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SOME APPLICATIONS OF PRINCIPAL AGENT MODEL

Abstract

Under conditions of incomplete and asymmetric information, new, yet of old descent, theory emerges: agency theory. Principal agent problem is generally connected with aligning the agent's interests with those of the principal. This paper gives an overview of agency theory, provides some examples of its more obvious applications. However, principal agent model is not limited to applications in the field of employment or business relations – in the last part of the paper the author argues, that it may be successfully implemented in the field of public or social choice.

Key words: agency theory, public choice, moral hazard, incentives.

Introduction

Relationship between principal and agent comes from long tradition of Common Law, where employment contract based on agency is one of the most important types of employment. This contract binds two sides: agent (agents) who is to act on behalf of and under control of principal (principals) for a certain fee. This principal agent relationship could be found in almost every contract that binds employee to conduct certain work (service) for his employer. It is not a hard task to find some examples of this:

- enterprise (legal person) hires managers, employees; owners of this enterprise hire (choose) board of directors to act on behalf of them,
- partnership (unlimited) company is a network of a few agency relationships, that tend to overlap: every partner (shareholder) is an agent for the other partners (shareholders),
- natural person (as a single person business) can take part in agency relationships mostly as middleman: insurance agent, broker, dealer, or service-provider: lawyer, counsellor etc.,
- other natural persons become agents providing services to society: physicians, policepersons, firepersons, etc.

Usually agents face many problems when acting for their principals, and principals cope with a wide variety of problems, usually in ensuring that agent's actions realise their preferences. Therefore, agency, and after that agency theory, have been constructed to provide the best understanding of these activities: behaviours of both principal and agent, problems of identifying and providing services by an agent and problems of leading and adjusting of agent's actions by a principal.

Main problems concerning principal – agent model are:

- contracting between agent and other persons, that should include acting accordingly to principal's preferences,
- principal's responsibility for agent's actions,
- mutual responsibilities and rights,
- methods of terminating the principal – agent relationship.

Generally, there are no formal constraints of the agency contract. The only prerequisite

is mutual agreement of both sides given in writing, that also include rights and responsibilities of both principal (salary of the agent, methods of control, conditions of termination of contract, etc.) and agent (empowerment to dispose certain assets, the boundaries of the right to act in the name of the principal, etc.). Besides contractual constraints, there are also certain legal or ethical norms that should be obeyed by both sides¹.

As it is stated above, relationship between principal and agent is far more common than it is perceived. Therefore, the theory of agency has multitude of applications that are yet to be discovered. This paper gives an overview of a few examples of principal agent model applications. The main aim of this article is to bring to the attention of The Reader, that agency theory is a great tool to model and analyze various relationships and to study them from the point of view of economics.

Fundamentals. History of the economics of incentives

Questions about motivations of persons' actions started with the division of labour in economy. Person A delegates the execution of certain task to person B, who does not have the same preferences as A and beside that has information about costs of the assignment. Person A starts to consider B's intentions. There are two main consequences of B's private information:

1. moral hazard of using this information to gain certain benefit by hidden action or inaction,
2. adverse selection, that is an effect of information about A's preferences and costs.

So as to induce person B to fulfil given task, person A offers explicit or implicit contract. Person A becomes a principal, person B is an agent and the outcome of this is principal agent relationship.

The person who has begun those considerations was no one else than Adam Smith. In his work, *The Wealth of the Nations*², he pointed out the problem of **sharecropping**. The main point of his concern in this matter was that the tenant tends to maximize his profit, maximizing also the profit of the property owner, however there were certain incentive problems, which discouraged tenant from the investment in the land and from the use of husbandry instruments. This problem remained unsolved resulting in the large critique of sharecropping until in 1974 when J. Stiglitz reconsidered the problem within the framework of principal agent model³.

There are two main areas of interest within the agency theory – as stated above: moral hazard and adverse selection. One of the first articles, which is perceived as a milestone of agency theory, was written by Kenneth Arrow (1963). In this article, he introduced the concept of moral hazard, which derives from insurance terminology. In his paper called *Uncertainty and the Welfare Economics of Medical Care*⁴, he touches rarely analyzed issues of the health care. He pointed out, that agent, that is the physician, by his or her actions can influence the expenses of insurance companies or even the probability of health threats of the

¹ E.W.Tucker, J.W.Henkel, *The Legal and Ethical Environment of Business*, Irvin, Homewood 1992, pp. 340 – 347.

² A.Smith, *Of the Discouragement of Agriculture in the Ancient State of Europe after the Fall of the Roman Empire*, w: *An Inquiry into the Nature and Causes of the Wealth of Nations*, Book 3: *Of the Different Progress of Opulence in Different Nations*, Chapter II, 1776, pp. 1 – 8.

³ J.Stiglitz, *Incentives and Risk Sharing in Sharecropping*, *Review of Economic Studies* 1974, nr 61, pp. 219 – 256.

⁴ K.J.Arrow, *Uncertainty and the Welfare Economics of Medical Care*, *American Economic Review* 1963, nr LIII (5), pp. 941 – 973.

patient which may cause the increase of his or her profit, provided the patient's sickness is covered by health insurance. This situation was possible because of the private medical insurance in the United States. The whole problem may lead to the collapse of the insurance market and Arrow gave examples of certain institutions that may limit moral hazard: associations of physicians that develop ethical codes of conduct. He also proposed public intervention and even taking over the medical insurance as government agency or company. As a reply, Mark Pauly in 1968⁵ pointed out that there are certain other measures that can constrain moral hazard: tax deductions, co-insurance and non-linear prices for medical services. Beside that, he argues that the government may also fail with limiting the moral hazard, same as private insurance companies, because there are the same constraints in information both for government and for private sector.

Utility function of the agent and adverse selection

Stephen Ross in 1973⁶ proposed expected utility function of the agent, that is maximized by the choice of certain action a :

$$\max_a G(f(w(a, \theta); \theta)), \quad (1)$$

where:

a – action of the agent,

θ – state of the environment known or unknown to the agent,

G – expected utility function,

f – function that describes the pattern of the fee,

w – payoff function.

In his work, Ross started the discussion of fitting principal agent model in larger framework of market equilibrium. His work was continued further by J.A. Mirlees⁷ and Bengt Holmstroem⁸.

In conditions of symmetrical information, we can simplify (1) to:

$$\max_a G(W; L), \quad (2)$$

where:

L – effort of the agent,

W – payoff function, $W = w(a; \theta)$.

Expected utility will be higher when the payoff will be greater and when the effort will be smaller while executing action a . The decision problem of an agent, after choosing a , will be how much effort put to fulfil his contract.

Different form of maximization is in the situation of asymmetrical information:

⁵ M.V.Pauly, The Economics of Moral Hazard: Comment, American Economic Review 1968, nr 58 (3, Part 1), pp. 531 – 537.

⁶ S.A.Ross, The Economic Theory of Agency: The Principal's Problem, American Economic Review: Papers and Proceedings, nr LXI (2), pp. 134 – 139.

⁷ J.A.Mirlees, The Theory of Moral Hazard and Unobservable Behaviour: Part I, Review of Economic Studies 1999 (1975), nr 66, pp. 3 – 21.

⁸ B.Holmstroem, Moral Hazard and Observability, Bell Journal of Economics 1979, nr 10 (1), pp. 74 – 91.

$$\max_a G(W^*; L; A), \quad (3)$$

where:

W^* – payoff for the agent, $W^* = W + W_e$, where W_e is extra payoff gained from asymmetrical information

A – the utilization of information asymmetry.

In this situation of asymmetrical information agent may act in two ways:

- hide information before contract and also during its time,
- act hidden from the principal.

If agent chooses to use asymmetrical information A will become the most important – the higher the asymmetry the lower effort may be.

The first ones, who tried to explain moral hazard, were J.A. Mirlees⁹ and Bengt Holmstrom¹⁰; adverse selection became domain of Joseph A. Stiglitz¹¹, Michael Mussa and Sherwin Rosen¹². The concept of adverse selection is very interesting. The explanation given analyzes why better agents fail to be hired. If one agent decides to use the asymmetry of information, he will do it prior to the contract and will know of conditions of the task. He may evaluate the extra payoff gained from the contract – W_e . If principal tends to minimize the costs of the agency, he will choose “cheaper” agent – that one who will try to use the asymmetry of information and therefore who will give lower price for his job with a prospect of extra benefits.

Incentives

In all of above mentioned models there have been proposed certain systems of incentives that should ensure the realization of principal's goals by chosen agent. In the situation of moral hazard, incentives base on the assessment of the possibility of the agent's failure and division of the responsibility between the principal and the agent. In the situation of the adverse selection, the main goal of the developers of the incentive schemes is to ensure agent's honesty. In both cases, incentives may be financial or non-financial, that are developed in the course of experiments of previous relations. In the countries of the Common Law principal agent relationship is fairly old, therefore incentive schemes are developed and thoroughly tested.

In the situation of the risk change or within certain scheme agent finds a possibility to raise his utility without the change of payoff. Incentive scheme is not enough. There has to be the system of the control and also the discipline has to be strengthened through organizational structure or self-discipline.

Other applications of principal agent model

As mentioned above, principal agent relationship is very common. Agency theory becomes a very useful tool to analyze behaviours of two or more persons, connected by some relationship.

It should be stressed, that principal agent model is used not only to analyze business or

⁹ J.A.Mirlees, An Exploration in the Theory of Optimum Income Taxation, Review of Economic Studies 1971, nr XXXVIII, pp. 175 – 208.

¹⁰ B.Holmstrom, Moral Hazard..., op. cit.

¹¹ J.Stiglitz, Monopoly, Non-linear Pricing and Imperfect Information: The Insurance Market, Review of Economic Studies 1977, nr XLIV, pp. 407 – 430.

¹² M.Mussa, S.Rosen, Monopoly and Product Quality, Journal of Economic Theory 1978, nr 18, pp. 301 – 317.

employment relations, though they are its most common applications. It could be useful also from the point of view of public choice theory in which the most important is the analysis of procedures of choosing. Therefore, it is fruitful to employ the moral hazard issues, adverse selection and incentives to study social and public choice, not only private choice.

Within the agency theory framework, Sean Gailmard developed very interesting model of multiple principal and single agent¹³. It is fruitful to employ his finding in the analysis of bureaucracy relations. In my previous work¹⁴, I analysed the issue of regional representation to the European Union from the point of view of public choice theory. In every society of a region, every single person has his or her individual interest. Those interests combined together give the interest of a region in question – the main problem is that regional interest is hidden and can only be revealed through the analysis of outcomes of public choice process – public goods supplied to the society – and by the analysis of procedures of choice.

The implementation of principal agent model into the framework of relation within a region is shown on fig. 1.

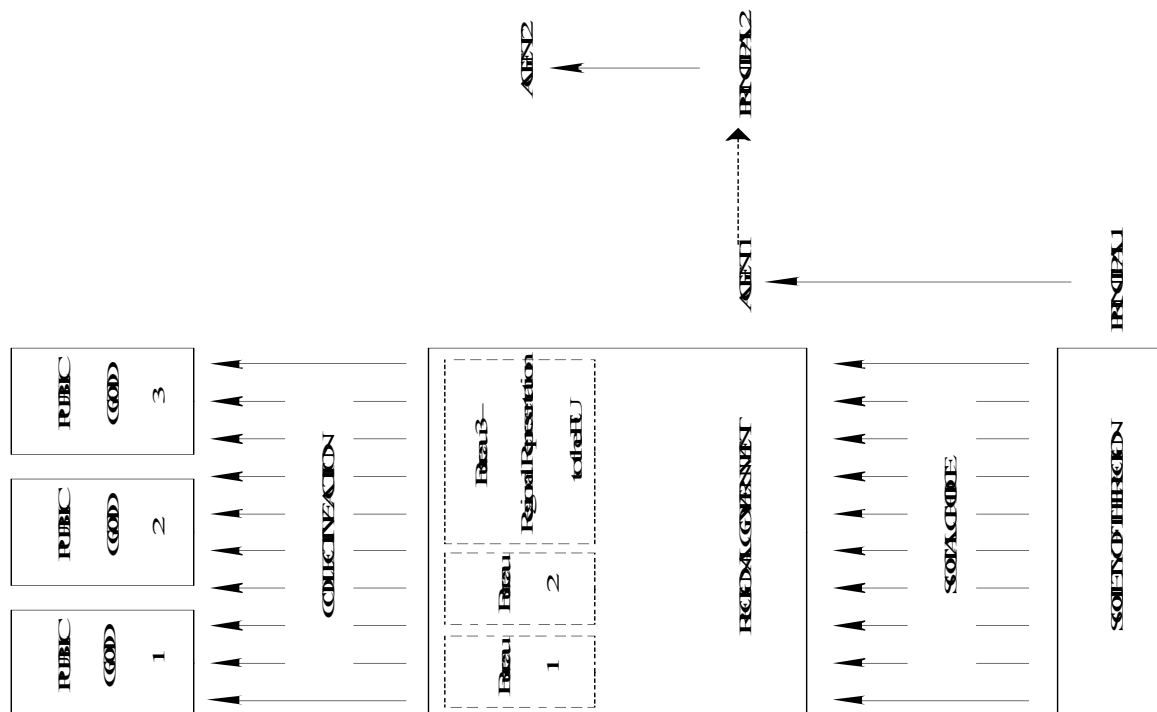


Figure 1. Principal agent relationships within the framework of region

Source: own

There is a procedure of social choice between a society and a government – elections. This part becomes first of two principal agent relationships, where a society is a principal and a government is an agent. They contact usually through media and legal control mechanisms. The contract between them is not explicit – each member of a society (with voting rights) has a right to vote for his or her candidate and therefore states, that this candidate is chosen to be his agent. Through the democratic procedure, a regional government is chosen and we may

¹³S.Gailmard, Multiple Principal and Outside Information in Bureaucratic Policy Making, <http://home.chicago.edu/~gailmard>, 2002

¹⁴M.Klimczak, Przedstawicielstwa regionalne przy Unii Europejskiej jako forma działań publicznych, unpublished, Wrocław 2004.

say (if those procedures are democratic) that chosen representatives should act in the name of the regional interest. Furthermore, regional government becomes principal for its employees – hired representatives to the EU, what creates second level of principal agent relationship.

This set of bonds is easily described through agency theory, enables to study contracts, incentives and control systems and provides detailed description needed by the public choice theory.

Conclusion

The agency theory becomes very useful tool in many various analyses. As it was shown above by a few examples, it enables to solve many emerging problems and allows to study further very interesting topics. In the world, where incompleteness and asymmetry of information is very common, agency theory in many of its variants and modifications provides practical tool of examination. It becomes very useful in analyses of employment or business relations, but, as explained above, it could be utilised in other areas of economics, such as public choice theory. Certainly, it would require some modifications of initial theory, as in the example in the paper, where proper explanation involved formulating a theory of multiple principals together with the analysis of two-staged agency.

Agency theory is still under development. Although most of its fundamental findings originate from the 70s, one can say that a lot can be achieved, especially in the field of its application.