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Incentives and Income under Market Socialism¹

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The nature of the bonus function under market socialism and the implications of such functions for a comparison of income distributions under socialist and capitalist economic systems are examined. It is shown that when efficiency is required, when enterprise shutdown rules are taken into account, and when information is decentralized, the bonus will be equal to the profits of the enterprise. Lange's social dividend must be zero. Hence, contrary to previous claims, one can make no strong conclusions when comparing the degree of inequality of the income distribution under competitive capitalism and market socialism. *J. Comp. Econ.*, Sept. 1984, 8(3), pp. 261-276. University of Maryland, College Park, Maryland 20742.

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1. INTRODUCTION

Theoretical works comparing the income distributions of different economic systems are almost unknown in economics. This lacuna is rather surprising given the central place that questions of distribution command when the advantages of different economic systems are discussed. A constant theme in such discussions is that socialism will lead to a more egalitarian income distribution than capitalism. For example, John Stuart Mill (1879, p. 96) claimed that socialism allowed redistribution to be a "public act." Lange (1964, pp. 101-103) focused on redistribution as one of the advantages of market socialism. Recently, Stauber (1977, p. 236) has made similar claims.

The works cited above, although theoretical works written by economists, do little more than allege that one system will be more egalitarian than another. Lange's (1964) essay is an especially good example in this respect. His lack of analysis of income determination stands in stark contrast to his

¹ I thank Barbara Dietz, Jeff Miller, J. M. Montias, and two anonymous referees for helpful comments. This paper was written when the author was with the International Institute of Management in Berlin.

careful theoretical presentation of other issues. Lange does nothing to show that his main redistributive tool, the social dividend, will be positive. Nor does he discuss the size of the incomes of enterprise managers. This omission is particularly grave since these managers are to be the functional equivalent of capitalism's entrepreneurs. Thus, in Lange's essay there is no theoretical analysis that would persuade us that his claims regarding income distribution are correct.

The primary purpose of the present paper is to provide an initial contribution to an economic theory of comparative income distribution by comparing market socialism and competitive capitalism. However, an examination of income distribution under market socialism must begin with a theory of managerial incentives. Without knowing how managerial performance is rewarded, one can make few comments on managerial incomes. Thus, the paper has a second aim: to make a contribution to the theory of market-socialist incentives.

It is rather surprising that, despite the interest in market socialism since Lange's essay appeared, there has been little discussion of incentives. As Bergson has remarked (1967, pp. 657, 658), this is one of the most important omissions in market-socialist theory. The omission stands in marked contrast to the voluminous literature on incentives in centrally planned economies.² This paper takes an initial step in filling that gap by showing that, under the requirement of efficiency, there exists a simple, uniquely determined, market-socialist bonus function.³ In the conclusion, the form of this bonus function will be shown to have not only important consequences for market-socialist income distribution but also important implications for the choice of the degree of decentralization chosen in reformed Soviet-type economies.

2. ASSUMPTIONS

The assumptions introduced in this section are ones that are standard in economics. They are consistent with those of Arrow and Hahn (1971) on competitive capitalism and Lange (1964) on market socialism.⁴ To aid in the comparison, corresponding assumptions for the two systems are given the same numbers. An S denotes an assumption on market socialism and a C on competitive capitalism.

² See, for example, the references contained in Miller and Murrell (1981).

³ Although I am not aware of any other papers that consider incentive schemes within the context of system-wide income distribution, two relevant contributions should be noted. Bergson (1978), and Hildebrandt and Tyson (1979) both consider the conflicts between efficient incentive structures and distributional concerns.

⁴ The relevant sections of Arrow and Hahn (1971) are Chap. 3-5 where they describe their basic general-equilibrium model. In this paper, it is assumed that the assumptions that guarantee the existence of equilibrium and its optimal properties are satisfied.

S.1 and C.1—Firms are price takers; in both systems firms have no power to influence prices.⁵

S.2 and C.2—All factors of production are paid their marginal products. S.3 and C.3—Trading is carried out only at equilibrium prices.⁶

S.4 and C.4—There is a free market for consumer goods.

C.5—Production equipment is owned by individuals or by joint-stock corporations.

S.5—Production equipment is owned by the state. Individuals' savings must be held in state-owned financial institutions and cannot be used to buy equipment.

C.6—Firms maximize profits because shareholders can effectively impose this policy on the firms' employees.

S.6—The decisions of a firm are made by a single manager. In making those decisions the manager is guided by self-interest. The central authorities can influence those decisions by changing the relationship between firm performance and managerial incomes.⁷

C.7—Profits are paid to shareholders.

S.7—Profits after payment of managerial bonuses are paid to the government. These profits form the social dividend, which is used for redistribution.

The next assumption specifies an important *ceteris paribus* condition for the comparison of income distributions. It is necessary because there is not a one-to-one relationship between type of system and income distribution. Within one system, policies can be introduced to change the income distribution. Meaningful comparisons will therefore require *ceteris paribus* assumptions on those variables that change when such policies are introduced. In this paper, attention is confined to a static system and a single-period equilibrium. Therefore, the one important variable that will change when redistributive policies are changed is the level of static efficiency. This variable must be constant across systems if one is to make valid comparisons.

In this paper, the comparison will focus on those income distributions which occur when static efficiency is achieved. This is a natural choice for a first analysis for two reasons. First, Lange's (1964, p. 65) objective was to show that the market-socialist system could produce an efficient outcome

⁵ The reasons why firms are price takers are omitted. A sufficient condition is that there are many firms in each industry.

⁶ The process of finding equilibrium prices is assumed to be costless.

⁷ It is possible to object that S.6 and C.6 are asymmetric because it has been assumed that shareholders can control the policies of a capitalist firm much more effectively than the socialist government can control its enterprises. If the assumptions were modified to remove this asymmetry, movement to greater realism would require that C.6 be changed to make it closer to S.6. In that case, all the qualitative results of the paper would stand. However, some reinterpretation would be required, especially concerning the issue of the division of profits between shareholders and managers under capitalism.

and that a more egalitarian income distribution than under capitalism would then result. Thus, the present paper is a direct examination of Lange's claims. Second, an attempt to compare inefficient equilibria would introduce problems of a purely technical nature into the analysis. In contrast, there is a fully developed set of tools available for analysis of efficient competitive equilibria. By using these tools, it is possible to pay full attention to the theoretical issues arising in comparing income distributions and designing incentive schemes without being distracted by purely technical problems.

3. THE COMPONENTS OF INCOME IN THE TWO SYSTEMS

In the simple model employed in this paper, it is assumed that there are two variable factors of production: labor and capital. A third factor of production is the enterprise in which the variable factors are employed. Thus under capitalism there will be three sources of income: wages, rent on capital, and profits. The profits accrue to the owners of the enterprises.⁸

The market-socialist firm makes payments to three economic agents. It pays wages to its employees and a bonus to its manager. Then the residual is paid to the government as owner of both the enterprise and the capital it uses. The market-socialist government must pay a return on the accumulated savings of its citizens. The balance that remains after these three types of payments are made is the social dividend.

Two issues must be resolved before one can make firm statements on the relative size of the social dividend. First, one must decide how much interest the government must pay to the owners of savings. Second, one must build a theory of managerial incentives. The first issue can only be resolved by recourse to a discussion of the nature of appropriate *ceteris paribus* conditions to be invoked when comparing income distributions. This is the subject of the remainder of the present section. Resolution of the second issue involves extended analysis of the relationship between managerial choices and system outcomes. This is the subject of Section 4.

The total payment to savers is a function of the rate of interest and the accumulated stock of savings. It is easy to settle upon an appropriate assumption on the rate of interest. If efficiency is the goal, then a competitive rate of interest must be paid on savings. This rate must be equal to the rate

⁸ The presentation assumes that there are no fixed payments to be made as a result of previous decisions, even though there are fixed factors of production. Efficiency demands that responsibility for these payments be allocated to the person who made the spending decision. Because our model is a single-period model, that decision is not included in the model. Therefore, it is preferable to exclude from the model transactions resultant on that decision. The presence of fixed payments would present no problems in a multiperiod model. Since the multiperiod model would give essentially the same results as the present model, simplicity dictates that the single-period model be used and fixed costs omitted.

of return on capital in production. Only then is there a possibility of intertemporally efficient saving and investment decisions.⁹

The fact that the rate of return on capital is equal to the rate of interest on savings is not sufficient to imply that the total payment to the socialist government resultant from its position as owner of capital will be equal to the total payments to savers in the socialist state. That implication is correct only if the amount of capital owned by the socialist government is equal to the size of the savings owned by the citizens of the socialist country. In the remainder of this section, it will be shown that it would be inconsistent with the objectives of this paper to assume that that equality does not hold. If the capital stock is larger than the stock of savings, then the government must have undertaken collective accumulation in the past by one of three means: (i) accumulation from the social dividend; (ii) accumulation from previous taxation; (iii) expropriation of capital equipment in the transition from capitalism to socialism.

It will be shown that, in the present context, it is inappropriate to assume that any of these three sources of collective consumption have occurred.

Assuming accumulation of a previous social dividend is tantamount to assuming that which is being investigated. For if the social dividend can be positive, it can be used for redistribution. Since this paper must investigate whether the social dividend can be positive, it is inappropriate to assume that (i) was a source of previous collective accumulation.

⁹ An inconsistency between the point of view of the present paper and that of Lange must be noted. Lange's view (1964, pp. 84-86) was that the rate of interest on savings would be a quite arbitrary number. He recognized that in such a case, when the rate of capital accumulation would not reflect the time preferences of consumers, a loss in social welfare would result. He viewed this loss as acceptable, however, in return for the gains that he saw as flowing from the collective determination of the rate of accumulation. These gains are two in number. First, the influence of the income distribution on the rate of accumulation would be weakened. Second, macroeconomic fluctuations caused by changes in saving decisions would be lessened. In the present paper, Lange's argument that only collective determination of the rate of accumulation is possible under socialism is rejected for a variety of reasons. First, efficiency is a legitimate goal for a system. It is appropriate to ask (as indeed Lange did) whether a system can produce efficient outcomes and what the properties of those outcomes are. The present paper examines an outcome that is efficient, both intra- and intertemporally. Second, Lange's argument (1964, p. 85) that consumer determination of the rate of accumulation is "scarcely compatible" with socialism is hardly compelling. To the present author it would seem to be an appropriate aim of socialism to follow consumer preferences, both intra- and intertemporal ones. Third, Lange was not explicit concerning the source of the funds for capital accumulation. Presumably, these funds would have to come from taxes and an inefficiency in the short-run equilibrium would result. This conflicts with the goal of efficiency. In sum, it is legitimate to argue that both pursuit of efficiency and collective choice of the rate of accumulation are possible goals for a socialist society. Here, in contrast to Lange, the outcome resultant from pursuing efficiency is examined. However, it is certainly not the point of view of this paper that this is the only outcome relevant for analysis; it is only one of a whole spectrum of such outcomes.

Obviously, it is feasible for the market-socialist government to have used taxes in a previous period in order to increase accumulation. However, this taxation will have caused an inefficiency in the previous time period. Accumulation from source (ii) should be ruled out due to the requirement that the comparison is one between systems that undertake policies aimed at obtaining efficient outcomes.¹⁰

Source (iii) must also be ruled out. This paper aims to examine the properties of a system which are inherent in that system, not those due to the nature of the transition from a previous system. If one is to examine the distributional consequences of a system, one cannot rely on ephemeral features such as a one-time expropriation. Further, it is not certain that all socialist governments would undertake such expropriations. Lange (1964, pp. 124, 125), in fact, had no objections to compensating capitalists with an amount equal to the competitive valuations of their productive equipment.

The above arguments imply that, in order to conduct a legitimate *ceteris paribus* comparison of the two systems, one should assume that the payments made by market-socialist firms to the government for the use of capital should equal the payments made by government to the owners of savings. In turn, this assumption implies that when the two systems have the same production equilibria the total payments made in return for the use of capital under capitalism will equal the total payments to savers under market socialism. Thus, the only possible remaining source of funds for the social dividend is that part of national income that would be called profits under capitalism. However, socialist managers must be paid their bonuses from this element of national income. Therefore, one must examine the relationship between the size of managerial bonuses and the size of profits.

4. MANAGERIAL BONUS FUNCTIONS UNDER MARKET SOCIALISM

In order to be able to say anything about the nature of the bonus system, some requirement must be imposed on the nature of managerial decisions. It has already been assumed that efficient decisions are required. Thus, one seeks a bonus function that causes the manager's utility-maximizing decisions

¹⁰ The reader will notice that implicit in the structure of the argument is a rejection of the claim that any desired ex-post income distribution can be achieved without loss in efficiency by using a system of lump-sum taxes and grants. Although this claim is often made, there has been no discussion in the economic literature of how such a scheme could work. If the taxes were administered ex-post, then they would weaken the link between effort and ex-post income, thus affecting incentives and efficiency. The center could administer such taxes ex-ante and leave incentives unaffected, but this would require centralized information (Pazner and Schmeidler, 1978, p. 257). A third possibility, solving the incentive problem by assuming that labor is allocated by command (Pazner and Schmeidler, 1978), is inconsistent with the basic goals of the market-socialist economy.

to be consistent with the conditions for economy-wide economic efficiency. To find such a bonus function, one must specify the structure of the economy and the way the manager interacts with it. Here a very simple structure will be specified. Many of the assumptions contained in the ensuing paragraphs are made purely to simplify the analysis. Where this is the case they will not be given any justification. When the final results are obtained, it will become obvious that nothing more than an increase in notational complexity could be gained from specifying a completely general model.

There is a single output in the economy. This output is produced by n firms in amounts y_i . In each firm labor, capital, and the services of one manager are used to produce this output. Let the aggregate availability of labor in the economy be \bar{x} . This can be used either for leisure or for production:

$$\bar{x} = \sum_{i=1}^n x_i + x_s,$$

where x_i = amount of labor used by the i th firm and x_s = aggregate amount of leisure.

It is assumed that the aggregate capital stock \bar{k} , can be divided between firms in any manner. Thus, if k_i is the amount used by the i th firm:

$$\bar{k} = \sum_{i=1}^n k_i.$$

To distinguish between managerial input and ordinary labor, the symbol e_i will be used to denote the managerial input for the i th firm. Following Keren (1972, pp. 470, 471), e_i is assumed to be a function of both labor time and a continuous stream of exertion and will be called effort. It is crucial to include effort in the production function because, as Granick (1979, p. 257) remarks, this variable is of deep concern to the planners in socialist countries and is regarded as a variable with high variance. Thus, the production function can be written as:

$$y_i = F_i(x_i, k_i, e_i).$$

The structure of preferences in the economy must now be described. This structure is given only enough detail to derive those efficiency conditions that are relevant to the problem of finding the managerial bonus function. Two simplifications can then be made. First, the rest of society, apart from the managers, is assumed to be a single entity. Second, since the form of the bonus function will be independent of consumers' saving decisions, no generality is lost by ignoring the distinction between goods saved and goods consumed. Thus, c_i represents the income of the i th

manager measured in units of the single produced good and it is income, rather than consumption or savings, that is used as an argument of the managers' utility functions. These functions can be written

$$u_i(c_i, e_i)$$

and embody the assumption that effort leads to disutility. Since the effort variable is a function of a manager's time at work, managerial utility is implicitly a function of the manager's consumption of leisure.

The income of the rest of society is c_s . Using previous assumptions, one can now introduce an arbitrary Bergsonian (1938) social-welfare function:

$$G(c_s, x_s, u_1(c_1, e_1), u_2(c_2, e_2), \dots, u_n(c_n, e_n)).$$

When a specific $G(\cdot)$ is maximized, a particular optimum of social welfare is found. The results derived in the following, however, are not restricted solely to that optimum. The only property of $G(\cdot)$ that is used in the analysis is that it is increasing in all its arguments. Thus, the results hold for all $G(\cdot)$ with that property and therefore for all efficient equilibria. Taking into account previously specified constraints plus the fact that

$$\sum_{i=1}^n y_i = c_s + \sum_{i=1}^n c_i,$$

the necessary conditions for efficiency in the economy are the necessary conditions for the maximization of the following Lagrangean:

$$G(\cdot) + p_x(\bar{x} - x_s - \sum_{i=1}^n x_i) + p_k(\bar{k} - \sum_{i=1}^n k_i) + p_y(\sum_{i=1}^n F_i(x_i, k_i, e_i) - \sum_{i=1}^n c_i - c_s),$$

where p_x , p_k , and p_y are Lagrange multipliers. Given that the maximization of $G(\cdot)$ will mirror the outcome of a market process, it is known from elementary programming results that the Lagrange multipliers will be equal to the scarcity prices found on the market.¹¹ Therefore, these multipliers will also be used to represent the market prices of the goods that are represented in their subscripts.

Using subscripts to denote partial derivatives (e.g., $\partial G/\partial x_s = G_x$ and $\partial G/\partial u_i = G_i$), the necessary conditions are:

$$G_c = p_y, \quad (1)$$

¹¹ Except, perhaps, for a factor of proportionality. To ensure that these multipliers exist it is assumed that all F_i are concave functions.

$$G_x = p_x, \quad (2)$$

$$G_i u_{ic} = p_y, \quad i = 1, \dots, n, \quad (3)$$

$$G_i u_{ie} = -p_y F_{ie}, \quad i = 1, \dots, n, \quad (4)$$

$$p_y F_{ix} = p_x, \quad i = 1, \dots, n, \quad (5)$$

$$p_y F_{ik} = p_k, \quad i = 1, \dots, n. \quad (6)$$

Let us now examine the choices made by the manager. It has already been assumed that managers act in their own self-interest and that they will be constrained to choose efficient outcomes. There are two possible ways in which the government could try to ensure that both these assumptions are satisfied. First, the government could construct a bonus function so that efficient choices coincide with utility-maximizing choices. Second, the government could set up a monitoring mechanism to ensure that the manager makes the desired choice. However, only the former method is consistent with the goals of the present inquiry and the tenor of the market-socialist literature.

In order to monitor managerial decisions, effort must be observed. Effort is a function of a continual stream of exertion. It is entirely plausible that exertion cannot be observed except by the person undertaking the exertion. If it is observable, the government would need to employ one person to monitor each manager. This in itself would result in loss of efficiency. Given the number of firms that the government owns, a monitoring agency would have to be created. A further efficiency loss would occur from the dysfunctional behavior that inevitably attends the creation of such monitoring agencies (see Downs, 1967). Thus direct monitoring of managers is inconsistent with the goal of examining income distributions consequent on efficient allocations.¹²

Direct monitoring is also inconsistent with an important property of market-socialist schemes: informational decentralization. Inclusion of informational decentralization in a model of socialism was exactly the way in

¹² As noted earlier, there is a possibility of asymmetry in assumptions between market socialism and competitive capitalism. No mention has been made of how capitalist shareholders monitor their managers. Standard works on competitive capitalism (e.g., Arrow and Hahn, 1971) give no guide on this matter. They implicitly assume that all traded inputs are costlessly observable. They do assume that some inputs (managerial ability; see Arrow and Hahn, p. 35) are private to a firm, but then the earnings of these inputs are included in shareholders' earnings.

No attempt will be made here to resolve this possible asymmetry since it is due to ambiguities in the model of competitive capitalism. However, it should be noted that the essential conclusions of the paper hold whatever assumptions are made about the manner in which shareholders control their managers.

which Lange (1964, p. 89) claimed to have countered the Austrian arguments on the impossibility of rational pricing under socialism. Lange (p. 109), in a famous passage, stated explicitly that: "... the real danger of socialism is that of a bureaucratization of economic life ...". Thus, one can reasonably conclude that the creation of a large-scale bureaucracy to monitor the decisions of managers would be inconsistent with Lange's conception of market socialism. Hence, in order for the following analysis to be consistent with the market-socialist literature and consistent with the assumption of efficiency, one must assume that managers' decisions are guided solely by a bonus function.

The bonus can depend only upon those variables that can be easily observed. Because the internal operations of the enterprise will not be monitored, the bonus can depend only on flows into or out of the enterprise. As these flows are naturally observed by at least one individual outside the enterprise, the center will obtain accurate information on them because normal accounting procedures provide a check on enterprise reports. Thus, the bonus function for the i th manager can be written as:¹³

$$B_i(y_i, x_i, k_i).$$

The bonus can, of course, depend also on observable variables that are parametric to the manager.¹⁴

As the bonus is measured in monetary units the income argument of the manager's utility function must be expressed in real terms, $c_i = B_i/p_y$. Thus, the manager will maximize:

$$u_i(B_i(F_i(x_i, k_i, e_i), x_i, k_i)/p_y, e_i).$$

¹³ Regularity conditions on utility and production functions ensure that the bonus function must be continuously differentiable. This follows from assuming that the utility and production functions are twice continuously differentiable in their arguments. The following is a sketch of a proof. The implicit-function theorem (Courant, 1936, pp. 113-122) guarantees that the efficient levels of the endogenous variables are continuously differentiable functions of exogenous variables. To construct a proof by contradiction, assume that the bonus function is not continuously differentiable. Then the solutions to the manager's maximizing conditions must have a discontinuity. (If they had no discontinuity, the implicit-function theorem would imply that the bonus function theorem is continuously differentiable, contrary to the assumption.) Then the manager's choice is not a continuous function of the parameters of the manager's problem, which are also the parameters of the general-equilibrium problem. This means that there must be at least one inconsistency between the manager's choice and the efficient outcome. Hence a contradiction between efficiency and discontinuity of the bonus function.

¹⁴ Here, the use of a demand-revealing-type bonus system (see Loeb and Magat, 1978) is ruled out. This type of bonus violates two assumptions of market socialism: informational decentralization and absence of physical input-allocation mechanisms. The former is violated in a demand-revealing scheme because the center accumulates information on all production functions; the latter because inputs are allocated directly to producers.

Hence, the first-order conditions for maximization are (noting that $\partial u_i/\partial(B_i/p_y) = u_{ic}$):

$$u_{ic}B_{iy}F_{ik} + u_{ic}B_{ik} = 0 \quad (7)$$

$$u_{ic}B_{iy}F_{ix} + u_{ic}B_{ix} = 0 \quad (8)$$

$$u_{ic}B_{iy}F_{ie}/p_y + u_{ie} = 0. \quad (9)$$

A necessary condition for efficiency is that $B(\cdot)$ must be such that Eqs. (7)-(9) are consistent with Eqs. (1)-(6) for at least one value of the arbitrary function $G(\cdot)$.

As there is informational decentralization, the government does not know the functions $u_i(\cdot)$ and $F(\cdot)$. However, the bonus must be a function of variables or functions that can be observed by the government. Therefore, in order to derive the conditions placed on the construction of the bonus function by insisting that (7)-(9) and (1)-(6) must be consistent, one must solve these equations for relationships that are independent of unobservables.

Since $G(\cdot)$ is arbitrary, (1)-(6) reduce to (5) and (6) plus the solution to (3) and (4)

$$u_{ie} = -u_{ic}F_{ie}. \quad (10)$$

Use of (5), (6), and (10) to replace the functions in (7)-(9), which the government does not know, gives the following partial differential equations after simplification:¹⁵

$$B_{iy} = p_y, \quad B_{ik} = -p_k, \quad \text{and} \quad B_x = -p_x.$$

The form of the bonus function is then easily found by integrating each of these equations. The only bonus function consistent with all three integrations is:

$$B_i(y_i, x_i, k_i) = p_y y_i - p_k k_i - p_x x_i + D,$$

where D is a constant of integration that must be independent of y_i , x_i , and k_i . Thus, the only bonus function that will lead to efficient decisions is one that has the property that the manager is paid all of profits plus or minus an amount which is independent of the enterprise's performance. In making enterprise decisions the manager will maximize utility, which is a function of enterprise profits and effort.

D , in fact, cannot be arbitrary. The above analysis ignores the efficient shutdown rules for the enterprise. D determines whether the manager chooses to leave the enterprise or not and consequently whether the enterprise does or does not produce. A necessary condition for efficiency is that the manager chooses to stay in the enterprise when a positive production

¹⁵ It is easy to see that satisfaction of these three equations is indeed a necessary condition for an optimal bonus function because these three equations are independent and any set of four independent equations derived from (1)-(6) and (7)-(9) must contain at least one unobservable variable.

level enhances social welfare, and that the manager chooses to leave the enterprise when zero production is better for society than positive production. D must be set according to the dictates of this efficiency condition.

To set up formally the rules for calculation of D would involve a difficult comparison of two discrete programming problems. Thus, a heuristic approach will be used. Let us suppose that the manager faces equilibrium prices (p_x^* , p_x^* , p_x^*). Suppose also that the production point will be $(y^*$, x^* , k^* , e^*) if the manager decides to produce. On the assumption that the firm is small, the enterprise's production enhances the rest of society's welfare by an amount equal to $p_y y^* - p_x x^* - p_k k^* - p_e e^*$, measured in social-welfare terms. Call this amount V^* . Payment of the bonus to the manager reduces the rest of society's welfare by the amount of the bonus, which equals $V^* + D$.

A manager leaving an enterprise will become an ordinary member of the work force. Suppose that the ex-manager then chooses to work an amount equal to x_m^* . The contribution of the ex-manager's work to the rest of society's welfare is equal to the value of the marginal product, $p_x x_m^*$. Payment of the manager's wages reduces the rest of society's welfare by $p_x x_m^*$.

By adding the various effects identified, one can see that when the manager leaves the enterprise and enters the labor force the rest of society's welfare is reduced by an amount equal to $-D$.¹⁶ The efficient shutdown rule dictates that when the manager is indifferent between staying in the enterprise and leaving, society as a whole should be indifferent. This implies that when the manager is indifferent between leaving or staying, the rest of society must neither gain nor lose from the manager's decision to move from one occupation to another. Hence, D must be zero. The manager must be paid an amount equal to profits and will be expected to leave the enterprise when greater utility can be obtained elsewhere. Any deviation of D from zero would mean that efficiency would be lost either because firms operate in an inefficient region of the production schedule or because managers make socially inappropriate decisions on when to move from one job to another.¹⁷

Thus, the bonus paid to a manager will always be at least as large as the manager's opportunity wage¹⁸ and could be much larger, depending on the size of profits in short-run equilibrium.

¹⁶ Of course, if D is positive, the rest of society's welfare is actually increased.

¹⁷ Here it is appropriate to justify the comment, made at the beginning of the present section, that the results would hold in a more general model. It is easy to see that all the relationships used in deriving the present results are also relationships that hold in a more general model—that of market-socialist general equilibrium. None of the results derived depend in any way on the one-good-one-consumer assumption. Therefore, in turning to a more general model by relaxing this assumption, there would be no change in the results.

¹⁸ In order to reach the conclusion contained in this last sentence a small technical point

Short-run profits can be expected to be large in some enterprises because in each short-run equilibrium the number of enterprises and the size of the capital stock are unlikely to be perfectly adjusted to their long-run equilibrium values. Thus, in an economy that is not in a stationary state, there will be some managers who will earn much more than their opportunity wage.

5. CONCLUSIONS

The results derived in Section 4 lead to many conclusions about the nature of market socialism and its behavior compared to competitive capitalism. In the remainder of this paper, a number of these conclusions will be outlined. The direct implications are presented first, followed by observations of a more conjectural nature.

The analysis of Section 4 shows that there is a unique bonus function that will guarantee efficiency under market socialism when there is informational decentralization. That analysis constitutes a missing link in the theory of market socialism (Bergson, 1967, pp. 657, 658). One can certainly conclude that the form of the bonus function is inconsistent with the expectations of the originators of market socialism. Dickinson (1939, pp. 213-219), who was the most explicit on incentives, concluded that "quite a small pecuniary interest" would be a sufficient encouragement for the manager. In fact, it has been shown that the manager must have as large an interest in the firm as would a capitalist owner.

Paying managers the whole of profits will certainly conflict with the egalitarian goals that are usually implicit in market socialism. Combining the results on the nature of the efficient bonus function with the discussion in Section 3, one can conclude that the social dividend will be identically zero unless the government has accumulated capital in the past using taxes or expropriation. Thus, contrary to the predictions of Lange, there will be no ready-made fund that could be used to change the distribution of income without reducing efficiency. In a society with egalitarian goals, conflicts between efficiency and distribution must surface in the design of the bonus functions. This conclusion is at variance with the results of Hildebrandt and Tyson (1979, p. 23). They conclude that when there is informational decentralization (their term is subjective uncertainty), a bonus function can be constructed that achieves both efficiency and distributional goals. The

must be noted. (Mention of this point is necessitated by the fact that the manager may undertake different levels of effort inside and outside the firm.) Since the manager could always choose to do nonmanagerial work within the enterprise, the manager's marginal product as a manager will always be at least as high as the manager's marginal product outside the enterprise. This means that the manager will always choose to contribute at least as much effort within the enterprise as outside the enterprise. So the manager's monetary income within the enterprise will be at least as high as that of a member of the ordinary work force.

inclusion of managerial effort in this paper explains why the present results differ from those of Hildebrandt and Tyson.

Conclusions on the comparison of the income distributions of competitive capitalism and market socialism follow directly from the result that the social dividend is zero. The total income paid to socialist managers will be equal to total payments to shareholders under capitalism. Total payments to capital under capitalism will equal total payments to savers under socialism. However, each system's personal income distribution depends upon the way in which these total payments are divided. The structure of the income distribution under capitalism will depend on the correlation between ownership of enterprises and ownership of variable capital. The structure of the income distribution under socialism will depend on the correlation between possession of managerial ability and ownership of savings. The values of these correlations are features of the economies derived from history. One could only comment on these values by undertaking an extensive investigation into, for example, the relationship between frugality and ability or on the strength of the proclivity to leave bequests. It is not the intention to undertake such discussion here, nor is such discussion usually undertaken by economists. Thus, the conclusions on comparative income distribution must be carefully stated.

One cannot say whether one system will have a more egalitarian distribution than another. However, if one system does have a more egalitarian income distribution than the other under the constraint of efficiency, that result will not be due to features intrinsic in either system. Rather the result will be solely due to characteristics of the economies unrelated to their systems. This conclusion is obviously at odds with the claims made by the proponents of market socialism.

The foregoing results also lead to conclusions on the organization of market socialism in practice. One of these conclusions is *not* that managers will be paid all profits. Socialist regimes will have distributional objectives. In order to pursue these objectives, absolute efficiency will be sacrificed. Since the socialist regime owns enterprises, it can pursue its distributional objectives by means other than redistributive taxation. That regime may decide to monitor managers in order to collect information for use in making adjustments in the bonus scheme. For example, the government could estimate the level of profits in the region of the most likely equilibrium point for the firm. If, in that region, profits are much larger than the opportunity wage of the manager, D could be set at a level that would reduce managerial income but not impair efficiency. Of course the monitoring causes efficiency losses but these losses may be less than those that would occur by employing a different means of redistributing income. Thus, one is led to the important conclusion that complete informational decentralization is unlikely to occur in any practical application of market socialism.

A direct consequence of the foregoing argument is that, under market socialism, there will be a complicated interrelationship between incentive structure, income distribution, and the degree of centralization. Hungary's experience in the 1970s has exhibited this interrelationship. Increasing centralization occurred in 1970 when the bonus system that had been designed to encourage efficiency was seen to have damaging distributional consequences (Adam and Nosal, 1982, p. 187). Later, distributional concerns resulted in increasing ministerial supervision of a number of large enterprises (Vajna, 1982, p. 181). Flakierski (1979, p. 30) concludes that expected increases in decentralization did not occur in the mid-1970s precisely because of income-distribution questions. Thus, Hungary's experience shows that distributional concerns are likely to influence the degree of centralization, as this paper predicts. The degree of centralization cannot be chosen solely with reference to efficiency considerations, as has often been implied by the proponents of market socialism.

The last conclusion to be made refers to directions for future research. It has been shown that, under the assumption of efficiency, the income distributions of market socialism and competitive capitalism are indistinguishable. However, one would assume that most governments will make some attempts to redistribute income. Thus, a comparative theory of income distribution should look at the relative effectiveness of redistributive tools in the two systems. For example, one should examine the effectiveness of centralized monitoring under socialism compared to redistributive taxation under capitalism. Or, introducing a third system, one could examine the efficiency and distributional consequences of self-management. This system has often been slighted by neoclassical economists because it inevitably leads to losses in static efficiency. However, the conclusion of the present paper is that market socialism cannot obtain a more egalitarian distribution than competitive capitalism without losses in efficiency. One does not know whether self-management or market socialism leads to greater losses in efficiency, given that redistribution is required. Thus, the most important area for future research is to identify the relative efficiency losses that attend redistributive policies.

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The Applicability of Information-Revealing Incentive Schemes in Economic Organizations¹

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The applicability in centrally planned economies of bonus functions that are designed to encourage subordinates to report information honestly is evaluated. If central planners seek Pareto-efficient outcomes, a unique bonus function and therefore a unique distribution of managerial incomes results. Hence, income-distribution considerations must be embodied directly in the objective function. However, once such a change in the objective function is introduced, an optimal bonus function can no longer be found. *J. Comp. Econ.*, September 1984, 8(3), pp. 277-289. University of Maryland, College Park, Maryland 20742, and University of Delaware, Newark, Delaware 19711.

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1. INTRODUCTION

Studies of organizational behavior, whether of large capitalist corporations or of state planning systems, invariably emphasize the dysfunctional behavior that results when superiors must elicit information from subordinates. Thus, a great deal of interest has centered on a new set of results that show that there are circumstances under which it is possible for superiors to construct

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