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Power Distribution and Profit Sharing under Uncertainty

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Abstract

The paper represents an attempt to research the link between changes in external environment and the degree of profit sharing implemented by a profit maximizing producer. Profit sharing is used as a proxy that traces changes in real power distribution between owners and employees within a firm. The paper introduces a mathematical model to formalize the relation in question. The results obtained during the research generally support the applicability of the model to real life economic environment and reveal the existence of some alternative tools other than property rights redistribution that may be used by the government to optimize power distribution.

Introduction.

The category of economic power is not as easily definable as it may seem. It is natural to expect that property rights and economic power should exhibit some direct relationship; in modern societies, however, this relationship does not always seem to be particularly strong.

For the purposes of this paper we define economic power as the authority to make decisions [in this sense it is equivalent to decision-making authority]. In the end, it is the right to participate in the decision-making process that defines the scope of one's power since it is the authority to determine economic variables and control the processes through which an economic entity changes. Thus, this kind of authority produces allocative effects and ultimately determines the outcome of economic activities. It may well be the case that an economic agent who has a significant share of property rights plays a relatively minor role in the decision-making process (ownership-management conflicts in modern corporations).

The rationale behind linking economic power and decision-making authority lies in the fact that the latter is in general observable. More importantly, changes in the distribution of decision-making authority in response to changes in exogenous variables are also observable. To mathematically express the process of adjusting to external shocks, however, one needs a proxy to define the pattern of

the distribution of economic power in a given economic entity. On the other hand, it is often more important to define the direction of change (i.e. the sign of the first partial derivative) of a variable in response to exogenous changes. Thus, the only restriction that has to be placed on the proxy is that the variable in question always changes in the same direction as the proxy (this requirement would of course be insufficient if one is interested in precise functional forms of the relationships in question). If we let the proxy be δ, and the variable in question is γ, we should require that $\partial\gamma/\partial\delta \geq 0$.

We suppose that it is logical to expect that the extent of employees' participation in profit-sharing plans can be regarded as a proxy that defines the level of decentralization of economic power within the firm; more importantly, we assert that changes in this variable trace changes in the power distribution of the firm. Our argument is based on the following. First, profit sharing increases the marginal value of an employee's participation in decision-making (better decisions lead to larger profits). Second, profit sharing increases the marginal cost of employees' non-participation. Thus, employees are pressed to more actively participate in the decision-making of the firm and acquire wider economic power. Third, since employees are likely to become self-monitoring some managerial responsibilities may become redundant and thus even amplify the effect of profit sharing on power distribution.

We do not assert that profit sharing is a means of always improving economic performance (otherwise, all firms would excessively implement it in their economic activity). We only assert that changes in power distribution within the firm can be traced through changes in the extent of participation of its employees in profit sharing. On the other hand, the terms of profit sharing contracts are not usually very flexible and cannot be changed immediately. Moreover, this proxy does not render itself to a simple empirical estimation. Later we discuss some ways to deal with these problems.

The purpose of this research is to measure the response of a profit-maximizing firm to changes in the riskiness of external environment. Empirical importance and certain practical applications of this analysis will be discussed after considering the formal mathematical model.

Review of literature.

An extensive body of literature, most of which was developed within the framework of managerial sciences, deals with the category of economic power (see, for instance, Noam, 1984, Diamantopoulos, 1987, or Fluck, 1999). On the other hand, the literature on the problems of property rights distribution comes primarily from the field of economics: Armen Alchian, Harold Demsetz, Samuel Bowles and Herbert Gintis are some of the prominent researchers in this field. We need to emphasize, however, that the formal models and approaches developed by some of the most renowned economist, have been in many cases of little practical applicability. The reason as we see it stems from the fact that most researchers confine themselves to explaining and formalizing relationships between economic power and property rights. On the other hand, the distribution of property rights cannot be easily changed or mandated by the state, especially in the developed economies. This produces the situation when the tools suggested by scholars require steps contradicting the very fundamental principles of the market economy.

In this paper we suggest a slightly different view on the problem of optimizing economic power. We attempt to research the influence of some other variable, generally observable and not equivalent to the category of property rights, on the distribution of economic power. Unfortunately, we have been unable to find literature using this or a similar approach.

Description of the theoretical model.

In the first approximation we specify the following problem (actually a variation of the ordinary profit-maximization problem under the assumptions of perfect competition):

maximize

$$\pi = p*f(R,\delta) - w*R - c(\delta),$$

where δ denotes the share of profits distributed to employees, p is exogenously determined output price, R is the vector of resources used in production, w is the vector of resource prices, and c is the function representing the costs of implementing a profit sharing plan [administrative costs and the share of profits foregone by the owner(s) as it has been distributed between employees].

This model says that the owner(s) of the firm maximize their share of profits given exogenous output and factor prices. Note that the parameter δ enters the production function also: it is natural to expect that employees' participation in decision-making will influence the production process and the quality of work.

Let us define the indirect profit function φ as the maximum value of the profit function for given parameters. That is, given δ, p, and w, the indirect profit function φ will be the maximum value of π. Note that while π is dependent on all *four* parameters δ, p, R and w, φ is a function of δ, p, and w only (because the value of R is substituted from the first-order conditions for profit maximization). The economic reasoning underlying the indirect profit function may be explained as follows: the producer determines the share of profits distributed to employees (probably by signing a formal agreement) before the output price is known. After the output price is revealed, the owner of the firm determines the volume of other resources to be employed, that is, for any given δ the producer chooses R to maximize profits.

Thus, we have

$$\varphi(p,w,\delta) = max_{\ over\ R}\ [p*f(R,\delta) - w*R].$$

We assume linear homogeneity of the production function. Then, we can write

$$\varphi(p,w,\delta) = \delta*\eta(p,w),\ where\ \eta\ is\ a\ new\ function.$$

Under uncertainty, the owner maximizes expected profits. Assuming risk-neutrality, we have:

maximize (over δ)

$$E[\delta*\eta(p,w) - c(\delta)].$$

The sufficient conditions are:

$$E[\eta(p,w) - c'(\delta)] = 0$$

$$-c''(\delta) < 0.$$

Note: the negative sign of the second derivative of the cost function asserts that it must be convex. It is a by-product of our theoretical considerations: under the assumptions of the above model the function representing the costs of implementing a profit sharing plan possesses the general properties of ordinary cost function in the theory of production.

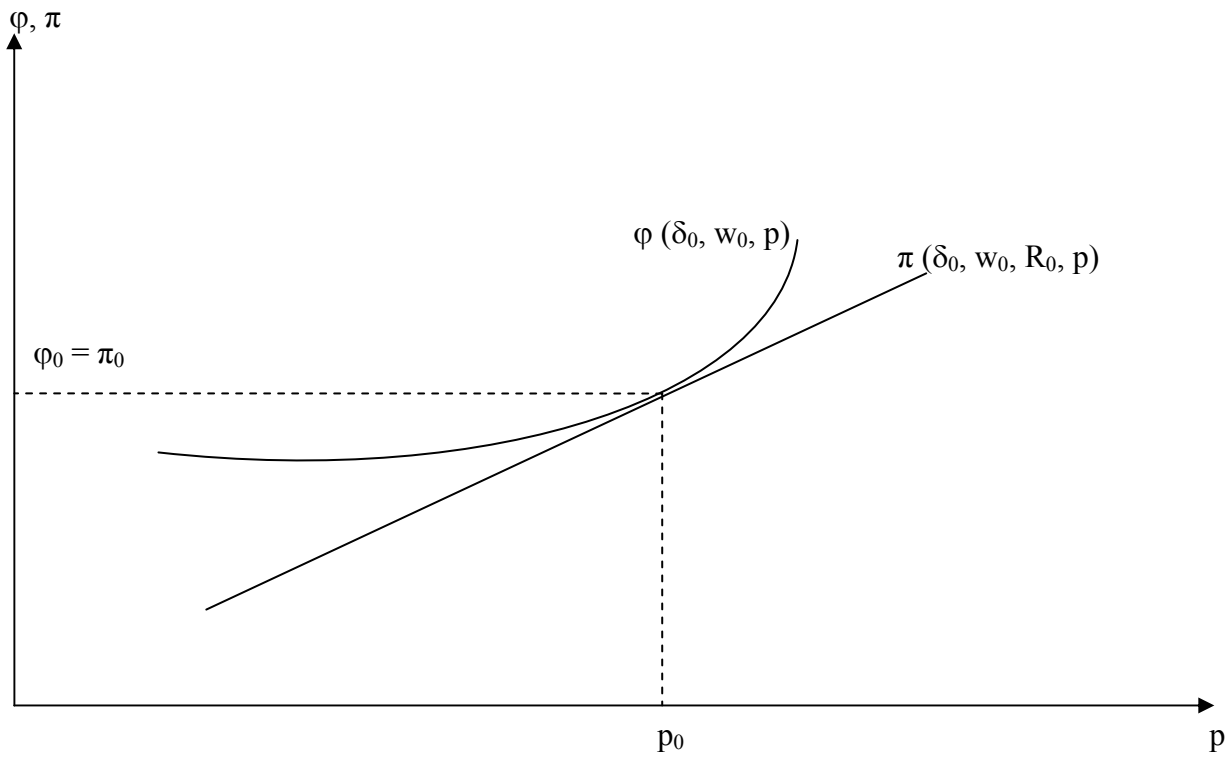
Let us assume now that the output price has become more variable (the riskiness has increased), specifically, it has undergone a mean preserving spread. Let α be the parameter that represents the mean preserving spread to the distribution of p. Then after differentiating the first-order condition with respect to α we have:

$$\partial\{E[\eta(p,w)]\}/\partial\alpha - c''(\delta)*\partial\delta/\partial\alpha = 0$$

It can be shown that $\eta(p,w)$ is convex in p and w. Let us consider the original profit function (π) first. It can be readily seen that this function is linear in p: if we fix all the variables except for p at an arbitrary level, say δ_0, w_0, R_0, we derive:

$$\pi = f(R_0,\delta_0)*p - w_0*R_0 - c(\delta).$$

Since δ_0, w_0, R_0 are constants, π is linear in p.



Graph 1.Convexity of the indirect profit function.

On the other hand, $\varphi \geq \pi$ since φ is the maximum value of π (in the point of maximum profits $\varphi_0 = \pi_0$, $p = p_0$). That is, φ must lie above π in any neighborhood of p_0, which means φ must be convex since π is linear. The proof that φ is convex in w is analogous. The convexity of η directly follows from the convexity of φ.

Thus, a mean preserving spread will increase the value of $E[\eta(p,w)]$ (the proof that a mean preserving spread increases expected values for convex functions can be found in Silberberg's "The Structure of Economics: A Mathematical Analysis"). The first term in the above equality is therefore positive; thus, knowing that $-c''(\delta) < 0$ from the second-order relation, we have

$$\partial\delta/\partial\alpha > 0.$$

An increase in riskiness leads to an increase in the share of profits for employees.

Discussion of results.

The results obtained from using our simplistic model are perfectly consistent with common sense: in a riskier environment profit sharing is a form of risk sharing at the same time. Thus, it can be used to shift increased risks to employees.

It is more important, however, to understand the generality of the result and its applicability to the real world economic environment.

The generality of the model follows from its theoretical postulates. First, the assumption that the degree of profit sharing is determined in advance is consistent with the view that employment and profit sharing contracts are inflexible and cannot be changed quickly. Moreover, the simplicity of the model, though being one of its most significant flaws, enables us to focus on specific relationships.

Our model asserts that changes in external environment produce changes the degree of employee's participation in profit sharing and thus influence the real power distribution within the firm. To stipulate a more efficient power distribution the government need not engage in the redistribution of property rights, which may be exceedingly difficult and may lead to discontent among the general public and business circles. The state has other tools to influence the power distribution in the economy, one of which is mandating terms of profit sharing contracts.

We should note that some other, better proxy variables may exist. The primary purpose of this paper, however, was to show the applicability of the general comparative statics methodology to the problems of power optimization.

As far as the model specific results are concerned, empirical testing of our propositions may yield interesting conclusions about the level of competition in different sectors of the economy or in different countries: we should expect that increases in price variation in competitive industries should lead ceteris paribus to higher participation in the sharing of the firms' profits. The extent to which this process is inhibited may be attributed at least partly to departure from perfect competition. Moreover, this analysis can also become an alternative means of assessing transaction costs in the economy (the analysis may shed light on the degree to which transaction costs inhibit the proper response to increases in riskiness). The latter are not directly observable and thus largely elude successful

mathematical analysis; it may be expedient therefore to try to assess them through as many indirect methods as possible.

Our model, however, is a weak interpretation of reality. Moreover, it does not take into account the role employees play in determining the terms of profit sharing contracts, which is probably the most significant flaw of the above analysis.

Empirical testing

Empirical testing of our model may become a difficult task to be accomplished. In the Republic of Belarus, for instance, using data from specific enterprises is illegal unless authorized by the government. It is also impossible to use aggregate data since the Ministry of Statistical Analysis does not collect information about the implementation of profit sharing plans.

On the other hand, our model depends on the form of the production function. It may well be the case, however, that price variability within a specific industry is insignificant to produce statistically significant results (since it is likely that the level of costs will be similar for different enterprises within an industry). Another obstacle is the lack of reliable time series data in the transition economies due to the fact that economic environment and government regulation in such countries changes quickly. One of the ways to circumvent this difficulty is to estimate a probit regression model, which will determine whether the level of riskiness of external environment determines the degree of profit sharing at some statistically significant level; this specification may also help deal with the problem of inflexibility of the profit sharing contracts but will require the utilization of data from specific enterprises.

We hope that this paper will stimulate more extensive research in this field that will lead to the development of a comprehensive mathematical model formalizing the most important relationships in the theory of economic power while having considerable empirical applicability.

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