve vrste ulaganja, potrebno je da stopa prinosa u preduzeću sa društvenim vlasništvom bude znatno viša od stope prinosa u preduzeću sa ličnim vlasništvom. To se može lako pokazati na sledećem jednostavnom primeru. Pretpostavimo da je radnikov horizont samo jedna godina (tj. radnik očekuje da će u datom preduzeću ostati još samo jednu godinu) i da je stopa prinosa u preduzeću sa ličnim vlasništvom 10% godišnje. Ukoliko radnik uloži 100 dinara u preduzeće sa ličnim vlasništvom (ili na štedni ulog) posle godinu dana imaće 110 dinara. Ako novac uloži u preduzeće u kome nema pravo vlasništva nad sredstvima za proizvodnju, stopa prinosa mora da iznosi 110% godišnje kako bi radnik na kraju godine imao 110 dinara. Naravno, sa porastom radnikovog horizonta razlika između ove dve stope prinosa će se smanjiti, ali osnovni princip ostaje nepromenjen.

U situaciji kada privredu čine samoupravna preduzeća sa društvenim vlasništvom, ali gde postoji i mogućnost ulaganja u finansijske instrumente (recimo, u štedne uloge) nad kojima se zadržava pravo vlasništva, postojaće tendencija da se što veći deo dohotka preduzeća raspodeli na lične dohotke, kako bi se štednja vršila prvenstveno preko instrumenata nad kojima se pravo vlasništva zadržava. To, pak, znači da će samofinansiranje biti relativno malo zastupljeno i da će se većina investicija u preduzeću finansirati putem kredita. Samoupravno preduzeće sa društvenim vlasništvom imaće tako veću tražnju za kreditom nego samoupravno preduzeće u kome pravo vlasništva nad sredstvima za proizvodnju pripada radnicima.

Članak razmatra različite slučajeve kad postoji razlika između kamatnih stopa na kredite (koje plaća preduzeće) i kamatnih stopa na štedne uloge. Nameće se zaključak da je optimalna ekonomska politika, kad je vlasništvo nad sredstvima za proizvodnju društveno, ona koja omogućava konkurenciju na finansijskom tržištu, tako da se ka-

matne stope na kredite i kamatne stope na štedne uloge što manje razlikuju. U tom slučaju, preduzeća bi se orijentisala u potpunosti na kreditno finansiranje investicija, dok bi radnici štedeli ulaganjem na štedne račune. Ukupan obim štednje i investicija ne bi bio niži od onog kad postoji lično vlasništvo nad sredstvima za proizvodnju u samoupravnom preduzeću.

Na kraju treba primetiti da, iako su u perfektnoj konkurenciji kredit i samofinansiranje podjednako dobri načini za finansiranje investicija (jer do samofinansiranja neće doći dokle god postoji neki projekat sa višom stopom prinosa od one koja je ostvariva unutar datog preduzeća), u stvarnosti je kredit preferabilan. Razlog za to je što se radnici u datom preduzeću mogu, usled subjektivnih faktora, pre odlučiti za ulaganje u soptsveno preduzeće, čak i kad je stopa prinosa niža od one koja je ostvariva van preduzeća. Naravno, takva situacija je, sa društvenog stanovišta, suboptimalna.

THE SELECTIONS OF ELEMENTS FROM A GIVEN SET RELATIVE TO ONE CRITERION

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1. INTRODUCTION

At present we are increasingly encountering problems concerning the identification of one subset from a given set of elements that would, as a separate entity relative to some criterion, represent an extreme group of that set.

An example of such a problem would be, in the first place, the selection of the best or weakest elements relative to one or more variables, or relative to one common or synthetic criterion.

Problems of this sort are found in the everyday practice of numerous social, scientific and economic activities. For example, we could say that this problem area is the foundation of the policy for personnel promotion in administration, in the economy, in cultural fields, in the military, etc. The same is also true regarding the selection of candidates for job posts, school entrance exams, the organization of various representational groups, drawing up guest lists for receptions or meetings, approving individual items in investment or budget plans and, in general, when giving priority to individuals or categories.

It is obvious that problem-solving will be rendered more difficult if we have to deal with one multidimensional or synthetic criterion because the question is then raised of selecting the variable as well as an adequate synthetic criterion. Much discussion has already been devoted to these issues[1,2] so there is no need to dwell further on them here.

This group of problems also includes the very topical issue of nationalization of banks and industrial enterprise groups in France. In addition to 139 foreign banks, there are presently 111 national

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[1] B. Ivanović, "Problème de l'identification des pays les moins avances parmi les pays en voie de développement", Conférence des Nations Unies sur le commerce et le développement (CNUCED), Genève, 1970.

[2] B. Ivanović, "Comment établir une liste optimale des indicateurs de développement", Revue de Statistique Appliquée, No. 2, Paris, 1974.