Retaliatory disagreement point with asymmetric countries. Evidence from European wine sector during enlargement

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Abstract. The vector space model facilitates a very useful representation of the strategic interaction in trade because it is possible to incorporate both symmetric and asymmetric features of the players. This paper characterizes the Nash solution of the non-cooperative international trade game in the orthogonal vector space. We have used the standard properties of the Nash solution to determine if the non-cooperative action-reaction trade policy space should be written in terms of 'import-import' or 'import-export' quotas as strongest punishment. The trade policy space defined by 'import-export' quotas is not a Nash solution of the non-cooperative game but an improvement in the disagreement set. We show the positive correlation between import and export quotas using data on trade relations between EU-15, Romania, Hungary and Bulgaria for wine sector during 1995-2005. In our model the outcome of the non-cooperative trade is autarky. Retaliation is played when countries restrict their imports to one third of the national optimum.

JEL Classification: C72, F14, F51
Keywords: disagreement point, quotas, non-cooperative game, Nash solution

1. Introduction

In this paper we explain EU-15 trade relations with the Central East European Countries (CEEC's) employing the method of the reduction to the absurd. We suppose that a small country market may be used as outlet for dumping a large country's market surplus so that so that a trade policy space defined with import quotas restricting exports is a retaliatory stance between two countries of asymmetric market size. We prove the supposition wrong building up a model that accounts for the asymmetry of the partners while encompassing both conflict and cooperation features of the strategic interaction in trade. Conflict is reflected in the level of retaliatory market access modeled through the mean of both import and export quotas. Cooperation is induced through political negotiations on the level of market access. In this way defined trade relations fit perfectly in the governmental welfare function defined by Grossman&Helpman (1995)[1] which minimized independently provides the politically least acceptable import/export quotas in contrast with the common welfare governmental function which provides the politically acceptable level

[1]The governmental welfare function is discussed in detail when we present the model.

of import/export quotas that both governments would agree through negotiations[2]. The outcome of the internal political negotiations on the level of market access are in the parameter attached to the national welfare which is higher the higher are the political pressures for exporting respectively more protection is need it. In line with the previous studies as well as the practice of trade liberalization, we study the strategic interaction in trade between CEEC-s and the European Union focusing on a single sector with the highest conflict potential. Three of the CEE countries and the European Union are main wine producers in the world sharing high exporting potential while EU is facing wine market surpluses administered even through distillation. Confronted with such situation it might be argued that the CEEC's markets could have been used as an outlet for European exports which coupled with a low market access points a retaliatory type of trade relations on wine market.

We start the analysis considering that retaliation can be played with both import and export quotas even if the outcome of the non cooperative game is still controversial in the literature. Retaliation with both import and export quotas has been modeled by Towers (1974), Syropoulos, Dinopoulos and Kreinin (1995), Noritsugu Nakanishi (1999) but retaliation is played with 'optimum quotas' which would maximize each country's welfare. Except Towers (1974), autarky was not found to be the outcome of retaliatory game. Indeed EU15-CEEC relations have not been autarkic suggesting that the hypothethical situation in the beginning might be wrong.

It was Noritsugu Nakanishi (1999) who suggested that the diversity of results might be due to the Nash equilibrium concept so that our contribution to the strand of research is to ensure that the retaliatory game is played starting out from the conflict point of the non-cooperative game in trade that is the point where each government minimizes the governametal welfare individually. We plot the disagreement point of the non-cooperative game within the topological space representing international trade and we show that the retaliatory policy space defined by 'import-export' quotas is not a Nash equilibrium therefore not a solution of the retaliatory game but an improvement from the worse outcome. Our result supports Milner's (1988) argument that highly exporting firms are not likely to lobby for protection in fear of foreign retaliation even if the sector's import penetration ratio is high. Using the linkage between export dependence ratios, import penetration ratios and internal political pressures in CEEC strategic trade relations with EU-15 for wine sector we show that exports do not carry a retaliatory conflict potential on the contrary, they are a better outcome of the strategic interaction in trade.

The model is applied to the EU trade relations in wine sector with Romania, Bulgaria and Hungary which best exemplifies the evolution path from autarky, retaliation and cooperation through both restrictive import quotas and highly expansionist volumes of exports.

[2]The common welfare governmental function is provided by Grossman, M. Gene and Helpman, Elhanan , *Trade wars and trade talks*, Journal of Political Economy, **103**, 675-708, (1995)

In the next section we explicitly determine the Nash equilibrium of the retaliatory game with both import and export quotas as well as market asymmetries and we provide evidence that exports are an improvement from the worse outcome of the non-cooperative game. In Section 3 we illustrate the Nash behavior on trade relations between EU and CEEC's. Starting out from retaliation we empirically show that negotiations have helped to increase the market access and to avoid the conflict possibly generated by a large difference in market potential. Conclusions about the model and further directions of research are subject of the last section.

2. The Model

We model conflict in trade relations in international political economy fashion in a two countries two goods general equilibrium framework using a governmental welfare function introduced by Grossman and Helpman (1995), $G^C = C^C + a^C W^C$. Countries have similar political and economic structure. C^C is the lobby campaign contribution for setting up a quota while a^C is the value that the government attach to the national welfare, W^C . The lobby contributions and the value of the governmental weight is higher in exporting countries and lower in the importing ones. Governments count on rents and export licenses revenues in their welfare function. Each country exports one good and imports the foreign substitute. Production and consumption frontiers are continuous linear functions of price, $\mathbf{Y}^C = \alpha + \beta \mathbf{p}^C$, $\mathbf{Y}^C : \mathbb{R}_+ \to \mathbb{R}$ and respectively $\mathbf{X}^C = A - B\mathbf{p}^C$, $\mathbf{X}^C : \mathbb{R}_+ \to \mathbb{R}$ while $\mathbf{p}^C = (p_1, ..., p_j)$ is the price vector for $j = 1, ..., n$. The set of feasible consumption bundles $\mathbf{X}^C$ of the country C is the list $\left(X_1^C, X_2^C, ..., X_n^C\right)$ respectively $\mathbf{Y}^C = \left(Y_1^C, Y_2^C, ..., Y_n^C\right)$ for production, $\mathbf{Y}_j^C, \mathbf{X}_j^C \in \mathbb{R} \backslash \{0\}$ and$j = 1, ..., n$. We denote by $\mathbf{E}^C = \mathbf{Y}^C - \mathbf{X}^C$ one country's exports. According to the definition of the topological space the additive inverse of $\mathbf{E}^C$ must be included in $\mathbf{T}^1$. Let $-\mathbf{E}^C$ be the additive inverse of $\mathbf{E}^C$ so that $\mathbf{I}^C = -\mathbf{E}^C = \mathbf{X}^C - \mathbf{Y}^C$ denotes country C imports. Thus the offer curve is allowed to bend back towards the axis representing imports so that Tower's restrictive assumption of elasticity of imports is eliminated. International trade is characterized by the one dimensional space $\mathbf{T}^1 = \{\mathbf{I}^C \,|\mathbf{I}^C = \mathbf{Y}^C - \mathbf{X}^C, \mathbf{Y}_j^C, \mathbf{X}_j^C \in \mathbb{R} \backslash \{0\}\}$ so that geometrically the space which contains one vector and its additive inverse is represented as follows,

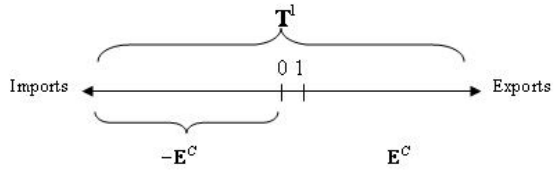

Figure 1. International Trade Space

At this point note that the one dimensional international trade space $\mathbf{T}^1$ could be defined as either imports or exports. In line with the usual approach in the literature we model trade interaction in the orthogonal space

$\mathbf{T} \times \mathbf{T}^{\perp}$, $\mathbf{T}^{\perp}$ is the orthogonal complement of $\mathbf{T}^{1}$. In order to distinguish between the one dimensional space and its orthogonal complement we define $\mathbf{T}^{\perp} = \{\mathbf{E}^{C} \left| \mathbf{E}^{C} = \mathbf{Y}^{C} - \mathbf{X}^{C}, \mathbf{Y}_{j}^{C}, \mathbf{X}_{j}^{C} \in \mathbb{R} \backslash \{0\} \right.\}$. $\mathbf{T}^{\perp}$ being a subspace of $\mathbb{R}$ any subspace properties must hold so that similar to Cowell(2004):

1. Autarky
   $\{0\} \in \mathbf{T}^{\perp}$
2. Asymmetries
   $\lambda \in \mathbb{N}, \mathbf{E}^{C} \in T^{\perp}$ implies $\lambda \mathbf{E}^{C} = \lambda \left(\mathbf{Y}^{C} - \mathbf{X}^{C}\right) = \lambda \mathbf{Y}^{C} - \lambda \mathbf{X}^{C} \in T^{\perp}$
3. Aggregate offers
   $\mathbf{E}^{C}, \lambda \mathbf{E}^{C} \in T^{\perp}$ implies $\mathbf{E}^{C} + \lambda \mathbf{E}^{C} \in T^{\perp}$

The second property of any linear transformation of exports included in the international trade space ensures the possibility that both symmetric and asymmetric countries are modeled. To infer this consider that each linear transformation of one country's production and consumption functions from Property 2 can be assigned to other countries to obtain a full range of countries of higher market size as reflected by λ which is a measure of the difference in market size between the countries strategically interacting in trade.

The non-cooperative game is played in the orthogonal space $\mathbf{T} \times \mathbf{T}^{\perp} = \left\{ \left(\mathbf{I}^{C}, \lambda \mathbf{E}^{C}\right) | \mathbf{I}^{C} \perp \lambda \mathbf{E}^{C}, \mathbf{I}^{C} \in T^{1}, \lambda \mathbf{E}^{C} \in T^{\perp} \right\}$ so that $\mathbf{T}^{1} \subset \left(\mathbf{T}^{\perp}\right)^{\perp}$ property of the orthogonal space and at the same time the asymmetric structure of the game is verified. The outcome of the non-cooperative game is the orthogonal set $\mathbf{D} \times \mathbf{D}^{\perp} \subset \mathbf{T} \times \mathbf{T}^{\perp}$ while $\mathbf{D}^{1}$ is the retaliatory disagreement set of a small importing country and $\mathbf{D}^{\perp}$ is the orthogonal retaliatory disagreement set of a large exporting country.

We define $\mathbf{D}^{1} = \left\{ d^{C} \in D^{1} \left| d^{C} = \min_{I^{C}} G^{C}, G^{C} = C^{C} + a^{C} \left(\Pi^{C} + CS^{C} + Q^{C}\right) \right.\right\}$

and $\mathbf{D}^{\perp} = \left\{ d^{C} \in D^{\perp} \left| d^{C} = \min_{\lambda E^{C}} G^{C}, G^{C} = C^{C} + a^{C} \left(\Pi^{C} + CS^{C} + Q^{C}\right) \right.\right\}$, where Π^{C} are the producers profits, CS^{C} the consumers surplus, Q^{C} are the gains from the quota rents and import licenses calculated as the product between the price differential and the volume of trade.

3. Retaliatory disagreement point

The strategic interaction between two countries Home(H) and Foreign(F), $C \in \{H, F\}$, is modeled in the space $\mathbf{T} \times \mathbf{T}^{\perp} = \left\{ \left(\mathbf{I}^{H}, \mathbf{E}^{F}\right) | \mathbf{I}^{H} \perp \mathbf{E}^{F}, \mathbf{I}^{H} \mathbf{E}^{F}, \mathbf{I}^{H} \in T^{1}, \mathbf{E}^{F} \in T^{\perp} \right\}$ so that Home is small and Foreign is large. "Optimum quotas" are replaced by the points where a quota would minimize each government's welfare function called retaliatory disagreement point (RDP) so that,

Lemma 1. *G^{C} is convex and increasing in $\left(\mathbf{d}^{H}, \mathbf{d}^{F}\right)$ while*
(RDP) $\left(\mathbf{d}^{H}, \mathbf{d}^{F}\right) = (1/3)\left(z^{H}\mathbf{Y}^{H} - t, -\left(z^{F}\mathbf{Y}^{F} + \lambda t\right)\right)$ for $(\forall)\, \lambda \in \mathbb{N}$ (1)

Proof. We determined the influence of the trade policy choice on terms of trade using imports and exports definitions as follows (for comparative purposes see Bond and Park (2000)),

$\partial p^{H} / \partial I^{H} = -1/(B + \beta), \partial p^{H} / \partial E^{F} = -1/\lambda (B + \beta)$,

$\partial p^F/\partial E^F = 1/\lambda(B+\beta), \partial p^F/\partial I^H = 1/(B+\beta)$.

In the classic analyze of the social welfare by envelope theorem, Roy identity, Bernheim and Whinston "truthfulness" property and setting the first order condition equal to 0 (see Cadot, Melo, Olarreaga (2002)): $I^H = (+1/3)\left[z^H Y^H - t\right]$,

$\mathrm{E}^F = (-1/3)\left[z^F Y^F + \lambda t\right]$ for $z = 1/a^C,\ t = (B+\beta)\left(p^F - p^H\right)$ $\square$

The retaliatory disagreement point $\left(\mathbf{d}^H, \mathbf{d}^F\right)$ is a Nash solution of the non-cooperative game if it satisfies the standard Nash axioms: symmetry (SYM), invariance (INV), independence of the irrelevant solutions (IIA) and Pareto optimality (PAR) while it is necessary to establish if the disagreement points are attained with import or export quotas.

(SYM) Since $\mathbf{E}^F \in \mathbf{T}^\perp, \mathbf{I}^H \leqslant \mathbf{E}^F$ implies that the strategic interaction space $\mathbf{T} \times \mathbf{T}^\perp$ includes trade solutions which are the results of the non-cooperative trade interaction between:

a) Symmetric players if $\mathbf{I}^H = \mathbf{E}^F$ when $\lambda = 1,\ \mathbf{Y}^H = \mathbf{Y}^F,\ \chi^H = \chi^F,\ \mathbf{p}^H = \mathbf{p}^F$. The welfare weight is equal $a^H = a^F = a$. Countries are of equal size when $\lambda = 1$ so that they produce a comparable level of production denoted by $\mathbf{Y}^H$. Equation (1) writes,

$$(RDP)\left(\mathbf{d}^{H\prime}, \mathbf{d}^{F\prime}\right) = (1/3)\left(z^H \mathbf{Y}^H,\ -z^H \mathbf{Y}^H\right) \quad (2)$$

Using the definition of the exports that was set up in the model, $-\mathbf{d}^{F\prime} = \mathbf{I}^F$. The retaliatory game is played at the disagreement point $\mathbf{d}^{F\prime}$ where Foreign restricts Home's optimum exports to at most one third and less of the politically acceptable minimum internal production. Similar for Foreign's exports. Retaliation starts when the politically optimum import quotas are the same for both countries. Therefore, the retaliatory disagreement set of the symmetric non-cooperative game writes,

$$\mathbf{D} \times \mathbf{D}^\perp = \left\{\left(\mathbf{d}^{H\prime}, -\mathbf{d}^{F\prime}\right) \middle| \mathbf{d}^{H\prime} = \mathbf{I}^H, -\mathbf{d}^{F\prime} = \mathbf{I}^F\right\} \quad (3)$$

b) Asymmetric players if $\mathbf{I}^H < \mathbf{E}^F$ when $\lambda \in [1, \infty),\ \mathbf{Y}^H < \mathbf{Y}^F, \chi^H < \chi^F,\ \mathbf{p}^H < \mathbf{p}^F$ and $a^F \neq a^H$. Equation (1) writes,

$$(RDP)\left(\mathbf{d}^{H\prime\prime}, \mathbf{d}^{F\prime\prime}\right) = (1/3)\left(z^H \mathbf{Y}^H - t, -\left(z^F \mathbf{Y}^F + \lambda t\right)\right) \quad (4)$$

Foreign disagreement point is $-\mathbf{d}^{F\prime\prime} = \mathbf{I}^F$ so that retaliation is played with an import quota. However a similar conclusion is not straightforward for Home. Home's retaliatory point writes,

$$\mathbf{D} \times \mathbf{D}^\perp = \begin{cases} \left(\mathbf{d}^{H\prime\prime}, -\mathbf{d}^{F\prime\prime}\right) \middle| \mathbf{d}^{H\prime\prime} = \mathbf{I}^H, -\mathbf{d}^{F\prime\prime} = \mathbf{I}^F \ \text{ if } z^H \mathbf{Y}^H > t \\ \mathbf{0} \text{ if } z^H \mathbf{Y}^H = t \\ \left(-\mathbf{d}^{H\prime\prime}, -\mathbf{d}^{F\prime\prime}\right) \middle| -\mathbf{d}^{H\prime\prime} = \mathbf{E}^H, -\mathbf{d}^{F\prime\prime} = \mathbf{I}^F \ \text{ if } z^H \mathbf{Y}^H < t \end{cases} \quad (5)$$

In expression (5), asymmetry in the non-cooperative problem extends the solutions set to the fourth quadrant of the orthogonal axes so that so that Home could retaliate with either an import or an export quota against an import quota set by Foreign.

Proposition 1. *Changing players identities changes the outcome of the game, therefore imports and export quotas cannot be at the same time a Nash equilibrium.*

Proposition 1 implies that one of the outcomes of retaliation that we should be concerned with is stability. At this point we have only one result which is stable for further analysis of EU15-CEEC trade relations. A retaliatory stance of a large exporting country is in fact a tight import quota. For the small country, a higher market size of its trading partner enlarges the range of policy options so that its retaliatory best response may be either an import quota or a retaliatory increase in the volume of exports or both. Looking up at the previous result through the lances of the Nash equilibrium, if each government seeks individually an equilibrium in trade relations, the policy choice that brings retaliation has to follow the usual Nash properties. From all, asymmetries in the Nash equilibrium is the most worrying because when the retaliatory game is played with asymmetric players it should not be expected variations in the Nash equilibrium trade relations. Nash axioms imply that each player should know when a trading partner policy option is retaliation and which one is his best response to such situation so that proposition 1 implies that the standard symmetric property of the disagreement set is not verified. We could anticipate that either the 'import-import' or the 'import-export' retaliatory policy space is not a Nash solution of the game so that we check invariance (INV) property of the Nash equilibrium solution.

(INV) The affine transformation of the symmetric disagreement points is quite straightforward since the disagreement points of two symmetric countries $\left(\mathbf{d}^{H\prime}, \mathbf{d}^{F\prime}\right) = (1/3)\left(z^H \mathbf{Y}^H, \ -z^H \mathbf{Y}^H\right)$ fits perfectly in the affine form $m\mathbf{d}^C + n$ for $(\forall)\ m \in R_+,\ n \in R$. Suppose first that the retaliatory policy space is given by import quotas. By mean of transformation $m\mathbf{d}^C + n = mz^C\mathbf{Y}^C - m\lambda t + n,\ m \in R_+,\ n \in R$. Denoting $-m\lambda t + n$ by r , $mz^C\mathbf{Y}^C + r$ varies with $mz^C \in R_+, r \in R, \lambda \in \mathbb{N}$ following any affine transformation of the type $m\mathbf{d}^C + n$. If the retaliatory policy space is given by both import and export quotas then $m\mathbf{d}^C + n = -mz^C\mathbf{Y}^C - m\lambda t - n,\ m \in R_+,\ n \in R$. Denoting $-m\lambda t - n$ by r', $-mz^C\mathbf{Y}^C + r$ varies with $-mz^C \notin R_+, r' \in R, \lambda \in \mathbb{N}$. Export quotas do not follow the affine transformations of the retaliatory point.

Proposition 2. *The retaliatory policy space defined with 'import-export quotas' is not a Nash equilibrium of the retaliatory game.*

Indeed, invariance of the Nash solution is not verified if retaliation is played by the small country with an increased volume of exports. A retaliatory policy space defined with retaliatory exports against a large country's tight import quota is not a Nash solution of the non-cooperative game and the hypothesis presented in the beginning for EU15-CEEC relations was wrong *(Q.E.D)*.

Further, in order to explain the result from Proposition 2 the next property of the Nash solution helps us to sort out the relevant solution of the game from the non-Nash solutions while delineating the retaliatory types of policy opyions from the non-retaliatory ones.

(IIA) We can define now the disagreement set of the non-cooperative game as the convex set $\mathbf{D}^2 = \mathbf{D} \cap \mathbf{D}^{\perp}$ of retaliatory points. The previous axioms have already revealed a common point of the intersection set, namely the 'import-import' choice of the retaliatory policy space so that any equilibrium solution must satisfy the inequality $z^H \mathbf{Y}^H < t$. The intersection set of Nash solution in both Home and Foreign country is the set of disagreement points,

$$\mathbf{D} \cap \mathbf{D}^{\perp} = \left\{ \left(\mathbf{d}^{H\prime\prime}, -\mathbf{d}^{F\prime\prime} \right) \middle| \mathbf{d}^{H\prime\prime} = \mathbf{I}^H, -\mathbf{d}^{F\prime\prime} = \mathbf{I}^F \right\} (6)$$

The previous analysis yields the set of the irrelevant solutions of the non-cooperative game is the retaliatory disagreement set, $\mathbf{IRR} = \mathbf{D}^2 \backslash \left(\mathbf{D} \cap \mathbf{D}^{\perp} \right)$.

$$(IRR) \left(1/3\right)(\mathbf{d}^{H\prime\prime}, \mathbf{d}^{F\prime\prime}) = \left(\mathbf{E}^H, \mathbf{I}^F \right) (7)$$

Proposition 3. *A trade policy space defined by import and retaliatory export quotas is an irrelevant solution of the non-cooperative game, moreover it is an improvement from the disagreement set.*

The result can be justified and visually confirmed in the topological space of the international trade employing the next axiom of the Nash solution.

(PAR) In the last expression (4) of the retaliatory disagreement point it can be showed the impact of Home's export quota on the disagreement set. According Olson (1965) the there is less power of collusion in the large country so that $a^F < a^H$. Therefore, $z^F > z^H$ and the import quota of the large country is not restrictive for the small country's exports since $z^F \mathbf{Y}^F + \lambda t > z^H \mathbf{Y}^H - t$. This relationship is not a retaliatory stance in trade relations between two asymmetric countries. Moreover, in equation (4) the small country may increase its exports without changing the retaliatory stance of the large country contradicting the Preto improving requirement of the Nash solution. It is possible to expand exports increasing internal production till the price differential is eliminated. At limit, when $t = 0$ the countries are symmetric and the retaliatory disagreement point is the one in expression (2).

[Figure 2 here]

(MARKET ASYMM) In Figure 2 the disagreement set of two asymmetric countries is different from the set of two asymetric ones so that the symetric property of the non-cooperative solution must be once again ensured for. Because of the induced asymmetry, we search those common disagreement points complying with the Nash solution properties. For this we compare the set of symmetric disagreement points with the asymmetric ones. In the equation (2) and (4), the import quota of the Home country declines by t in the asymmetric case as compared to the symmetry $d^{H\prime\prime} < d^{H\prime}$ so that we may consider the asymmetric set of disagreement points defined by imports quotas included in the symmetric set and $\mathbf{d}^{H\prime\prime} = (1/3)\left(z^H \mathbf{Y}^H - t \right)$ the Nash equilibrium solution of the non-cooperative game. Using again Olson's (1965) result we establish the inequality $-z^F \mathbf{Y}^F - \lambda t < -z^H \mathbf{Y}^H$ for $\lambda > \frac{z^H Y^H}{z^F Y^H + t}$ and we retain the asymmetric set of the disagreement points $\mathbf{d}^{F\prime\prime} = (1/3)\left(-z^H \mathbf{Y}^H - \lambda t \right)$ also defined by import quotas as the Nash equilibrium solution of the non-cooperative game

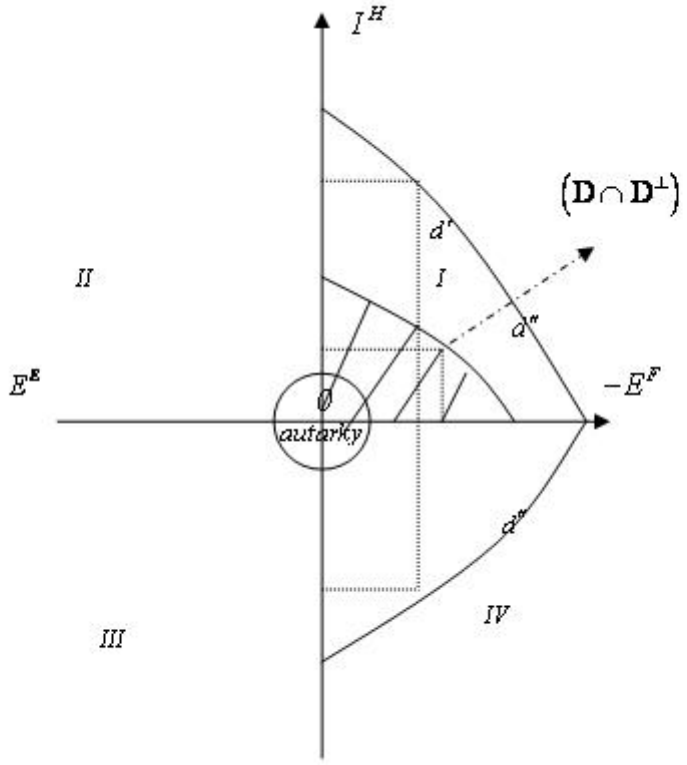

FIGURE 2. Retaliatory disagreement set

in the Foreign country. The symmetric retaliatory disagreement point is

$$(SRDP)\left(\mathbf{d}^{H\prime\prime}, \mathbf{d}^{F\prime\prime}\right) = (1/3)\left(z^H \mathbf{Y}^H - t, -z^F \mathbf{Y}^F - \lambda t\right) \text{ for } z^H \mathbf{Y}^H > t \ , \lambda > \frac{z^H Y^H}{z^F Y^H + t} \quad (8)$$

Proposition 4. *Asymmetries in the market size between two strategically interacting trading partners reinforces the retaliatory stance between them.*

Within equation (8), SRDP varies inversely related with t. A change in the parameters defining production and consumption function will determine proportional changes in both countries' prices therefore we can conclude that a country cannot be made better off without worsening the retaliatory partner. Increased openness of one country won't deter its strategic partner from tightening the protectionist stance. The market size limit is a necessary condition for SDRP to be Pareto improving and the change is less than proportional when $\lambda \in (1, \infty)$. In the figure 2 is depicted the Pareto frontier of $\mathbf{D}^2$.

Further we are concerned with the impact of the difference in market size on the retaliatory stance between countries. At first glance we might be tempted to conclude that increasing differences in market size by varying the parameter λ pushes the trade equilibrium away from the retaliatory one and the large

country may freely increase its openness without changing the other country's retaliatory stance. However, such conclusion would violate the Pareto constraint of the Nash solution. The Pareto axiom is verified if we notice that increasing differences in market size determines a decease in price differential and production potential so that Pareto improving equilibrium changes. In order to be maintained the market size increase has to be less than the price differential decrease and production potential loss. Suppose that $\lambda^{''}$ is a higher difference in market size which determines a lower price differential ($p^{F''}$-$p^{H''}$) which is the source of a lower production potential $y^{F''}$ and a higher one $y^{H''}$

$$\text{then, } \begin{cases} \lambda'' - \lambda > \left(p^{F''} - p^{H''}\right) + \left(y^{F''} - y^{H''}\right) \text{ then } I^{F''} > I^{F}, I^{H'} > I^{H} \\ \lambda'' - \lambda = \left(p^{F''} - p^{H''}\right) + \left(y^{F''} - y^{F''}\right) \text{ then } I^{F''} = I^{F}, I^{H''} = I^{H} \\ \lambda'' - \lambda < \left(p^{F''} - p^{H''}\right) + \left(y^{F''} - y^{F''}\right) \text{ then } I^{F''} < I^{F}, I^{H''} > I^{H''} \end{cases}$$

If the price and production effects do not exceed the rate of market size increase the impact on the retaliatory stance in trade is not Pareto like and countries may increase their trade openness. On the other side, using exports as retaliatory stance implies the inequality $z^F\mathbf{Y}^F + \lambda t < z^H\mathbf{Y}^H$ for $z^H\mathbf{Y}^H < t$, $\lambda < \frac{z^H Y^H}{z^F Y^H + t}$ and we retain the symmetric set of the disagreement points $\mathbf{d}^{F''} = (1/3)\left(-z^H\mathbf{Y}^H\right)$ also defined by import quotas as the Nash equilibrium solution of the non-cooperative game in the Foreign country. But a SDRP with $d^{F"}$ defined in this way is not Pareto improving and this explains why countries may both improve the retaliatory stance without being necessary one to be worse off than before. In addition, the small country find itself in a better situation that the retaliatory stance for very small differences in market size, $\lambda \in (0, 1)$.

Consequently, increasing the market size by varying the parameterλ as the European Union already proceeded through enlargement pushes the trade equilibrium away from the retaliatory one. The question is, are there any limits to enlargement? The answer is No. *As long as the price differential included in t exists and can be eliminated through political pressure for lower protection in the small country while the large country's exports expand, the difference in market size may be increased.*[3] In the next section we empirically show that the above objective can be attained using enlargement negotiations as proxy for the political pressure.

The analysis reveals that the trade policy space defined with import quota is the only Nash equilibrium of the retaliatory game between an large exporting country and a small importing one. From $\mathbf{I}^H \in \mathbf{T}^1, \mathbf{I}^F \in \mathbf{T}^{\perp}$ then $\left\langle \mathbf{I}^H, \mathbf{I}^F \right\rangle = 0 \Leftrightarrow I^H = 0$ or $I^F = 0$. In other words, at least one country chooses autarky as policy option. A market surplus may be beneficial for retaliatory trade if it is not associated with an important impact on prices and production potential. Moreover, an export quota as retaliatory stance against a large country import quota is a better outcome because it creates premises for better market access. *As long as the price differential exists and can be eliminated*

[3]The price differential doesn't exist if $p^F = p^H$. Then $t = 0$ and λ can be increased if $\frac{a^F}{a^H}$ increases. If the price differential doesn't exist anymore, the limits of enlargement are the limits of the internal political pressure.

through political pressure for lower protection in the small country while the large country's exports expand, the retaliatory import quota of the small country is not restrictive for the small country;s exports. Futhermore, if by Milner (1988) the small country's exporters fear retaliation and the political pressure for protection decreases allowing a better market access for the large country's exports. Therefore, *an import quota may increase at the same time with the volume of export increase and the supposition in the introduction was wrong.* These findings explain why EU's exports on Central East European markets have not been associated with autarky in trade relations but with enlargement.

In the next section we explore the retaliatory potential in EU15-CEEC trade relations based on the Nash equilibrium of the non-cooperative game. We further show the impact of the difference in the market size and of the varying political pressure through negotiations on the retaliatory stance. We further provide the empirical support to the claim that high volumes of exports are not deterring cooperation in trade relations.

4. Empirical analysis

4.1 Data and methodology

In this paper we have determined the retaliatory disagreement point in the space determined by the optimum import respectively export quotas or the difference between the national production and consumption potential. Formally,

$$\begin{cases} \mathbf{d}^{H\prime\prime} = \mathbf{I}^{H} = (1/3)\left(z^{H}\mathbf{Y}^{H} - t\right) \\ \mathbf{d}^{F\prime} = \mathbf{E}^{F} = -(1/3)\left(z^{F}\mathbf{Y}^{H} + \lambda t\right) \end{cases} \quad (9)$$

Substituting $d^{F\prime}$ in $d^{H\prime\prime}$ through the mean of t, $I^{F} = (1/3)\left(\lambda z^{F} Y^{H} + \lambda z^{H} Y^{H} - I^{F}\right)$ so that we have a formal expression for the retaliatory game. In order to control the influence of the production potential on the retaliatory game we have divided both sides of the last expression by $\mathbf{Y}^{H}$,

$$\frac{I^{F}}{\mathbf{Y}^{H}} = (1/3)\left(\lambda z^{F} + \lambda z^{H} - \frac{I^{H}}{\mathbf{Y}^{H}}\right) \quad (10)$$

This is an equilibrium of the international trade which we estimate empirically with the following equation,

$$lnY = \beta_0 + \beta_1 lnX_1 + \beta_2\ lnX_2 + \beta_3 lnX_3 + \beta_4 lnX_1 * X_3 + \beta_5 lnX_2 * X_3$$

where the analysis of the difference in market size and political negotiations impact is related to the small country's retaliatory stance. The dependent variable Y is the small country's import penetration ratio as compared to its import dependence. The independent variable X1 is each on his turn the import dependence respectively export dependence of the small country when we control for the difference in market size X2 and a dummy variable X3 for starting the enlargement negotiations. The import penetration ration is different from the traditional definition because the observed level of imports between countries is replaced with the difference between the internal production and the internal consumption. The optimum trade flows as difference between production and consumption have been previously estimated empirically by

Baldwin (1971) through the vector of adjusted net exports[4] for the empirical test of Heckscher-Ohlin model. In our model the vector of the optimal trade flows is similar but the empirical estimate cannot be made using adjusted net exports because in the data one country's imports are the other country's exports so that we cannot calculate the corresponding vector of adjusted net exports for the opposing player in the strategic interaction. We then compute the difference between production and consumption for optimum export quota, respectively imports minus exports for optimum import quota. In Fig. 3 we plot the adjusted net exports of the small countries in the sample against the optimum trade flows. The adjusted net exports representing the actual trade balance for wine is lower than the optimum trade flows so that if the model is verified empirically at the optimum, the actual lower volumes of net exports were not retaliatory.

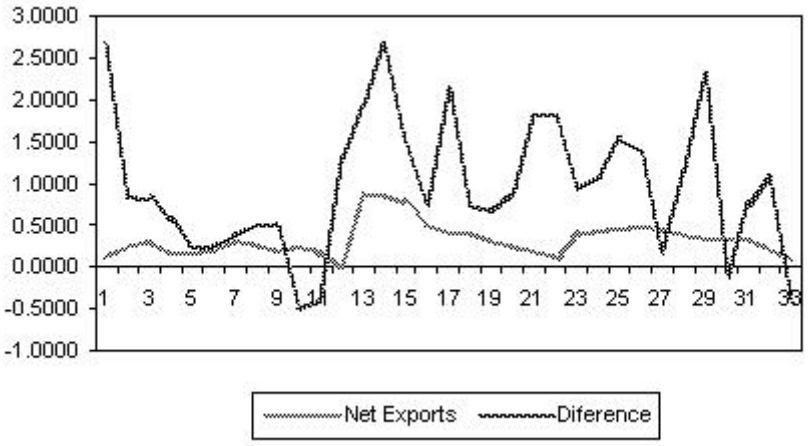

FIGURE 3. Actual versus optimum exports ('000000hl)

The dummy variable is used as a proxy for the parameter repersenting the internal political pressure and we model it as a qualitative variable interacting with each other variable defining the model. So that the rest of the variables capture the effects of the interaction between the political option of being involved in negotiations or not on the protectionist stance and the more complex interaction with the difference in market size.

We have collected data from the California Wine Institute for the European Union's wine sector. Our data covers a period of eleven years between 1995 and 2005 for three countries (Romania, Hungary and Bulgaria) included in international statistics as main wine producers on the world market and at the same time trading partners for the EU-15, candidates to enlargement and involved in negotiations for trade liberalization.

This choice of the countries is one of the most appropriate because the 1995-2005 time span includes variability in the internal political pressure for trade

[4]Adjusted net exports have been defined as industry exports minus industry imports (Feenstra (2002)).

No	Country	Average 2001-2003 ('000hl)	No	Country	Average 2001-2003 ('000hl)
1	France	50,034	11	Chile	5,988
2	Italy	46,994	12	Romania	5,269
3	Spain	35,274	13	Hungary	4,242
4	United States	24,249	14	Russia	4,007
5	Argentina	13,918	15	Greece	3,454
6	China	11,200	16	Brazil	2,933
7	Australia	10,683	17	Moldova	2,230
8	Germany	8,989	18	Austria	2,552
9	South Africa	7,504	19	Ukraine	2,197
10	Portugal	7,269	20	Bulgaria	2,185

TABLE 1. World hierarchy of wine producers, California Wine Institute

openness. The countries have started enlargement negotiations at different points in time so that it should be possible to assess the impact of a lower political pressure after the opening of negotiations.

The model suggests that a) an increase in one's player import quota doesn't change the retaliatory stance of the opposing partner (-). Because of orthogonally, the import quota is replaced by the export quota as dependent variable and we expect the same slopes but the opposite sign. As the model also suggests, b) the small country's import penetration ratio increases to permit higher access for the large country's exports. (+)

Helen Milner (1988) has been extensively analyzed the linkage between the internal protectionist pressures and the import penetration respectively export dependence ratio. For the sample of data at hand, in Table 2 we show how Milner's conclusions that higher global interdependence trigger more trade openness may be applied for EU and Romania, Bulgaria and Hungary and why we expect statistically significant result for retaliation with exports being a better outcome for international trade relations.

In 1995, five years after the collapse of the communist regime in Central East European countries, the economic reminiscences of the autarkic stance in trade are still obvious. In the economic literature there is a broad consensus regarding the isolationist economic stance which has been a characteristic for the CEEC's economies during '80 and early '90. The data in the Table 2 gives us important information of what actually isolation meant. That is a) a high export dependence rate for all Eastern European countries in the sample and b) very low import penetration ratio for EU exports. We notice high rates of wine exports finding market access on European market. Moreover, there is an obvious imbalance between the volumes of exports which have far

	Import penetration		Export dependence	
	1996	2005	1996	2005
Romania	3	4	53	22
EU-15	3	1	0.08	0.1
	1996	2005	1996	2005
Bulgaria	0.4	4	300	42
EU-15	6	1	0.002	0.04
	1995	2005	1995	2005
Hungary	5	29	103	68
EU-15	0.08	2	3	0.5

SOURCE: Author's calculations using UN Comtrade data

TABLE 2. 'Resisting protectionism' in Central East European Countries, 1995-2005

exceeded the national optimum exports while the imports penetration ratios are very close to the level we have defined as being retaliatory. In 1995, we calculated the retaliatory rates as being 4 in Romania, 22 in Bulgaria and 8 in Hungary. The import penetration ratios were all lower than the retaliatory rates. From the European Unions side has been applied an import quota of 300,000 hectoliters representing an import penetration ratio of 2.45 which is even less than the 12 percentage points the retaliatory rate. We conclude that in 1995 trade relations between Romania, Bulgaria and Hungary and EU were retaliatory. Agricultural negotiations have been opened with Hungary in 2000 and Romania and Bulgaria in 2002. In 2005, the retaliatory rates were 2 in Romania, 19 in Bulgaria and 5 in Hungary. The import penetration ratios were higher than the retaliatory rates except for Bulgaria. But in 2004, liberalization was achieved with all three countries in the sample. Not less important is the lack of imbalance between the import penetration ratios and export dependence ones. At optimum, they should be approximately equal and higher than the retaliatory rates. Table 2 depicts the most balanced situation for Hungary in 2005. Indeed, Hungary became a member of the European Union since May 2004.

4.2 Results and discussion

We have shown that the data sample fits our model and we start the empirical test using the ordinary least squares estimation technique with panel data in STATA. The data has been scaled to measure the small country production in 300,000 hl respectively 3,000,000 hl for the large country's production. The

dummy variable has been constructed assigning a 0 value for the periods when the countries were not involved in enlargement negotiations over the Agricultural Chapter and 1 starting with the year when the Agricultural Chapter has been opened for negotiation. One particular case is the one of Hungary who closed all negotiations in 2004 when it became a full member of the European Union so that we perform a sensitivity analysis estimating the model as if Hungary would still negotiate in 2004 and 2005 versus unbalanced panels with missing dummy variable for Hungary in the same period. The data is transformed into logarithms to ensure normality and hetroskedasticity. The plot of the natural logarithm of the large country's import quota against time indicates the existence of an outlier for Bulgaria in 1999 so that we reestimate the model excluding the outlier. Before proceeding with the analysis, the Hausman test for the suitability of fixed effects versus random effects for model estimation is performed. We obtain a very small Hausman statistic so that we proceed with the random effects model. In Model 1 we estimate the model using import quotas. In Model 2 we include export dependence ratio as independent variable to show orthogonality.

	Model 1	Model 2
Constant	0.172***	0.172***
	(0.023)	(0.023)
Log Small country's import quota	-0.565*	0.583*
	(0.316)	(0.324)
Log difference in market size	-0.058***	-0.058***
	(0.006)	(0.006)
A dummy for enlargement negotiations	-0.081**	-0.081***
	(0.037)	(0.037)
Log Small country's import quota*negotiations	0.759*	0.771*
	(0.470)	(0.473)
Log difference market size*negotiations	0.024***	0.024***
	(0.010)	(0.010)
Observations	33	33
R2	0.80	0.81

*p$\leq 0.10; **p \leq 0.05; ***p \leq 0.01$

TABLE 3. Empirical estimation of the retaliatory game

We have obtained the expected signs for the correlations. Indeed, under retaliation the increase of the large country quota won't deter the small country from tightening its retaliatory import quota so that at least one country chooses autarky. To further understand why this result was possible consider that the large country accepts a lower volume of exports instead of the small

country's exports and increases its import quota. But the small country choses to expand its exports by setting an import quota to protect its infant industry for example. The countries choose opposite stances and trade liberalization is not possible. On the contrary, expanding exports on competitive groundsincreases the large country's increases trade openness benefiting the global trade. As expected being involved in negotiations increases access to the large country's market. The interaction between the small country's import penetration ratio and the probability of being involved in negotiations is very interesting because it assigns a 0 value to the small country's import quota when there are not negotiations versus the politically minimum import quota when there are trade liberalization negotiations. We have obtained a positive statistically significant coefficient which indicates that negotiations make a difference in retaliatory trade relations by moving them away from autarky at least towards the Nash equilibrium of the non-cooperative game.

Political negotiations make a positive difference also in the case of the market size impact. For the European wine market the increasing surplus it can be associated with a higher order magnitude impact on internal price and production volumes suggesting a retaliatory type of market increase of the large country. However political negotiations for lower political pressure for exporting changes the impact of the market size from a retaliatory one into a positive development.

Next, we are concerned with the time impact in our cross-sectional data. Our estimates of the equation (11) reflects a simultaneous moves game for choosing the protectionist trade policy. In Model 3 we test this assumption also including a lagged value of the small country's retaliatory import quota. Time and delays might still be a concern for production because import quotas are established yearly based on the previous year production potential and the next year's forecast. Model 4 estimates the retaliatory equation including a lagged value of the difference in market potential as regressor. In Model 5 we include the squared regressor for the small country's retaliatory imports to check the linearity in the model.

As expected, we have found a negative statistically not significant value for the lagged value of the current period import quota of the small country reinforcing our assumption of a simultaneous moves game. The retaliatory game is overall significantly influenced by the change in the difference in market size between countries. Taking into consideration the past and present values of the market size difference improves the statistical significance of the retaliatory import quota at 5 percent while the linearity of the model is also verified.

Trefler (1993) estimated the endogenous protection for US using data on non tariff barriers from United Nations Conference on Trade and Development (UNCTAD) and an extensive list of regressors to capture the free-rider problem of the lobby coordination. A likelihood ratio test shows that the comparative advantage regressors given by the import penetration ratio, the change in import penetration of the following year as compared with the previous and exports are the most significant in the regression. There is not a statistically significant parameter for the import penetration ratio but for the change in

	Model 3	Model 4	Model 5
Constant	0.180***	0.195***	0.198***
	(0.025)	(0.026)	(0.026)
Log Small country's import quota	-0.537	-0.857***	-1.741**
	(0.336)	(0.341)	(0.757)
Log difference market size	-0.061***	-0.053***	-0.055***
	(0.007)	(0.007)	(0.007)
A dummy for enlargement negotiations	-0.083**	-0.087***	-0.095***
	(0.035)	(0.035)	(0.034)
Log Small country's import quota*negotiations	0.794*	0.786	1.132**
	(0.444)	(0.437)	(0.509)
Log difference market size*negotiations	0.025***	0.026***	0.029***
	(0.009)	(0.009)	(0.009)
Lagged value of Small country's import quota	-0.210		
	(0.348)		
Lagged value of Log difference market size		-0.012	-0.012
		(0.008)	(0.008)
Squared value Log Small country's imports			-32.366
			(24.845)
Observations	30	30	30
R2	0.84	0.86	0.87

*p$\leq 0.10; * * p \leq 0.05; * * *p \leq 0.01$

TABLE 4. Time changes in the retaliatory game

import penetration over the subsequent years. We are again concerned with the robustness of our results at 'time impact' so that as in Trefler (1993) we estimate the change of the large country's import quota against a yearly change in the protectionist stance of the small country. We create a new regressor to estimate the 1 percent change in the large country's protectionist stance given 1 percentage change in the small country's politically minimum import quota. We estimate the model including the change in Model 6. Similar to Trefler (1993) and in accord with our simultaneous moves game assumption, we show that the results are robust to a change in the method of estimation. In model 7 we use simultaneous equations method.

	Model 6	Model 7
Constant	0.196***	0.172***
	(0.028)	(0.020)
Log Small country's import quota	-0.882**	-0.565**
	(0.388)	(0.286)
Log difference market size	-0.066***	-0.058***
	(0.008)	(0.006)
A dummy for enlargement negotiations	-0.088***	-0.081**
	(0 .035)	(0.034)
Log Small country's import quota*negotiations	0.758*	0.759*
	(0.438)	(0.425)
Log difference market size*negotiations	0.026***	0.024***
	(0.009)	(0.009)
Yearly change in the Small country's import quota	0.052	
	(0.363)	
Yearly change in log inverse production	0.011	
	(0.008)	
Lagged value of Small country's import quota	dropped	
Lagged value of Log inverse production	dropped	
Observations	30	30
R2	0.86	0.80

*p$\leq 0.10; * * p \leq 0.05; * * *p \leq 0.01$

TABLE 5. Trefler's change in import penetration and the relation with the retaliatory game

Unlike Trefler (1993) we did not find a statistically significant coefficient for the change in the import penetration. Our estimated results are robust to any change in time and simultaneous equations estimation reinforces the previous analysis. We have found an orthogonal relationship between the lagged values of the protectionist stances in trade and production potential and the yearly changes. Neither of them is statistically significant.

Finally, the already mentioned sensitivity analysis with unbalanced panels and sensitivity to outliers is performed in Model 9 respectively Model 10.

We have found strong evidence that the retaliatory stance in trade is influence by the size of the countries in negative sense. The sign of the coefficient defining the retaliatory protectionist stance of the opposing partner is the one suggested by the model however its statistical significance is sensitive to changes in the data sample. One limitation of the estimation is the small sample size so that we cannot proceed with a more extensive analysis of sample variations.

	Model 8	Model 9
Constant	0.172***	-0.114***
	(0.023)	(0.022)
Log Small country's import quota	-0.565*	-0.222
	(0.322)	(0.260)
Log difference market size	-0.058***	-0.040***
	(0.006)	(0.006)
A dummy for enlargement negotiations	- 0.085**	-0.023
	(0.041)	(0.032)
Log Small country's import quota*negotiations	0.822	0.417
	(0.537)	(0.377)
Log difference market size*negotiations	0.025**	0.006
	(0.011)	(0.009)
Observations	30	27
R2	0.80	0.77

*p$\leq 0.10; **p \leq 0.05; ***p \leq 0.01$

TABLE 6. Sensitivity analysis of the retaliatory game

5. Conclusion

We have shown that a retaliatory policy space defined with 'import-export' quotas is not a Nash equilibrium of the non-cooperative game. The vector space model facilitates a very useful representation of the strategic interaction in trade because it is possible to incorporate both symmetric and asymmetric features of the players. In our model the outcome of the non-cooperative trade game is autarky but despite our autarky result of retaliation we would advise cautiousness in making it general. The result is dependent on the orthogonality of the vector space which defines international trade. An extension of the paper is to reconsider retaliation in an extended vector space by removing orthogonality. Our results throw a shed of light on retaliation in trade relations. For policy making, the model is important because it specifically determines how much should be restricted the volume of imports for retaliation to start, namely 1/3 from the politically minimum acceptable quotas. Exports being a better outcome of the retaliatory game explains why EU15-CEEC liberalization has been possible despite the expansionist volumes of exports on both sides. Increasing difference in the market size reinforces the protectionist stance while international negotiations benefit trade.

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