BARGAINING WITH A HETEROGENOUS PLAYER: AN APPLICATION TO THE GATT URUGUAY ROUND

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by

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Abstract

The paper analyzes a situation in which negotiations take place between a party made up of a single decision maker and a party made up of a group of two decision makers. This group, in setting its negotiating proposal to the opponent party, may act cooperatively or non-cooperatively within itself. The model seems to be applicable to many cases, such as wage negotiations with a group of different workers' unions, disarmament negotiations with a group of allied countries, etc. In the paper, however, the model is directly applied to the case of the Uruguay Round of GATT negotiations. In that case the authors' conjecture is that much of the difficulties currently experienced in reaching an agreement stem from the often non-cooperative nature of the preliminary agreement that is necessary within the European Community before it is able to come up with a definite proposal for negotiation with other countries.

1. **Introduction**

The prolonged and frustrating Uruguay Round of GATT negotiations has baffled most observers for the apparent difficulty in reaching a satisfactory outcome in reasonable time. The centre of the conflict appears to be located in the confrontation between the United States and the European Community on the respective agricultural policies, with the European Common Agricultural Policy (CAP) as the main culprit.

While on the European side the deadlock is often imputed to the US reluctance to accept the negotiating weight of the EC, it is also clear that much of the difficulty arises from the fact that, while the US comes to the negotiating table as a unified party, the EC first has to agree on a negotiating platform among its members. The process leading to this platform is not always a cooperative one and, in any case, it appears that, by the time a compromise is reached, the room for manoeuvre left to EC negotiators at the GATT level is much less than the one available to the opposite parties, lest the whole process of negotiation at the EC level has to be reconsidered.

Now, a superficial appraisal of this predicament would lead one to conjecture that it is in the interest of the party opposed to the EC that the compromise at the EC level be reached in a non-cooperative way, so as to be able to exploit at its own advantage the potential rifts among EC members during the process that leads to such a compromise. However, at least with respect to the frustrating negotiations currently under way and their deadlock in waiting that the EC first reaches a common position on reforming its CAP, our conjecture goes in the contrary direction: we submit that in some important cases (like the one of trade negotiations), it may be in the interest of a negotiating party that its opposing party comes to the negotiating table with a proposal reached cooperatively rather then non-cooperatively.

One other such case where this conjecture appears well grounded concerns the current worries by NATO countries, and in particular by the US, that the disintegration of the former USSR may endanger the results obtained by negotiating on disarmement with the integrated USSR. Clearly this is a case in which the unified party (the US) has an interest in negotiating with an internally cooperative rather than non-cooperative opponent group.

Other examples, where however the sense of the conjecture is less clear, are wage negotiations conducted between a unified representation of entrepreuners, or the Government

in case of public employees, and a more or less scattered group of trade unions[1]. Think also of the negotiation between Israel and an Arab coalition. And so on and so forth.

Thus, in many situations each of the parties engaged in the stipulation of a contract or in a bargaining process comprises several sub-parties, whose preferences may not be in complete agreement. This paper studies the simplest such situation, that is one with three agents, two of which constitute a party. In our model the scene is dramatically simplified. We assume that three parties A (France), B (Germany), C (the US), have to agree on the value of a variable, in the following way. Firstly, A and B, as members of a single "union" E (for Europe) have to come up with a proposal; then party C decides whether to accept this proposal or not. A and C have opposite preferences on the possible outcomes (e.g. on negotiations on agricultural policies). The difference between A and B is that the former is directly interested in the specific outcome of the agreement, if any, while the latter is only interested in whether there is an agreement or not. More precisely, B prefers a situation in which an agreement is reached to a situation in which C rejects E's proposal. However, in the case of C's acceptance, B is indifferent between all values of the variable.

While clearly a very incomplete picture of the actors and their stand in the current GATT negotiations, the idea behind such a formulation is more generally applicable. In fact often a union has to bargain with an outside party over issues that are of direct concern only to some of its members. Still, those members who are not directly interested in the issues are likely to care that the bargaining process does not end in a breakdown. To revert to the EC vs. US case, our caricature representation hints to the fact that Germany is mainly interested in trade in manufactures, while France has a substantial interest in agricultural products; and that Germany, while relatively indifferent to the outcome of negotiations on the latter, may be worried that a negative outcome may call for US restrictions on German exports of manufactured products[2].

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[1]Horn and Wolinsky (1988) consider a game in which a firm faces either a unified union for its different type of workers or separate unions for them, and show that the outcome depends, among other things, on the relations of substitutability or complementarity between the different groups of workers. See also Davidson (1988), where, contrary to our results, industrywide bargaining always results in higher wages.

[2]A more satisfactory model from this point of view will require a specification of different products, their consumption, and trade, and the specific use of retaliation on the part of at least one country (C in our example).

Thus, one main reason why the members not directly interested in the issues still care about the possibility of a breakdown may be that the very bargaining procedure is structured in such a way that a breakdown over one issue entails a failure in all the others, of interest to the remaining members. This is the case when the opposing delegation just "walks out". As another example, in many countries labour negotiations are conducted by a union that represents different categories of workers. Obviously, members of trade "a" will not be intrinsically interested in the wage level decided for trade "b"; but, lest the whole negotiation process collapses, they will hope that *some* agreement is reached, and act consequently.

A second main reason for our assumption is that a member of a union may at least partially identify with the union in abstract, if not with any of the other members; so that the failure to reach an agreement, constituting a failure of the union, enters negatively in the member's payoff. This may be especially the case, for instance, for different "wings" of a political party, or for any other coagulation of interests broadly based on an ideology.

We do not claim, of course, that the above assumptions constitute the only, or even the "normal" case of the problem at hand, although we do believe they constitute at least a significant aspect of it[3].

2. The model

Members A and B choose a proposal $t \in [0,1]$. Party C may accept or reject the proposal. The rejection is definitive. Let the (Von Neumann-Morgenstern) utility that B derives from the acceptance (resp. rejection) of any proposal t be equal to b (resp. zero). Let A's utility function be denoted by $a(t)$ and normalize to zero the level of utility that A derives from the rejection of any proposal t. We will need to hypothesize the possibility of interpersonal comparisons of utility *differences*, so that A's and B's utility must be expressed in the same units (even though their zero points need not necessarily be comparable). This will mean, in particular, that when we talk for example of "a change in b" we will mean "a change in b relative to A's utility".

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[3]As it now stands the model, taken from Mariotti (1992), is simple but sufficiently tractable. A more extended version is forthcoming in Basevi, Delbono, Mariotti (1992).

Since we are interested in this paper in A's and B's choice problem, we will not model C's problem explicitly, but assume directly that C has a reservation value $t_c \in [0,1]$ such that if $t>t_c$ the proposal is rejected, whereas if $t_c \geq t$ the proposal is accepted. A and B do not know with certainty this reservation value, and attach probability F(t) to the event $t_c \leq t$. Therefore, from the point of view of A and B, the probability that a proposal t is accepted by C is $p(t)=1-F(t)$.

We will make the following assumption troughout:

Assumption 1:

$a(t) \geq 0$ for all t.

This assumption is not as trivial as it may seem, although it is surely reasonable, given its interpretation. In particular, it should be noticed that it is not a normalization. We have already normalized A's utility by setting the utility from a rejection equal to zero. What Assumption 1 says, then, is that the acceptance of any proposal is not worse than the failure of reaching an agreement with C. In this sense, it could be called the "no bluff" assumption.

Assumption 2:

(i) the function $a(t)$ is twice differentiable and increasing, with $-a''(t)/a'(t)>1/t$;

(ii) the density $F'(t)$ is finite for all t and single-peaked.

Assumption 2(i) is restrictive, but not necessary. It is the simplest regularity condition one can think of, that is sufficient to avoid multiple equilibria; many others would do. It imposes a lower bound on the curvature of $a(t)$. Since $a(t)$ is a utility function, $-a''(t)/a'(t)$ is the Arrow-Pratt index of risk aversion. The assumption can thus be interpreted as saying that A must be sufficiently risk averse. Assumption 2(ii) is quite trivial.

We wish to answer essentially four questions:

(1) How does the equilibrium depend on the *procedure* used by A and B to formulate a common proposal?

Given a certain procedure,

(2) How do A's and B's *beliefs* on C's behaviour affect the decision?

(3) How do A's and B's *preferences* affect the decision?

(4) How does the *union* with B modify the proposal with respect to the situation where A alone (the party in the union that derives utility directly from t) is deciding?

Questions (2), (3) and (4) are standard comparative statics exercises. In order to answer question (1) we will consider two procedures within E. The first one consists in proposing the value of t that maximizes the *sum* of of A's and B's expected payoffs. The second one consists in proposing the value of t that maximizes the *Nash product* of the expected payoffs.

The former solution should be viewed as an expression of "cooperative" behaviour on the part of A and B. In this case E has the nature of a cartel. Its members want to maximize the total payoff of the cartel without worrying about the question of "to whom" the utility goes. In other words, the type of reasoning involved in this procedure is the following. Suppose A and B are considering whether a proposal t' is better than a proposal t: they will judge this to be the case if, and only if, either of the two members benefits more out of the move from t to t' than the other loses. An alternative interpretation of this procedure is that decisions are taken in E by a central authority, who calculates E's welfare by means of the sum of its members' utilities. In this case, too, the procedure can be interpreted as "cooperative".

The Nash procedure, on the contrary, is the expression of a non-cooperative behaviour. A and B will each bargain over the proposal with the aim of obtaining the maximum own utility, without caring about the other's level of welfare.

3. **The cooperative union case**

The proposal by the union E will consist of a solution c^* to the following problem:

$$\text{Max } u(t) = a(t)p(t) + bp(t)$$

At an interior maximum c^*, it must be that

$$a'(c^*)p(c^*) + (a(c^*) + b)p'(c^*) = 0$$

It is convenient to rewrite this first order condition in terms of elasticities:

$$-\pi(c^*)=\alpha(c^*)k(c^*)$$

where $\pi(t)$ and $\alpha(t)$ are the elasticity functions of p(t) and a(t), respectively, and

$$k(t)=a(t)/(b+a(t)).$$

We can then state the following:

Proposition 1:

the problem has a unique solution.

Proof: notice first of all that $p(0)=1$, $p(1)=0$, $p'(t)<0$ and, because of assumption 2(ii), $p'(t)$ is finite. Then $-\pi(0)=p'(0)0/1=0$ and $-\pi(1)=p'(1)1/0=\infty$. Moreover, calculations show that

$$\pi'(t)=[tp''(t)+p'(t)(1-\pi(t))]/p(t).$$

Since $p'(t)<0$, $\pi(t)<0$. Because of assumption 2(ii), $p'(t)$ can have at most one stationary point. Therefore $p''(t)$ can change sign at most once and, as a consequence, so does $\pi'(t)$. We want now to show that it has to be $-\pi'(t)>0$ for all t. Since $-\pi(0)=0$ and $-\pi(t)\geq 0$ for all $t>0$, $-\pi'(0)>0$. If there was t' such that, for $t>t'$, $-\pi'(t)<0$, then $-\pi(t)$ would be bounded from above, contradicting $-\pi(1)=\infty$. We can conclude that $-\pi(t)$ is a strictly increasing function. Now consider $k(t)\alpha(t)$. Calculations show that

$$(k(t)\alpha(t))'<0 \quad \textit{iff} \quad (b+a'(t))[ta''(t)+a'(t)]-t(a'(t))^2<0.$$

It follows from assumption 2(i) that $k(t)\alpha(t)$ is a decreasing function. Since $k(0)\alpha(0)\geq -\pi(0)=0$, the proposition follows.

In Fig.1 we present the graph of the functions underlying Proposition 1: point P is the unique solution stated in the proposition.

Let t^* be the value of t that A would choose alone. That is, letting $c^*(b)$ be the cooperative solution expressed as a function of b, $t^*=c^*(0)$. Then, given the monotonicity of $k(t)\alpha(t)$ and $\pi(t)$ and the f.o.c. of the problem, it is straightforward to verify the following comparative statics statements:

Proposition 2:

(i) $t^*>c^*(b)$ for all $b>0$;

(ii) if the function $\pi(t)$ is shifted up for all t, then c^* decreases;

(iii) if the function $\alpha(t)$ is shifted up for all t, then c^* increases.

The interpretation of these results is quite intuitive. While A is willing to trade off some "safety" for an increase in t, B cares only for safety. Since in the cooperative solution A must take into account B's preferences, the presence of B in the union has the effect of decreasing what would be the optimal proposal for A alone. Moreover, the more sensitive A is to a change in t, the more the union as a whole will be willing to risk in the choice of the proposal, and therefore the higher the optimal proposal. And, finally, the more "sensitive" C is believed by E to be to changes in t, the less E will be willing to risk with their proposal, so that the lower will c^* be. It is worth noting that a shift of probability mass from lower to higher values of t_c (in a certain interval) has no effect per se. What matters is the *sensitivity* of $p(t)$ with respect to changes in t.

In Fig. 2.1, 2.2 and 2.3 we show the graphical representations of the three statements in Proposition 2. These statements might be applied to some current problems of GATT negotiations that were recalled in the Introduction.

In particular, Proposition 2(i) suggests that the larger is the value that Germany (as representative of the EC members that are most interested in manufacturing exports and thus

more likely to be damaged by a failure of the GATT negotiations) attaches to the US leaving the bargaining table, the lower will be the protective measures offered by the EC on agricultural products (of interest to France, as the country representative of the EC members most supportive of the CAP).

Similarly, Proposition 2(ii) may be referred to the tendency to come to an agreement on the part of the EC with the US on agricultural trade, when the EC started to realize that the probability of the EC proposal being accepted by the US was decreasing with the approaching of the electoral campaign in the US and thus moderated its bargaining proposal.

Proposition 2(iii) might be applied to the higher sensitivity that under, say, an election period the French Government may have to the interest of its agricultural producers, and thus the greater difficulty in reaching an acceptable (to the US) proposal on agricultural trade in such a period.

4. The non-cooperative union case and comparison with the cooperative case

We assume that disagreement payoffs are equal, for both A and B, to the payoffs obtained in case of a rejection on the part of C, which had been normalized to zero. Then an optimal proposal n^* will be a solution to the problem:

$$\text{Max } u(t) = ba(t)p^2(t)$$

with respect to t. At an interior solution n^* the first order condition can again be expressed in terms of elasticities:

$$-\pi(n^*)/\alpha(n^*)=1/2.$$

It is easy to calculate that a sufficient condition for $\alpha'(t)$ to be negative is that

$$-\alpha''(t)/\alpha'(t)>(1-\alpha(t))/t.$$

Since $\alpha(t) > 0$ this condition is satisfied because of assumption 2(i). From the analysis carried out in the proof of Proposition 1 we can then conclude:

Proposition 3:

the bargaining problem has a unique solution.

Notice that such a solution does not depend on the value of b. That this was the case was obvious "a priori", upon the observation that the Nash solution must be invariant with respect to linear transformations of the payoff functions. Again, it is straightforward to see that the following holds:

Proposition 4:

(i) if $\pi(t)$ shifts up for all t, then n^* decreases;

(ii) if the function $\alpha(t)$ shifts up for all t, then n^* increases.

Note that the comparative statics results of Proposition 4 are analogous to those derived for the cooperative solution. The interpretation, however, is different. Take, for example, the effect of a global increase in $\pi(t)$. In the cooperative case, the reason why c^* decreases is that, by reducing the value of the proposal, both A's and B's utilities are increased, so that the union as a whole increases its utility. In the bargaining case, though, the reason why n^* decreases is that with an increased risk of rejection on the part of C, A is more willing to make a concession in the bargaining process, and B takes advantage of this[4]. Similarly, a global increase in A's sensitivity to t (i.e. an increase in the function $\alpha(t)$) increases the ability of the union as a whole to derive utility from increases in t; whereas the same global increase will increase A's power to stick to its own terms in a non-cooperative intra-union bargain.

Finally, upon inspection of the f.o.c. of the cooperative union case, it is clear that as b goes to infinity $c^*(b)$ goes to zero continuously, and as b goes to zero $c^*(b)$ goes continuously to one. Furthermore, $k(t)$ is a positive function bounded above by 1, which implies that $k(t)\alpha(t)$ lies always below $\alpha(t)$. By comparison of the f.o.c. in the two cases it is not difficult then to derive the final result of this section:

Proposition 5:

(i) $c^*(0)>n^*$;

(ii) there exists a unique b' such that $c^*(b')=n^*$ and $c^*(b)<n^*$ for all $b>b'$.

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[4]It is well-known that Nash's model is mathematically equivalent to Zeuthen's model, cast in terms of "concessions". See, e.g., Harsanyi (1977).

In Fig. 3.1 and 3.2 we show the graphical representation of Proposition 5.

Thus the proposal decided by a cooperative union will be higher or lower than the one decided by means of a non-cooperative union, depending on the value B attaches to reaching an agreement (relative to A's payoffs); and there is a unique such value that equates the two proposals. Moreover, the proposal made by A alone will always be higher than the one emerging from the bargaining with B.

Unlike the previous ones, the result of this Proposition (and in particular that of 5(ii)) is perhaps surprising. On the basis of a hasty analysis, one might have conjectured that, since the interests of E's members are partially opposed, when the union's proposals are decided upon by means of non-cooperative bargaining, "competition" between A and B would lead to more moderate proposals relative to the situation in which A's needs are viewed sympathetically by B. And, if not surprising, the result is surely less clearly expected than some of the others. But the explanation is clear, if subtle. When E's procedure is cooperative, either member partially "internalizes" the other's view, while in the non-cooperative case either member takes into account the other's preferences in deciding how "tough" to be, but still judges the outcome on the basis of its own preferences. If B's preference for an agreement is very strong relative to A's disliking of low proposals, this will surely make it more difficult for A to obtain a concession from B in a bargaining process. But, in the cooperative case, this will in fact almost identify B's preferences with those of the union or those of E's central authority. And the opposite occurs reversing the relative strength of the preferences. This has the consequence that, while the Nash bargaining always strikes a compromise between different views, in a cooperative setting the solution may be an "extreme one", in either direction.

5. Concluding remarks

This paper has established, under fairly general conditions, the following. Suppose that you are waiting for a proposal from a union composed of two members, and that your interests are in opposition to those of the union. Then you should be happy if one of the union's members is mainly concerned that an agreement is struck, rather than in what kind of agreement is struck. You should also be the happier the more sensitive they believe you

to be to changes in their proposal. However, you should not necessarily be happy if the members of the union settle their different views in a non-cooperative, as opposed to cooperative, way: you will not always gain from competition within the union. If a member cares sufficiently little about the proposal and is only keen that you accept it, and there is a "friendly atmosphere" within the union, the proposal you will receive may be more favourable to you than the one agreed on the basis of an "unfriendly" procedure within the union.

With reference to the Uruguay Round of GATT negotiations, a suggestion of this paper is that the difficulty to converge to an acceptable solution may be due to the non-cooperative character of the intra-EC negotiations that lead to the formulation of a common EC proposal on agricultural policies.

Within our framework, we managed to obtain our results without imposing very strong restrictions. What is restrictive is perhaps the framework itself. In particular, we are interested in extending the analysis in two directions. The first would model the behaviour of the third country in order to capture the possibility of retaliation, and one that would differently affect the different members of the union. The second would aim at describing the extensive form of the actual game taking place both within the EC and, within the GATT, between the EC and the other parties. In particular this requires, rather than a fixed probability attributed to the other party's acceptance, a learning process whereby, through a sequence of rejections, the EC can update its beliefs. This is the subject of our ongoing research.

Figure 1: Proposition 1

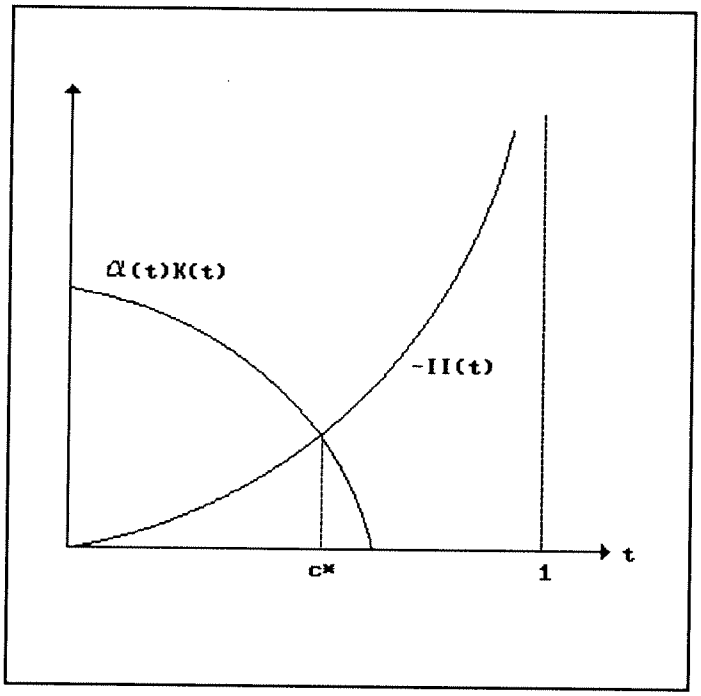


Figure 2.1: Proposition 2(i)

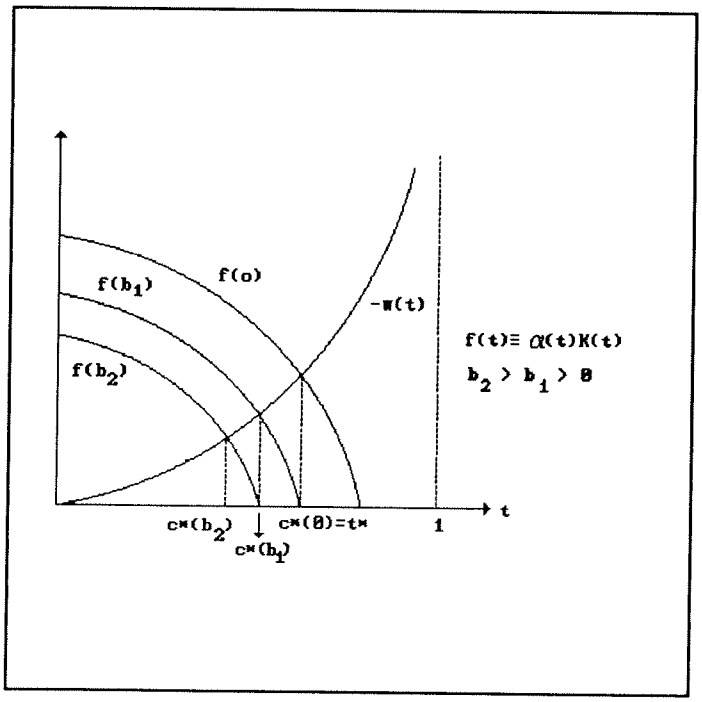


Figure 2.2: Proposition 2(ii)

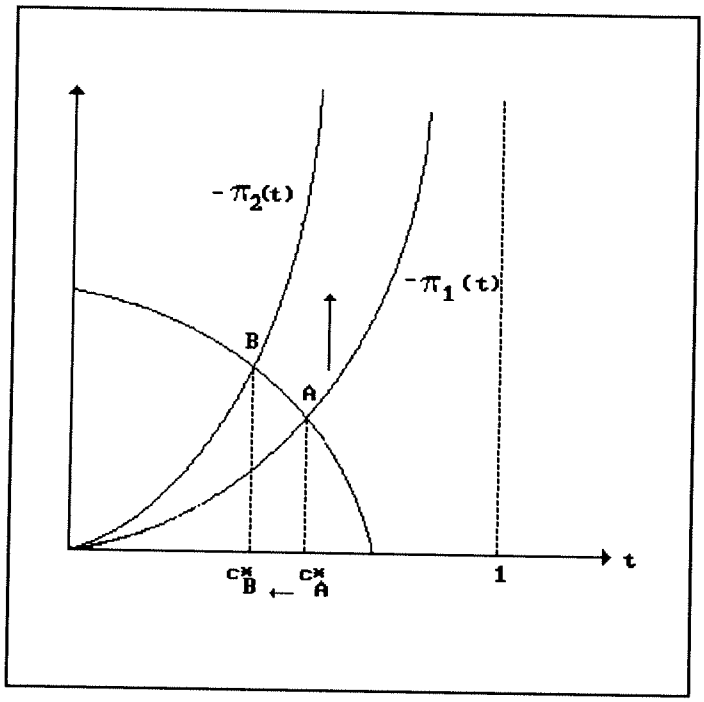


Figure 2.3: Proposition 2(iii)

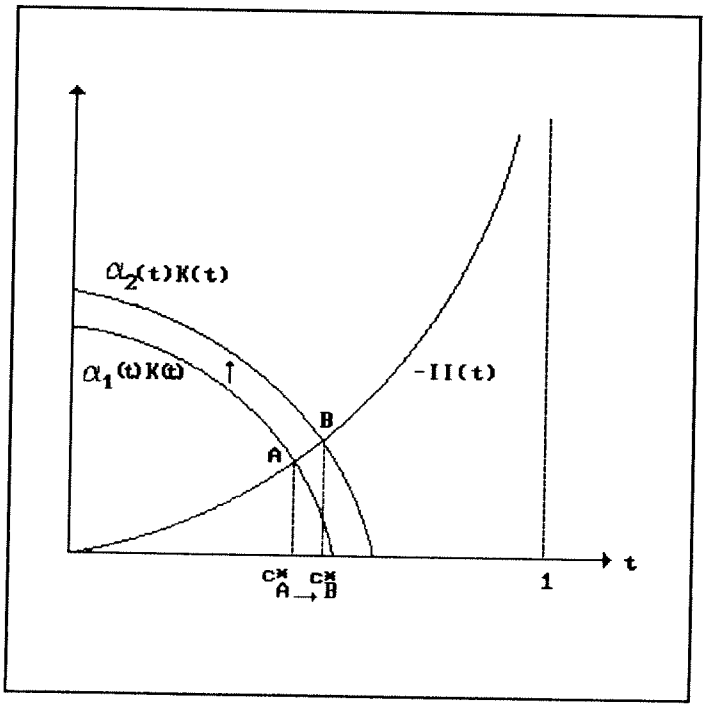


Figure 3.1: Proposition 5(i)

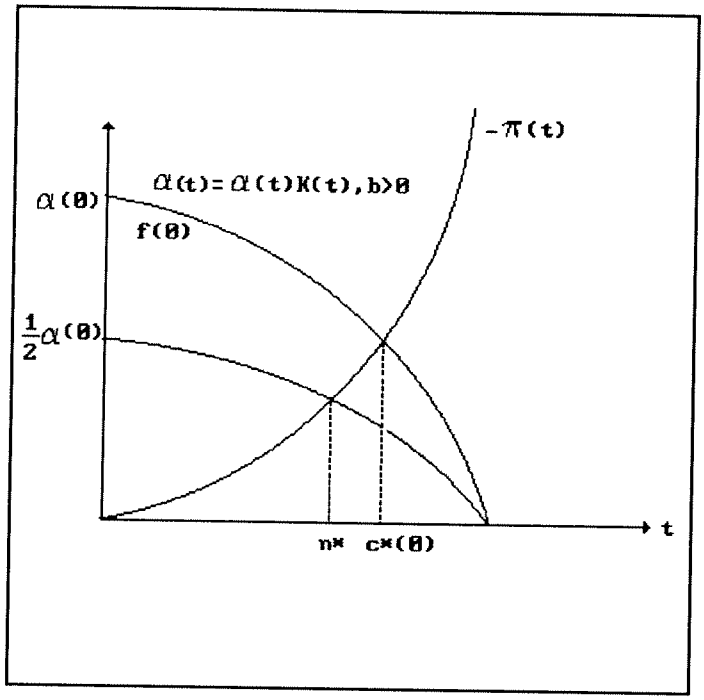
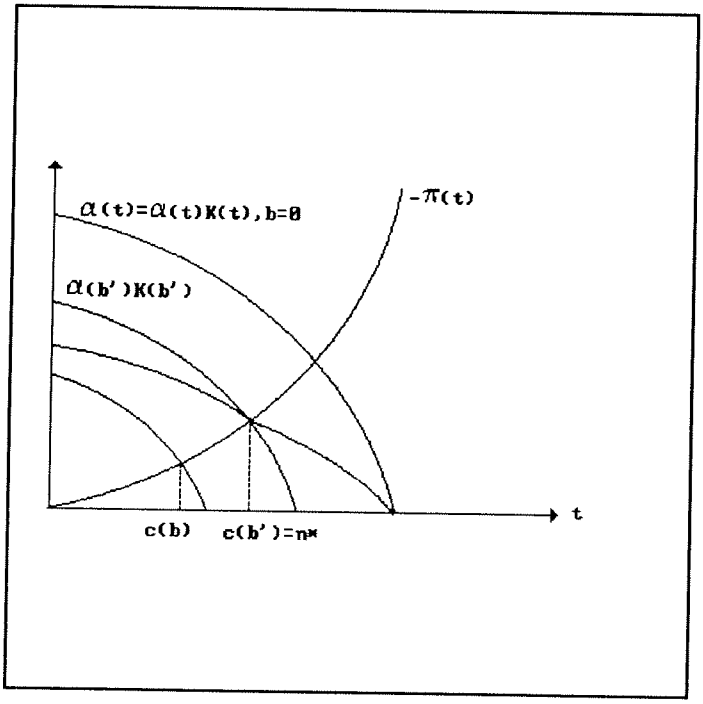


Figure 3.2: Proposition 5(ii)



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