Centre de recherche sur l'emploi et les fluctuations économiques (CREFÉ)

Center for Research on Economic Fluctuations and Employment (CREFÉ)

Université du Québec à Montréal

Cahier de recherche / Working Paper No. 132

Tax Harmonization versus Tax Competition in Europe: A Game Theoretical Approach *

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April 2001

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* Warin wishes to thank the CREFE for financial support and its generous hospitality. Thanks also to Steve Ambler, Louis Phaneuf and seminar participants at the Université du Québec à Montréal for helpful comments. The usual caveat applies.

Résumé:

L'objet de ce papier est d'utiliser une approche en terme de théorie des jeux afin d'étudier les questions d'harmonisation ou de compétition fiscale au sein d'une union monétaire. Plus spécifiquement, cette étude concerne l'Union économique et monétaire et le risque de « guerre d'usure ». Les arguments traditionnels sont d'une part que sans harmonisation, des comportements de « free-riding » peuvent apparaître, menant à un équilibre sous optimal en matière de politique fiscale, et d'autre part que la compétition peut aussi être à l'origine de problèmes importants en matière d'équilibre budgétaire. Mais l'autonomie fiscale a un avantage majeur. Lorsque la politique monétaire n'est plus du ressort des pays et lorsque la politique budgétaire est contrainte par le Pacte de stabilité et de croissance, l'instrument fiscal devient le dernier outil macro-économique à la disposition des gouvernements pour absorber les chocs asymétriques. Le modèle proposé est construit sous deux horizons. Si l'horizon est fini, les conclusions traditionnelles de la littérature en faveur de l'harmonisation sont représentées. Avec un horizon infini, les joueurs prennent en compte les coûts de dévier et d'entrer dans une guerre d'usure. La coordination apparaît alors sans qu'il y ait besoin d'un mécanisme institutionnel pour la forcer.

Abstract:

The purpose of this paper is to use a game theoretical approach to analyze tax harmonization, or competition, in a monetary union, more specifically in Europe. Without harmonization, free-riding behaviors may appear, leading to a sub-optimal tax equilibrium. Tax competition may also create budgetary problems and the objective of a balanced budget may not be attained. But national tax autonomy has one main advantage: as monetary policy is "federalized", and as fiscal policy is constrained by the Stability and Growth Pact, taxation becomes the last macroeconomic instrument within governments' hands to deal with asymmetric shocks. The literature often condemns tax autonomy because of possible free-riding behaviors. In such a case, the competition could conduct to the lowest tax rate of all countries, condemning others to diminish their public spending. But, this analysis rests on a static point of view: In that case, harmonization with strict rules is Pareto-optimum. In the dynamic case, as harmonization costs are not incurred, the final equilibrium may be of a higher welfare level. Coordination would occur without the need for strict rules. If countries maintain sound public finance, tax competition would *not* lead to a "race to the bottom".

Keywords :

Monetary union, Economic integration, Tax competition, Tax harmonization, Fiscal competition

JEL classification : H20, H26, H77, H87

1. INTRODUCTION

On November 5th, 1997, in its Report: "Measures to fight against tax competition in the European Union" (European Commission, Bull. 6-1997) the European Commission recommended a coordinated action against tax competition in Europe, the objective being to reduce distortions still existing within the Single market, to avoid losses on tax receipts and to establish tax structures more in favor of employment. The Ecofin Council of December 1st, 1997 gave its assent on the resolution relating to a code of conduct in the field of companies taxation, and approved the idea of tax harmonization on savings. In June 2000 the European Council finally agreed on a compromise on taxes on savings. European countries will have to inform other countries about savings made by residents from other member states. Yet, a transition period of 7 years is established whereby a minimum common tax rate of 15% until 2004, then 20% until the end of 2009 will apply. How to evaluate the economic rationale of this type of measure ?

The literature on tax competition[1] studies either the impact on multinational firms (Wilson, 1987) or is interested in a more macroeconomic point of view: the influence on governments' strategic behaviors (Wildasin, 1986).

From a microeconomic point of view, international tax competition does exist with respect to multinational corporations (Wildasin, 1993; Rasmussen, 1997). Considerable anecdotal evidence for tax competition is found, for example, in recent German experience (Weichenrieder, 1996). While several other countries lowered corporate tax rates or introduced special tax incentives for some kinds of corporate income, Germany's high taxes have seemingly induced multinationals to shift at least the more mobile part of their tax base abroad.

[1] Existing definitions of tax competition may be found in Oates (1972) and Wildasin (1986)

From a macroeconomic point of view, European Monetary Union (EMU) raises the question of tax competition between member states. Individual countries face the following twin objectives: achieving budget equilibrium in the medium term (the Stability and Growth Pact - SGP) and high employment (or growth) through a competitive taxation policy.

If each country's tax policy is independent of the others, free riding behaviors may exist. A sub-optimal tax equilibrium for the monetary zone as a whole may occur. Tax competition may also create budgetary problems and the objective of a balanced budget may not be attained. Lopez, Marchand and Pestieau (1996) show that fiscal competition leads to under-provision of public good or inefficient redistribution.

Finally, the literature generally considers that tax competition could trigger a "race to the bottom", i.e., lead to too low a tax rate (the lowest of all member states). Countries would then have to diminish their public spending insofar as tax receipts would decrease.

Facing these problems, several papers insisted on the necessity and the gains of coordination, that is to say tax harmonization (Razin and Sadka, 1991; van Ypersele, 1998; Holmlund and Kolm, 1999). But harmonization may require some conditions (Cremer and Gahvari, 2000), and this coordination mechanism may take several forms: from a central fiscal authority (Cardarelli, Taugourdeau and Vidal, 1999) to a capital control mechanism (Rasmussen, 1997).

But, is tax harmonization really the best way to deal with this problem?

True, without harmonization, as said above, free-riding behaviors may appear, leading to a sub-optimal tax equilibrium. But national tax autonomy has one main advantage: as monetary policy is "federalized", and as fiscal policy is constrained by the Stability and Growth Pact, taxation becomes the last macroeconomic instrument within governments' hands to deal with asymmetric shocks.

Moreover, if tax rates are cut, and if government expenditures have to be reduced as a consequence, could not that help reduce waste and inefficiencies in the public sector? In addition, tax competition might help to establish better tax systems, and every country could learn from the experiences of others. In contrast, tax harmonization could result in higher average taxes in the European union (Boss, 1999).

Another point: the idea that tax competition could lead to “too low” a tax rate and to a decrease in public spending rests on a static point of view.

Within a static game, possible free riding behaviors may lead to a sub-optimal equilibrium; the Pareto-optimal equilibrium would then require a cooperation mechanism, i.e., harmonization. In a dynamic analysis the final equilibrium may be of a higher welfare level than the static one. Indeed, conducting a policy of harmonization with strict rules is not without cost, whereas the “natural” coordination resulting from the dynamic case does not require any of these costs. The signals given by each player may be sufficient to lead to a long term cooperative equilibrium.

The model of this paper is based on a game between two European governments. This approach is very fruitful insofar as it incorporates interactions between member states in the conduct of their taxation policies.

Each government follows tax and unemployment objectives. The game is played both within a short term horizon and within an infinite one. The model rests upon a formal analysis of the relationship between both governments seeking to maximize employment under a budget constraint. The short term approach favors the need for tax harmonization in order to lead to a stable system. The infinite approach, through the threat of government’s reprisals following a non-anticipated decrease in taxes from the other government, underlines the role of tax competition to reach stability of the system.

The theoretical analysis sheds light on the paramount importance of taxation in Europe, and, more generally, in a monetary union. It demonstrates the need for a system that would, at the same time, allow to deal with asymmetric shocks while avoiding free riding behaviors. It leads also to an institutional analysis of the tax system in the EMU as well as to policy recommendations.

The mechanism leading to this type of stability under a tax competition regime, rests on the impact of the signal given by both players. If a country gives the signal that "friendly" taxation behavior is not its priority, the result can be a war of attrition (Fourçans & Warin, 2001). Conversely, if both countries signal their ability to conduct such a war, this war will not occur. And the stability of the system will be ensured. One measure of this ability is the total tax rate. The higher it is, the higher is the probability that the country would not be able to engage in a war of attrition.

2. ASSUMPTIONS OF THE MODEL

The Economic Union consists of two independent countries producing an homogeneous good using capital and labor. Each country has a fixed amount of immobile labor and a fixed endowment of capital per worker. Technologies are identical in both countries and exhibit constant returns to scale. Capital flows freely between member states to equalize after tax returns. Cooperative tax policies may imply that the tax authorities jointly determine tax rates in the two countries.[2]

2.1 The structure of the economy

As the trigger strategies are not taken into account, the governments cannot improve their reputation during the game.

The taxation rate used in the model is taken as a weighted average of all the country rates.

In the short run it is considered that an unexpected decrease in one country's taxation rate relative to the other country, decreases unemployment in the former country. If τ_i is the ratio of the change in one country tax rate compared to the other country's change, the unemployment rate in both countries is given by:

$$u_i = \bar{u} - \beta.\left(\tau_i - \tau_i^e\right),\ i=1,\ 2, \tag{1}$$

[2] The precise form of cooperation depends on the institutional features of the bargaining process between the tax authorities. The form of cooperation actually materializing is beyond the scope of the present paper.

where $\bar{u}$ is the equilibrium unemployment rate and τ_i^e the expected relative change of the tax rate in country *i*, with *i*=1, 2. τ_i and $\tau_i^e < 0$, we consider the case where countries are willing to decrease taxes. This assumption is relevant with the competition case study.

2.2 Players' objectives

Both players have the following loss functions (Barro and Gordon, 1983):

$$L_i = (u_i)^2 + \alpha(\tau_i)^2, \; i=1, 2, \tag{2}$$

where $\alpha \geq 0$ introduces the relative weight of the two partial objectives. A high α implies that a given player gives more importance to tax stability than to unemployment. And conversely for a low α. Alpha equals one means that the player gives the same importance to both objectives.

By substituting eq. 1 into eq. 2, the loss functions become:

$$L_i = (\bar{u} - \beta(\tau_i - \tau_i^e))^2 + \alpha(\tau_i)^2 \tag{3}$$

2.3 Players' strategies

Two strategies are possible : the "hawk" and the "dove". In the first case, player 1 reacts to a previously unexpected decrease of the other country's rate by a non-announced decrease of his own rate in the following period in order to mislead the other's expectations. In the second case, the first player does not react to an unexpected depreciation of the other tax rate and does not try to mislead expectations.

3. ONE SHOT GAME WITH A FINITE HORIZON

The one shot game is played within a complete information framework. Each player knows the strategies of the other as well as the payments. Three occurrences are then possible.

3.1 The generalized "dove" strategy

In this case, neither player tries to mislead the other's expectations, i.e. does not try to follow a policy that would lead to a depreciation of his own rate. In the model, this means $\tau_i = 0$ and $\tau_i^e = 0$.

Both "dove" loss functions become :

$$L_1^{D/D} = (\bar{u})^2 \text{ and } L_2^{D/D} = (\bar{u})^2 . \tag{4}$$

3.2 One country's hawk strategy

In that case, one country decides to upset the other's expectations. If country 1 is the "hawk" country then $\tau_1^e = 0$, but τ_1 must be positive in order to minimize the loss function. Hence, the "hawk" loss function is :

$$L_1^{H/D} = (\bar{u} - \beta\tau_1)^2 + \alpha(\tau_1)^2 , \tag{5}$$

which is minimized with :

$$\tau_1 = \frac{\bar{u}\beta}{\alpha + \beta^2} . \tag{6}$$

By substitution, the loss function becomes :

$$L_1^{H/D} = \frac{\alpha \bar{u}^2}{\alpha + \beta^2}. \tag{7}$$

As far as the second country is concerned, $\tau_2 = 0$, and $\tau_2^e = 0$ which leads to :

$$L_2^{D/H} = \frac{\bar{u}^2 \left(\alpha + 2\beta^2\right)^2}{\left(\alpha + \beta^2\right)^2}. \tag{8}$$

3.3 The generalized " hawk " strategy

The game being played with perfect information, each player knows the other's strategy. The minimization of the loss functions leads to :

$$\begin{cases} \tau_1 = \dfrac{\left(\bar{u} + \beta\tau_1^e\right)\beta}{\alpha + \beta^2} \\ \tau_2 = \dfrac{\left(\bar{u} + \beta\tau_2^e\right)\beta}{\alpha + \beta^2}. \end{cases} \tag{9}$$

Each policy being expected by both players means that : $\tau_1^e = \tau_2$ and $\tau_2^e = \tau_1$.

In that case :

$$\tau_1 = \frac{\bar{u}\beta}{\alpha} \text{ and } \tau_2 = \frac{\bar{u}\beta}{\alpha}. \tag{10}$$

This result shows a "bias" towards a decrease in taxes from both countries, even though they do not improve their unemployment rate which remains at the structural level. The two loss functions become :

$$\begin{cases} L_1^{H/H} = \dfrac{\bar{u}^2\left(\beta^2+\alpha\right)}{\alpha} \\ L_2^{H/H} = \dfrac{\bar{u}^2\left(\beta^2+\alpha\right)}{\alpha}. \end{cases} \tag{11}$$

Both of these functions are higher than those of the "dove" strategy.

3.4 The equilibrium strategy of the game

The results can be presented in the following matrix form.

Table 2. Matrix representation of strategies and results

	Second country: Dove *$\tau_2 = 0$*	Second country: Hawk *$\tau_2 > 0$*
First country: Dove *$\tau_1 = 0$*	$\begin{cases} L_1^{D/D} = \bar{u}^2 \\ L_2^{D/D} = \bar{u}^2 \end{cases}$	$\begin{cases} L_1^{D/H} = \dfrac{\bar{u}^2\left(\alpha+2\beta^2\right)^2}{\left(\alpha+\beta^2\right)^2} \\ L_2^{H/D} = \dfrac{\alpha\bar{u}^2}{\alpha+\beta^2} \end{cases}$
First country: Hawk *$\tau_1 > 0$*	$\begin{cases} L_1^{H/D} = \dfrac{\alpha\bar{u}^2}{\alpha+\beta^2} \\ L_2^{D/H} = \dfrac{\bar{u}^2\left(\alpha+2\beta^2\right)^2}{\left(\alpha+\beta^2\right)^2} \end{cases}$	$\begin{cases} L_1^{H/H} = \dfrac{\bar{u}^2\left(\beta^2+\alpha\right)}{\alpha} \\ L_2^{H/H} = \dfrac{\bar{u}^2\left(\beta^2+\alpha\right)}{\alpha} \end{cases}$

With a one shot game, the cooperative behavior ("dove") is dominated by the non-cooperative behavior ("hawk")[3]. The only equilibrium for both players is not to cooperate and therefore to follow the "hawk" strategy : the (H, H) solution. This is a traditional result of the prisoner's dilemma.

The process implies that the only sub-game perfect equilibrium is when both players do not cooperate at each period. However, as Selten (1978) pointed out, it could appear interesting to cooperate. The two players could prefer to agree and play the (D, D) strategy which leads to a better payment for both of them. Yet, if one decides to play "dove", it becomes interesting for the other to play "hawk" (cf. table 2). As a main result, both will play (H, H), that is to say the sub-optimal strategy.

The optimal Pareto combination is (D, D). But, this strategy is only possible if both countries agree on a bilateral contract aiming at a stable tax rate. Otherwise, the dominant strategy is the discrete one, i.e. (H, H).

4. THE REPEATED GAME WITH AN INFINITE HORIZON

Here, the prisoner's dilemma situation *cum* a repeated game with an infinite horizon or a finite one with a sufficiently distant last period is considered. In that case, the Kreps and Wilson (1982) approach can be used and the game is played with imperfect information. As the "hawk" versus "dove" strategy with a possible penalty (unexpected tax decrease) are compared, the "folk theorem" can be used, as well with an infinite horizon as with a finite but sufficiently distant one (Benoit and Krishna, 1985; Friedman, 1985).

[3] See appendix.

4.1 The players' possible choices

The gains or costs of distorting the other player's expectations are evaluated with respect to the best possible result :

$$\begin{cases} L_1^{D/D} = \bar{u}^2 \\ \\ L_2^{D/D} = \bar{u}^2. \end{cases} \tag{12}$$

In a one period game, if the optimal Pareto solution (D, D) is chosen, the above results are obtained. If player 1 plays "hawk" and player 2 plays "dove", player 1, instead of loosing $\bar{u}^2$, only looses $\frac{(\alpha\bar{u}^2)}{\alpha+\beta^2}$.

His gain is :

$$\bar{u}^2 - \frac{\alpha\bar{u}^2}{\alpha+\beta^2} = \frac{\bar{u}^2\beta^2}{\alpha+\beta^2}. \tag{13}$$

On the other hand, player 2 looses :

$$\frac{\bar{u}^2\beta^2(2\alpha+3\beta^2)}{(\alpha+\beta^2)}. \tag{14}$$

With a multiple periods game, things may change. Player 2 is able to punish player 1 in the following periods. Player 2 gains if he plays "hawk" and player 1 plays "dove" in the following period. And player 2 looses less if player 1 plays "hawk". Yet, the latest solution brings about a loss compared to the optimal

Pareto situation.

It is therefore interesting for both players to minimize the number of periods where the results are sub-optimal. Player 1 must quickly establish his credibility if he does not want to loose continually through the (H, H) strategy, where the loss is :

$$\frac{\bar{u}^2\left(\beta^2+\alpha\right)}{\alpha}-\bar{u}^2=\frac{\bar{u}^2\beta^2}{\alpha}. \qquad (15)$$

Given this information, both players decide on the duration of the conflict and thereby on their strategies.

Table 3. Matrix representation of the profits and losses

	Second country: Dove $\tau_2 = 0$	Second country: Hawk $\tau_2 > 0$
First country: Dove $\tau_1 = 0$	$\begin{cases} Loss = 0 \\ Loss = 0 \end{cases}$	$\begin{cases} Loss = \frac{\bar{u}^2\beta^2\left(2\alpha+3\beta^2\right)}{\left(\alpha+\beta^2\right)} \\ Gain = \frac{\bar{u}^2\beta^2}{\alpha+\beta^2} \end{cases}$
First country: Hawk $\tau_1 > 0$	$\begin{cases} Gain = \frac{\bar{u}^2\beta^2}{\alpha+\beta^2} \\ Loss = \frac{\bar{u}^2\beta^2\left(2\alpha+3\beta^2\right)}{\left(\alpha+\beta^2\right)} \end{cases}$	$\begin{cases} Loss = \frac{\bar{u}^2\beta^2}{\alpha} \\ Loss = \frac{\bar{u}^2\beta^2}{\alpha} \end{cases}$

4.2 Equilibrium with infinite horizon

A player plays "dove" if the gains resulting from the "hawk" strategy played at one period are lower than the present value of losses of the penalty decided by player 2[4] :

$$\text{Gains} \; < \; \sum_{t=1}^{T} \delta^{t} \; \text{Losses} \tag{16}$$

where $\delta = (1+R)^{-1} < 1$ is the present value factor and *R*, the real interest rate. A low δ means that the player does not exploit the penalty strategy for too long a period. After substitution, the condition becomes :

$$\frac{\left(\alpha \bar{u}^{2}\right)}{\alpha + \beta^{2}} \; < \frac{\bar{u}^{2} \beta^{2}}{\alpha} \sum_{t=1}^{T} \delta^{t} \, , \tag{17}$$

$$\frac{\alpha^{2}}{\left(\alpha + \beta^{2}\right)\beta^{2}} \; < \; \frac{\delta(1-\delta^{T})}{1-\delta} \, . \tag{18}$$

If T* is the period where the player can be indifferent between the "hawk" or "dove" strategy, eq. 18 implies that :

$$\frac{\alpha^{2}}{\left(\alpha + \beta^{2}\right)\beta^{2}} = \frac{\delta(1-\delta^{T*})}{1-\delta} \, . \tag{19}$$

When T > T*, the present value of losses is higher than the gains from the "hawk" strategy. The latter will therefore not be adopted. When T < T*, the gains from the

[4] This method is inspired by Solow (1990).

"hawk" strategy are higher than the present value of losses. This strategy will therefore be adopted.

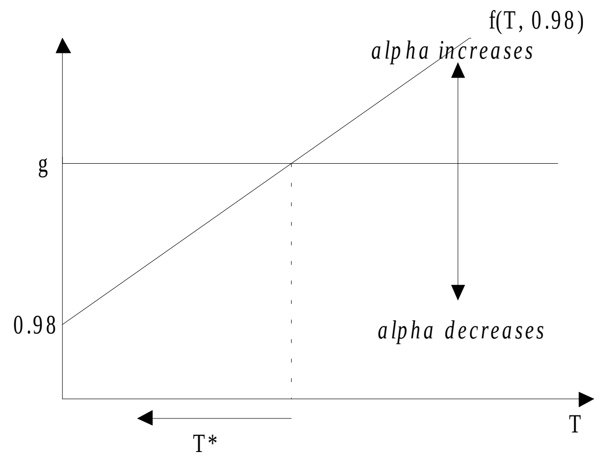
If $f(T,\delta)=\frac{\delta(1-\delta^T)}{1-\delta}$, with $f(1,\delta)=\delta$, $\frac{\partial f}{dT}>0$ and $\frac{\partial f}{dT}>0$, eq. 18 can be written :

$$\frac{\alpha^2}{(\alpha+\beta^2)\beta^2} < f(T,\delta). \tag{20}$$

For illustration purposes, $f(T,\delta)$ can be drawn with $\delta = 0{,}98$ (meaning R equals 2 %). The gains from the "hawk" strategy does not then depend on T and are equal to :

$$g=\frac{\alpha^2}{(\alpha+\beta^2)\beta^2}. \tag{21}$$

When $\alpha = 0$ (the loss function depends only of the unemployment rate), $g = 0$. When $\alpha = 1$ (the same weight is given to unemployment and to the change in the tax rate in the loss function), $g=\frac{1}{(1+\beta^2)\beta^2}$; and when $\alpha \to +\infty$, $g \to +\infty$.



When player 1 addresses a signal that he gives more and more weight to unemployment rather than to the tax rate (α decreases), the penalty period decided by player 2 becomes shorter and shorter. When less and less weight is given by player 1 to unemployment, the second player's penalty period increases.

5. POLICY IMPLICATIONS AND CONCLUSION

The proposed model has some main policy implications. In the one shot game, an optimal Pareto solution can only be obtained if both players mutually agree not to disrupt each other's expectations on the tax rate.

In the infinite horizon situation, things are somewhat different. It is in the interest of each player to address a clear and strong signal to the other about its own strategy. In other words, it is in the interest of each player to let the other know that if he tries to mislead his expectations, he will himself fire back by misleading the other player's expectations. Hence, a strong signal on the part of both players would reduce the duration of the possible conflict and therefore would reduce the volatility of the taxation rate.

Pros and cons of tax harmonization versus taw competition can be evaluated. Free-riding behaviors versus the need to deal with asymmetric shocks can also be weighted.

Finally, static versus dynamic considerations shed light on the best institutional set up to deal with the tax system in the EMU.

The theoretical analysis demonstrates the paramount importance of tax policy in Europe, and, more generally, in a monetary union. If tax competition exists, the mechanism driving to the stability of the system rests upon the importance of the signal given by both players. If a country gives the signal that tax discipline is not its priority, the result can be a war of attrition. Conversely, if both countries signals their ability to enter a tax war, this war will not occur. The stability of the system will be maintained. One measure of this ability is the weighted average of all tax rates in a given country. The higher it is, the higher the probability that the country would not be able to carry on a war of attrition. Considering that process, it is of a paramount importance for a country to be able to give a strong signal to the other country that a war of attrition is possible. For that, countries must have sound public finances. If not, the signal given would be that the country could not engage into a war. The result would be a free riding strategy implemented by the strongest country. The proposed theoretical model reinforces Boss' argument that the pressure on government expenditures helps to avoid waste and inefficiencies in the public sector. And that if countries have sound public finances, tax competition would not lead to a "race to the bottom".

APPENDIX

With a very close finite horizon, the cooperative behavior (“dove”) is strongly dominated by the non-cooperative behavior (“hawk”) under both conditions : $L_1^{D/H} > L_1^{H/H}$ and $L_2^{D/H} > L_2^{H/H}$. That is:

$$u^2.\frac{\left(\alpha + 2\beta^2\right)^2}{\left(\alpha + \beta^2\right)^2} > u^2.\frac{\left(\alpha + \beta^2\right)}{\alpha},$$

which leads to $\alpha > \left(\sqrt{2} - 1\right)\beta^2$.

β<1 means a very low α. In this case, both players give more importance to the unemployment objective than to the stability of the tax rate. The only equilibrium for both players is hence not to cooperate and therefore to follow the “hawk” strategy : the (H, H) solution.

When $\alpha < \left(\sqrt{2} - 1\right)\beta^2$, there exists two Nash equilibria : $\left(L_1^{H/D}, L_2^{D/H}\right)$ and $\left(L_1^{D/H}, L_2^{H/D}\right)$. The solution of this “chicken game” consists in playing the cooperation (see Espinosa-Vega and Yip (1994)).

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