

Predation, Institutional Quality and Economic Growth

Sajawal Khan* and Idrees Khawaja**

Abstract

This study develops a theoretical a model to examine the impact of predation on aggregate output and aggregate consumption. Using game theoretic framework we show that predation, reduces aggregate output and per capita consumption. Predation occurs when some agents enjoy comparative advantage in predation. Given predation under comparative advantage of some agents, a larger part of the aggregate output accrues to the predators. We also demonstrate that given inequality of endowments, the poorly endowed enjoys an incentive to predate. The payoff of the well endowed from production and predation is the same. Therefore the well endowed has no incentive to predate. If the well endowed still predate this would be owed to his comparative advantage in predation rather than inequality *per se*. Large endowments are only one of the numerous sources that afford such comparative advantage. Good institutions like rule of law and effective government tame this comparative advantage. It is due to this kind of taming, that despite significant inequality in some economies, the level of predation observed is relatively low. Institutional quality thus determines the level of predation. We also show that redistribution from well endowed to poorly endowed will not only increase per capita consumption but will also be a ‘Pareto improvement’.

JEL Code: D03; O43; P14

Key words: predation; institutions; growth.

1. Introduction

Large disparity exists among the per capita income of the countries’. World’s average per capita income was USD 9,238 in 2010. The average per capita income of the 20 poorest and the 20 richest countries, in 2010, respectively were: USD 913 and USD 46,734 — the disparity is hard to miss.¹. Thus an average person, living in high income countries of the world is earning about 50 times more than what the average individual earns in low income countries. Pakistan, with per capita income at USD 1,030 stood close to the 20 poorest countries in 2010. Though some of the economies like Korea have shown miraculous economic performance in recent history, many remain stagnant or have even deteriorated over time. Negative correlation between inflation and per capita income growth, which is contrary to conventional wisdom, is a characteristic feature of the poor countries.

¹ The data is from <http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD>.

Moreover while inflation is significantly higher in poor countries the per capita GDP growth in these countries is much lower than that of the high income countries. The questions then are: Why some economies grow slower than others and exhibit low steady state equilibrium? Why convergence does not take place as the conventional wisdom anticipates? Do conventional economic policies which have proved a success in developed economies work in poor countries as well?

These questions remain unsettled despite different theories having been put forth to explain the divergence in economic growth among the economies. Recently the role of institutions and governance, once an ignored topic, has gained currency as an explanation of differences in economic growth among countries and regions (Chang 2010). Better institutions and good governance are the driving force behind high and sustained economic growth. This view dominates all other explanations despite the unsettled debate over the direction of causality between institutions and growth [see for example Acemoglu et al.(2005)and North(2005)]². Traditional policies that have worked well in developed countries have failed to show their magic in the developing and poorer countries. The failure, it is argued, is owed to weak institutions and poor quality of governance, a norm in these countries.

The institutional vacuum that exists in the developing world has provided room for parasitic behavior. The parasites, though enjoying entrepreneurial potential do not contribute to production. They feed themselves on the profits of other entrepreneurs through illegal activities. Though the parasites can be found in industrialized countries, they are more rampant and dangerous in developing countries. These parasites include regular thieves, transformed rebel groups, middlemen, politicians, job shirkers in public sector, rent seekers, free riders and even those who earn more than what they rightfully deserve. In countries like Pakistan activities such as theft, robbery, bribery, *bhatha* (extortion), *chanda* (forced charity) and hoarding etc. are widespread. Such activities typically take place under the umbrella of those who wield *dejure* as well *defecto* power (e.g. powerful political, ethnic and religious groups). The absence or weaknesses of the institutions help flourish all kinds of parasitic activities. Good institutions curb

² The institutions have been defined along a broad spectrum. Most widely cited definition in literature is from North (1981) “a set of rules, compliance procedures, and moral and ethical behavioral norms designed to constrain the behavior of individuals in the interests of maximizing the wealth or utility of principals”. We define Institution more broadly to include the attitude of society or social system governing the overall behavior of society. For (economic) governance we use the definition given by Avinash (2009) “the structure and functioning of the legal and social institutions that support economic activity and economic transactions by protecting property rights, enforcing contracts, and taking collective action to provide physical and organizational infrastructure”.

parasitic activities by effectively protecting property rights, enforcing rule of law and by affording social and economic justice. In Pakistan 15,135 kidnapping, 19,943 robberies, 14,943 burglaries, and 36,023 theft cases were reported only in 2008³. Pakistan's ranking on institutional quality indicators like government effectiveness, rule of law and corruption is below the South Asian average. The country's rankings for government effectiveness and rule of law are close to the rankings of the least developed countries while the ranking for control corruption is even worse than that of the LDC.⁴ A look at per capita growth, inflation and institutional quality across countries suggest that the countries with good institutional quality have higher per capita GDP and lower inflation.

A limited literature attempts to model parasitic behavior that seeks to explain the divergence in growth pattern among different countries and the vicious circle of poverty observed in many countries. These models are mainly derived from Murphy *et al.* (1989) where the degree of industrialization is function of the size of the market and vice versa. Melham *et al.* (2003) embeds predatory activities within a dynamic general equilibrium model of industrialization. Predation in their model lowers profitability of the producers and hence reduces the investment and national income. They show how economies may fall into vicious circle of poverty and predation. Their model also predicts that probability of a society making an exit from the vicious circle depends on the flow of new entrepreneurs into the production club.

³ Source : Federal Bureau of Statistics

⁴Data is available at http://info.worldbank.org/governance/wgi/sc_country.asp

Table1: Per Capita Income, inflation, and Governance Indicators

Indicators	20 richest countries(Average)	20 poorest countries (Average)	South Asian countries(Average)	Pakistan
Per Capita GDP*	USD 46,734	USD 913	USD 3,586	USD 2,674
Per Capita GDP* Growth	4.4%	3.6%	5.9%	3.5%
Inflation Rates	1.4%	6.3%	8.8%	13.9%
Correlation between inflation and Per Capita GDP Growth	0.46	-0.46	0.0007	-0.16
Government Effectiveness	1.55	-0.95	-0.32	-0.77
Rule of Law	1.42	-0.95	-0.42	-0.79
Control Of Corruption	1.67	-0.73	-0.50	-1.10

NOTE: Source: World Bank (these statistics are for 2010 only). Values of institutional quality indicators lie between -2.5 and +2.5.

* GDP per capita based on purchasing power parity

North (1990) argues that the problem of switching institutional path is analogous to technological changes. In this spirit, the increasing returns to institutions due to specialization and accumulation of knowledge make the switching behavior costly and unattractive. Murphy *et al.* (1991, 1993) and Acemoglu (1995) discuss how and when parasitic behavior may yield rewards greater than entrepreneurship. If the institutions are weak it is more likely that more talented individuals will choose to be predators rather than producers. This situation allows for the existence of multiple equilibria within general equilibrium framework. The outcomes would hence be different in different social systems (or institutional set up?) Using this approach number of studies show how a society falls into poverty trap ([for example Acemoglu (1995), Grossman and Kim (1995, 1998 and 2002)]. Grossman (2002) shows that the existence of some

central authority, that enforces property rights, is beneficial for predators as well as for producers. Norris and Freeman (2004) developed a model with endogenous enforcement and showed that identical initial conditions may yield different equilibria depending upon the presence or absence of predation. Nuun (2005) formulates a sequential game, on similar lines, to explain the existence of underdevelopment in Africa. Wilhite (2006) has studied different types of protection against predation by applying agent-based computational economics. Amegashie (2008) shows how unequal income distribution induces predatory behavior in poor segments of society.

The main objective of this study is to develop a model showing how parasitic behavior reduces national income level and its growth through inefficient utilization of existing resources. In this study we have made an attempt to show that how weak institutions cause parasitic behaviour which throws the economy into low growth trap. We also show how inferior technology and low productivity aggravates this situation by increasing the returns of the parasites. More specifically, this paper is an attempt to answer questions like; what are the conditions under which appropriative activities become more lucrative than productive ones and how these activities can be minimized to increase aggregate output and hence social welfare.

Rest of the paper is organized as follows: The theoretical model and its implications under different scenarios are presented in section. Section 3 is devoted to discussion of results and section 4 concludes the study.

2. The Model

The limitation of the general equilibrium models is that these models allocate resources only among different productive activities and assume efficient distribution of output in a perfectly secured environment (Grossman 1998). In practice resources are also allocated to appropriative activities that damage the cause of production. Allocation of resources to appropriative activities is all together ignored in the general equilibrium models. Unfair appropriation of output reduces the rate of return on innovation and therefore discourages investment and technological progress. Given the failure to account for appropriative activities, the general equilibrium models fail to explain non-convergence and the divergence of growth path among the economies of globe.

We consider different scenarios to analyze the impacts of appropriative activities on individuals' consumption and overall welfare of the society. Our model is closer in spirit to Grossman (1998a, 1998b) but is different in the sense that we assume perfectly rational agents fully aware of all outcomes who are more concerned about absolute rather than relative consumption. This assumption rules out the possibility of Pareto sub-optimal equilibrium. Thus our model does not allow for sub-optimal equilibrium.

To examine the influence of parasitic behavior on national income and its growth, we assume that the parasites emerge from the common pool of entrepreneurs and that the parasites feed themselves on producers' profits. To establish the initial settings common to all cases described below suppose there are n potential producers each endowed with Λ_i units which can be used for production as well as predation. Each individual chooses to be either a producer or predator after comparing the level of consumption possible under either of the two activities. Each producer (*say i th*) can produce y_i units of differentiated consumable good. The producer consumes a part of the produce himself and the remaining is exchanged for consumable goods produced by others. The producer maximizes the utility function given by equation (1) subject to the budget constraint given by equation (2).

$$U(c_1, c_2, \dots, c_n) \quad (1)$$

$$C_i = \sum c_j = y_i \quad (2)$$

2.1 Case I: Identical Resource Endowments and Productivity of Agents

Given the initial setting described above, if all potential producers take part in the production process then aggregate output and consumption will be:

$$Y_1 = C_1 = ny_i \quad (3)$$

Now assume that m percent of n persons choose to become predators. The aggregate output and consumption, under some predatory activity will be:

$$Y_2 = C_2 = (n - m) y_i < Y_1 \quad (4)$$

and per capita consumption, will be:

$$c_i = (1 - \phi) y_i < y_i \quad (5)$$

Where $\phi = m/n$

Suppose all the m predators appropriate a portion θ of aggregate output, then the consumption per predator would be:

$$c_j = \frac{\theta}{m}(n - m)y_i \quad (6)$$

and consumption per producer is:

$$c_i = (1 - \theta)y_i \quad (7)$$

The Pay off matrix for the consumption of producers and predators is given in table 2.

Table 2

		Player i	
		Producer	Predator
Player j	producer	$c_i = y_i, c_j = y_i$	$c_i = (1 - \phi)y_i, c_j = c_i = (n - m)y_i$
	predator	$c_i = (1 - \phi)y_i, c_j = (1 - \phi)y_i$	$c_i = 0, c_j = 0$

The payoff matrix, given in table1, shows that in predation the payoff from predation and production is equal but less than case when predation is absent. There being no incentive to predate, predation is not likely to occur irrespective of the value of ϕ i.e. the ratio m/n . Equating consumptions from production and predation i.e. equation (6) and equation (7) we obtain:

$$\frac{\theta}{m}(n - m) = 1 - \theta$$

or
$$\frac{\theta}{1 - \theta} = \frac{m}{(n - m)} \quad (8)$$

Equation (8) states that given identical endowments of the producers and predators, the ratio of share of predators' to producers' in total output is equal to the ratio of number of predators to producers. Though predation is not likely to occur however if does occur than the aggregate output under predation (Y2) would be less than the output under ideal conditions (Y1) [see equation 4]. Similarly per capita consumption under predation would also be lesser (equation 5). The reason is that a part of the output is appropriated by the predator without participating in the production process.

2.2 Case II: Identical Resource Endowments and Same Productive but some Individuals have Comparative Advantage in Predation:

Now assume that some agents enjoy comparative advantage in predation, for example they might have association with a criminal, ethnic group or a politician who may facilitate predation. In this case predator's consumption is not only greater than that of a producer's consumption ($c_i = (1 - \theta)y_i$) but his consumption is also higher than y_i – the consumption of an agent under ideal conditions i.e. under no predation at all. His consumption c_j would be:

$$c_j = \frac{\theta}{m}(n - m)y_i \geq y_i \rangle (1 - \theta)y_i \quad (9)$$

or
$$\frac{\theta}{m}(n - m) \geq 1$$

The parameter $\theta < 1$. From this it follows that $n - m > m$. This means that the number producers must be sufficiently large relative to the number of predators.

or
$$\theta(n - m) \geq m$$

or
$$\theta \geq \frac{m}{(n - m)} \quad (10)$$

and
$$1 - \theta \leq 1 - \frac{m}{(n - m)} \quad (11)$$

Using equation (10) and (11) we obtain:

$$\frac{\theta}{1 - \theta} \geq \frac{m}{(n - 2m)} \rangle \frac{m}{n - m}$$

In this case ratio of the 'shares' of the predators' to producers' in the total output is larger than ratio of the 'number' of predators to producers. In simple terms a small numbers of predators enjoy a larger share of the aggregate output. The pay off matrix for consumption of producers and predators is given in table 3.

Table 3

		Player i	
		Producer	Predator
Player j	producer	$c_i = y_i$, $c_j = y_i$	$c_i = (1-\phi)y_i$, $c_j = (1-\phi)y_i$
	predator	$c_i = (1-\theta)y_i, c_j = \frac{\theta}{m}(n-m)y_i \geq y_i$	$c_i = 0, c_j = 0$

Thus when only some agents (but not all) enjoy comparative advantage in predation, it is profitable for individual i to be a producer and for individual j to be a predator. The agent j is the one who enjoys comparative advantage in predation. The Nash equilibrium in this case is the intersection of second last column and last row of the above table. To conclude, if some agents enjoy a comparative advantage in predation than a small number of predators enjoy a major share of the aggregate output. Moreover aggregate output and per capita consumption would be less than what the output and consumption are under ideal conditions i.e. in the absence of predation.

2.3 Case III: Unequal Resource Endowments

We assume that r of n individuals are well endowed while $n - r$ are poorly endowed with productive resources. This could be due to factors like differences in accumulation of/ access to physical or human capital. We also assume that the well endowed agent produce y_i while the poorly endowed produces αy_i where $\alpha \in (0,1)$.

If all potential producers take part in production process then the aggregate output and consumption will be:

$$Y_1 = C_1 = ry_i + \alpha(n - r)y_i$$

or
$$Y_1 = C_1 = [r + \alpha(n - r)]y_i$$

Here
$$c_i = \begin{bmatrix} y_i & \text{if well endowed} \\ \alpha y_i & \text{if poorly endowed} \end{bmatrix}$$

Now suppose l and s are respectively well endowed and poorly endowed agents and both choose to become predators. The aggregate output then is:

$$Y_2 = C_2 = [r - l + \alpha(n - r - s)]y_i \langle Y_1 \quad (12)$$

Also assume that all m predators appropriate a portion θ of aggregate output. The consumption per predator would then be:

$$c_j = \frac{\theta}{m} [r - l + \alpha(n - r - s)]y_i \begin{bmatrix} \langle y_i \\ \rangle \alpha y_i \end{bmatrix} \quad (13)$$

Here $m = l + s$. It is apparent from equation 13 that predation is not profitable for well endowed agent because consumption for them is the equal from predation and non-predation. This result is analogous to case 1 discussed earlier. However, the poorly endowed individual can appropriate more from predation as compared to what he obtains from production. Therefore all well endowed agents prefer to be producers while all poorly endowed agents prefer to be predators⁵.

Under unequal endowments, $l = 0, (n - r = s)$. Therefore equation (12) can be written as:

$$Y_2 = C_2 = ry_i \langle Y_1$$

$$c_i = (1 - \theta)ry_i \quad c_j = \frac{\theta}{s} ry_i$$

For predation to be profitable:

$$c_j = \frac{\theta}{s} ry_i \begin{bmatrix} \leq (1 - \theta)y_i \\ \rangle \alpha y_i \end{bmatrix}$$

This implies:

$$\frac{\theta}{s} r \rangle \alpha \quad (14)$$

Equation (14) implies that smaller the value of α i.e. larger the differential between well endowed and poorly endowed and smaller the ratio of poorly endowed to well endowed, the more profitable will it be for the poorly endowed to predate. The payoff matrix, under unequal endowments, is given in table

⁵ To keep the analysis simple we have fixed the differential between endowments of well endowed agents and poorly endowed agents.

Table 4

		Player i	
		Producer	Predator
Player j	producer	$c_i = c_j = \begin{bmatrix} y_i & \text{if well endowed} \\ \alpha y_i & \text{if poorly endowed} \end{bmatrix}$	$c_i = \frac{\theta}{m} [r - l + \alpha(n - r - s)] y_i$ $c_j = \begin{bmatrix} (1 - \theta) y_i & \text{if well endowed} \\ \alpha(1 - \theta) y_i & \text{if poorly endowed} \end{bmatrix}$
	predator	$c_i = \begin{bmatrix} (1 - \theta) y_i & \text{if well endowed} \\ \alpha(1 - \theta) y_i & \text{if poorly endowed} \end{bmatrix}$ $c_j = \frac{\theta}{m} [r - l + \alpha(n - r - s)] y_i$	$c_i = c_j = \mathbf{0}$

It follows from this that poor outcomes commonly attributed to the predatory activities of the rich and to inequality are not attributable to inequality *per se* because, *citrus Paribas*, well endowed individuals do not have an incentive to engage in predation. How, then, we explain the observed fact that well endowed individuals do engage in predation. It is noteworthy, in this context, that the outcome just described considers only unequal endowments. If unequal endowments are considered together with comparative advantage in predation then the outcome would be different. Intuitively it is not difficult to visualize that, if unequal endowments are coupled with comparative advantage in predation, then the well endowed would enjoy an incentive to predate. This case has not been included with rigor to avoid the complexity of analysis.

2.4 Collective Safeguard against the Appropriative Activities

a) Identical resource endowments, some individuals have comparative advantage in predation.

Suppose a central authority exists which provides protection to producers from appropriative activities and each producer pays a portion say $\mu \in (0,1)$ to buy protection. The cost of protection is increasing in ratio of the number of predators to producers i.e. $\frac{m}{n - m}$, output. Let us further assume that⁶:

⁶ To simplify we ignore here the possibility of free riding.

$$\mu = \kappa \left(\frac{m}{n-m} \right) \quad (15)$$

Where $\kappa \in (0,1)$ is the speed/scale parameter. Let p be the probability that predator will be successful i.e. will predate but will escape penal action of any sort. Then the expected consumption of the predator and producer are given by:

$$c_j = p \frac{\theta}{m} (n-m) y_i$$

$$c_i = p(1-\theta)(1-\mu) y_i + (1-p)(1-\mu) y_i$$

Now equating consumption from predation and consumption from production and making use of equation (15) we obtain:

$$(p\theta - 1)\mu^2 - (p\theta - 1)\mu - p\theta\kappa = 0$$

or

$$\mu = \frac{1}{2} \left\{ 1 - \sqrt{1 - \frac{4p\theta\kappa}{1-\theta p}} \right\} \quad (16)$$

We can discard the root with positive sign because μ cannot be greater than 1. Equation (16) then implies that larger is the probability of successful predation (i.e. predating without facing penal action from any quarter) the higher will be the cost borne by the producer and lower will be aggregate consumption and social welfare.

b) Unequal Resource endowments:

The protection cost of poorly endowed agent is given by:

$$\mu_l = \kappa_l \left(\frac{s}{r} \right) \quad (17)$$

The expected consumptions of the poorly endowed individual from production and predation, under this scenario, respectively are:

$$c_i = p(1-\mu_l)(1-\theta)\alpha y_i + (1-p)(1-\mu_l)\alpha y_i \quad \text{And} \quad c_j = p \frac{\theta}{s} r y_i$$

Equating the consumption from production and predation and making use of equation. (17) we obtain:

$$\alpha(p\theta - 1)\mu_l^2 - \alpha(p\theta - 1)\mu_l - p\theta\kappa_l = 0$$

or

$$\mu_i = \frac{1}{2} \left(1 - \sqrt{1 - \frac{4p\theta\kappa_i}{\alpha(1-\theta p)}} \right) \quad (18)$$

Equation (18) is same except that the endowment differential parameter appears under the square root sign. This means that larger the value of α i.e. smaller the endowments differential, lower will be the protection cost borne by poorly endowed. The cost is even less than what the agents bear when the endowments are identical (case a). This is because the well endowed have a greater share in production and therefore bear greater protection cost.

2.5 Redistribution of Resources:

Let us assume that the central authority to redistribute resources rather than spending on protection against predation. This could be through public spending on education of the poor or providing training to them to enhance their productivity.

Suppose a portion $\mu < \theta$ of each of the well endowed agent's wealth is redistributed equally among the poorly endowed individuals so that consumption of both type of agents is equalized.⁷

We then have:

$$(1 - \mu)y_i = \left(\alpha + \mu \frac{r}{s} \right) y_i$$

Or

$$\mu = 1 - \alpha \left(\frac{s}{r + s} \right) = 1 - \alpha \left(\frac{s}{n} \right) \quad (20)$$

In equation (20) the proportion redistributed depends on the endowment differential (between well endowed and poorly endowed) and the share of poorly endowed in the total population. The redistribution not only results into high per capita consumption but is 'Pareto improvement' as well.

3. Discussion

We examined the impact of predation on aggregate consumption and output under three different scenarios: (i) all agents have identical endowments and productivity (ii) agents have identical endowments and productivity but some agents enjoy comparative advantage in predation (iii) endowments of the agents are unequal. Next we examined the cost of protection against

⁷ Redistribution is possible only in the case of unequal endowment.

predation under different scenarios and finally we demonstrated how aggregate consumption and output behaves in the face of redistribution from the well endowed to the poorly endowed.

The theoretical model suggests that given identical endowments and productivity of the agents, in the absence of protection against predation, the level of consumption from production and predation will be equal but the output and consumption will be less than what the two would in the under no predation at all. Given the equal payoffs from production and predation, there is no incentive to predate and therefore predation is less likely. This case is analogous to a competitive environment. The main feature of the next case that we examined is that some agents enjoy comparative advantage in predation. Agents are still assumed to possess identical endowments and productive capacity. We demonstrated, under this setting, that in the absence of collective safeguards against predation, it pays those with comparative advantage in predation, to predate. However predation is not beneficial for others. We also showed that a greater part of the output under this scenario accrues to the predators. It is noteworthy here that richness is only one source of yielding comparative advantage in predation. There are number of other sources as well. In fact all sources of rent seeking yield the requisite comparative advantage. Examples include; closeness to *dejure* power who may influence outcomes in favour of some agents, *defecto* power enjoyed by criminals, and all those who somehow enjoy the ability to solve some collective action problem. Politicians, spiritual leaders and number of other individuals enjoy this ability. Next we demonstrated that given unequal endowments it is beneficial for poorly endowed agents to engage in predation but not for the well endowed. This raises the question how we may explain the common observation that well endowed agents (rich in this case) do, in fact, engage in predation. The answer is that predation is not due to endowments differential (richness) *per se*, rather it is owed to the comparative advantage enjoyed by the agents in predation. It is another matter that more commonly the rich enjoys the requisite comparative advantage however they are not the only ones enjoying such advantage. We also showed that a central authority can provide protection against predation. We demonstrated that if some agents enjoy comparative advantage in predation, the cost of protection for producers will increase with increase in probability of predation. Moreover aggregate consumption and social welfare will decrease, with increase in probability of predation. Finally we demonstrated that redistribution from the rich to the poor increase per capita consumption and is ‘Pareto improvement’

The most important result of this study is that it is not the inequality *per se* that encourages predation rather it is the comparative advantage in predation, which has many sources, that allows predation. Good quality institutions, like rule of law, effective government, security of property right and effective control over corruption can tame the comparative advantage that any agent may enjoy in predation. The lesser degree of predation observed in countries with high inequality but with good institutions supports this statement. The United States perhaps serves as an example to support this statement. Thus it is the institutional quality that determines the level of predation.

4. Conclusions

Predation reduces aggregate output and per capita consumption. Those who predate enjoy comparative advantage in predation. Given inequality poorly endowed will predate, on the other hand, the payoffs from production and predation being equal for the well endowed, the well endowed will not predate. However if the well endowed (implying rich here) engage in predation, it would be due to their comparative advantage in predation and rather than the inequality *per se*. Good institutional quality, like rule of law, effective government, protection of property rights and control over corruption, curbs this comparative advantage and hence predation. Thus institutional quality determines predation. Therefore to increase output improvement in institutional quality is called for. Moreover redistribution from the well endowed to the poorly endowed also increases per capita consumption and is a ‘Pareto improvement as well.

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Comparative adv and unequal resource.....probability....predators