January 11, 2010

Blood Diamond:
International Policy Options for Conflict Resolution*

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Abstract

We construct a trade-theoretic model of two open economies which are in conflict with each other. War efforts — which involve the use of soldiers and military hardware — are determined endogenously. The purpose of war is the capture of land containing a natural resource like diamond, but the costs are that lives are lost and production sacrificed. The capture of mining land helps to reinforce the war by using profits from the sale of the natural resource to purchase arms. We examine the effect of a number of policy instruments available to the international community (such as foreign aid, a tax on arms exports and on the export of the natural resource from the war areas) on war efforts. We identify the role of the 'protective' nature of arms, and of income effects of the policy instruments, on the results.

JEL Classification: D74, F02, F11, H56, H77

Keywords: War, Trade, Blood diamond, Conflict, Foreign Aid, Deaths, Tax on Arms Export, Sanction on the exports of blood diamond.

1 Introduction

Conflicts between nations or between groups within a nation (civil war) for land is unfortunately not uncommon, and no continent is possibly free from it.[1] The nature of, and reasons for, conflicts can be very diverse. There are wars between nations, there are civil wars within a country, and of course we have terrorism. Each one has its own characteristics. For example, terrorism by its very nature asymmetric in terms of the objective and actions of the terrorists and their targets, and more importantly, terrorism is usually not about ownership of land.[2] Wars on the hand can take place between nations or groups that have the same objectives and characteristics. Furthermore, in most conflicts the parties adopt both defensive and offensive strategies. Hirshleifer (1988) was possibly the first analytical attempt to distinguish between the two types of strategies in wars where there are more than one 'constests': a country can adopt a defensive strategy in one war front and offensive in another. In models of war with a single contest as in the present paper, the distinctions cannot be made and implicitly both strategies are pursued. Recently, Sandler and Siqueira (2006) and Das and Roy Chawdhury (2008) have shown that in models of terrorism the distinction can have important implications.

To complicate matters further, a large number of wars between nations and civil wars, particularly in Africa, is about the ownership of natural resources. Collier and Hoeffler (1998, 2004) point out that the existence of abundant of resources in a country can actually be the cause of civil war in that country. They show that the share of primary-commodity exports in GDP is positively associated with conflict even after controlling for income.[3] Collier and Hoeffler differentiate between the benefit of conflict from looting resources (the greed or

[1]According to Gleditsch (2004), there were 199 international wars and 251 civil wars between 1816 and 2002.

[2]For some recent papers on this issue see Das and Lahiri, 2006, 2007; Sandler and Siqueira, 2006; Das and Ray Chawdhury, 2008.

[3]There is now a sizable literature that followed the Collier-Hoeffler papers (see, for example, Lederman and Maloney, 2003; Ross, 2004; Fearon, 2005; Blattman, 2005; Stijns, 2005). For a trade-theoretic analysis on the relationship between resources and conflict, see Becsi and Lahiri (2006)

opportunity motivation) from the traditional explanations in terms of relative deprivation (the grievance motivation).

Conflict about resources can and do have another unfortunate consequences. Resources captured can be used to prolong the conflict by purchasing arms from profits obtained by the sale of such resources. This has been particularly true for many conflicts in Africa where diamonds mines are of particular interests to the warring parties. Because of this, diamonds obtained from conflict zones are often called 'blood diamonds.' It order to discourage fighting for blood diamonds, the United Nations introduced in 2003 the Kimberley Process Certification Scheme (KPCS) which was designed to 'certify the origin of rough diamonds from sources which are free of conflict fueled by diamond production.' The purpose of the scheme is to prevent blood diamonds from entering the regular diamond market and to assure consumers that by purchasing certified diamonds they were not financing civil wars.

From the discussion above, it should be clear that the issue of blood diamond cannot be meaningfully analyzed without paying some attention to the issue of international arms trade. Most conflicts these days are capital intensive and therefore there is a thriving international market in military hardware.[4] A small part of the literature on conflict has examined the relationship between arms trade and conflicts (see, for example, Anderton, 1995; Levine and Smith, 1995).

The use of arms in a war comes with some important benefits, apart from the benefit from the gain of resources. This benefit is the protection of the lives of soldiers in warfare. There is a large literature which examine conflict in trade-theoretic framework.[5] However,

[4]For a discussion on the size of legal and illegal trade in arms, see Brzoska (2001).

[5]See, for example, Skaperdas and Syropoulos, 2001; Syropolous, 2004; Becsi and Lahiri, 2007a, 2007b. There is also a broader theoretical and empirical literature on the economics of conflict. The theoretical literature follows the seminal work of Hirshleifer (1988) and develops game-theoretic models of conflict (see, for example, Brito and Intriligator (1985), Hirshleifer (1995), Grossman and Kim (1996), Skaperdas (1992), Neary (1997), and Skaperdas and Syropoulos (2002)). Contributions by Anderton, Anderton, and Carter (1999), Skaperdas and Syropoulos (1996, 2001), Garfinkel, Skaperdas and Syropoulos (2004), and Findlay and Amin (2000) emphasize trade and conflict in two-country frameworks, and Becsi and Lahiri (2007a) and Anderson and Marcouiller (2005) consider three-country models.

this literature does not incorporate the human cost of conflicts.[6] Collier and Hoeffler (2005) estimate the human cost for a typical developing country engaged in civil war as being equivalent of two years of GDP. Given the importance of the cost of human lives in conflicts, the protective nature of arms makes the incorporation of the arms market in models of conflict of particular significance.

To explore the interrelationships between conflict, resources and arms trade, we develop a trade-theoretic model. Our framework has three countries. Two of the countries are in conflict with each other. The role of the third country is somewhat implicit in our analysis: it exports arms, gives foreign aid to the two warring countries, and imposes trade sanction on the export of blood diamonds from the war zones. The war is for the capture of land containing some natural resource (which will be called diamond henceforth), and soldiers and imported arms are used to fight the war. The war equilibrium is specified as a Nash one where each warring country decides on the employment of soldiers. We consider two versions of the model. In the first, the entire profits from the sale of blood diamond is used to purchase arms, and in the second, the warring countries decide the proportion of profits (from the sale of blood diamond) that is used to purchase arms at the same time as the number of soldiers. The model is closely related to that of Becsi and Lahiri (2007b) and Lahiri (2009), but with an important and significant difference. In those two papers, the conflict is over a land, and the role of profits from the land is not explicitly treated. In fact, the amount of arms purchased are determined in the Nash game along with soldiers in those papers. In contrast, in this paper, the amount of arms purchased is related to the amount of land captured in the war in a very direct way to capture an essential feature of blood diamond.

The purpose of this paper is to examine the effects of four policy options available to the international community to help resolve conflicts. The policy options we consider here are foreign aid, a tax on the exports of military hardware, a tax on blood diamond (which

[6]Becsi and Lahiri (2007b) and Lahiri (2009) are the exceptions.

is a proxy for trade sanction), and a tax on diamond exports in general from the war zones (blood or otherwise).[7] By introducing disutility from the death of soldiers, and by allowing the warring parties to choose the proportion of blood diamond profits used to buy arms, we are able to bring in two aspects into the analysis of conflict, viz., income effects of policy changes and protective property of arms. Both these aspects turn out to give interesting results. For example, we find that when entire profits from blood diamond sale is spent on arms, foreign aid unambiguously increases conflict and the mechanism works entirely via income effects. However, then the proportion of blood diamond profits spent on arms imports is chosen optimally by the warring parties, foreign aid increases conflict when arms are sufficiently protective of the lives of soldiers.

The plan of the paper is as follows. In the next Section 2 we spell out our model structure. Section 3 performs the analysis of the model. Some concluding remarks are made in section 4.

2 The Model

We develop a two-region, many-factor model where the regions — labeled region a and region b — are engaged in a war or conflict with each other. All product and factor markets are perfectly competitive and the regions act like small open economies in international markets of all goods. There are many inelastically supplied factors of production; however, two of the factors, namely labor and land, play important roles in our analysis. A part of labor endowment in regions a and b is used in production and the rest is used to fight the war and land is what they fight for. Similarly, a part of land endowment is used to mine or extract some natural resource like diamond, and a part of this in turn is subject to conflict. The disputed diamond-producing land is denoted by X, and p^D is the international price of

[7] Labeling diamonds as blood diamonds has its problems like labeling goods that do not follow international labor or environmental standards. We shall ignore those issues here. For an analysis of labeling issues related to international labor standards, see, for example, Basu et al. (2006). For issues related to effectiveness of sanctions in general, see Hufbauer et al. (1990).

diamond. Without loss of any generality we shall assume that both regions own the same amount of the disputed land initially, i.e., each own $X/2$ amount. Regions a and b fight over the disputed diamond-producing land by employing soldiers L_s^a and L_s^b and buying military hardware A^a and A^b from the rest of the world.[8] A part of profits raised by selling diamond from the disputed land is used to buy military hardware from the rest of the world. We define $f(L_s^a, L_s^b, A^a, A^b)X$ as the net equilibrium ownership of the blood-diamond producing disputed land by country a from war. The net ownership function for country a increases when more fighting forces and military hardware — L_s^a and A^a — are committed to conflict but decreases when the opposition increases its fighting forces L_s^b and hardware A^b. For this net-ownership function we make the following assumptions.

Assumption 1 *The function $f(\cdot)$ satisfies: $f_1 > 0$, $f_2 < 0$, $f_3 > 0$, $f_4 < 0$, $f_{33} < 0$, $f_{44} > 0$, $f_{11} < 0$, $f_{13} > 0$, $f_{24} > 0$, and $f_{22} > 0$.*

The assumption that $f_{13} > 0$ and $f_{24} > 0$ implies that soldiers and military hardware complement each other in war.

The production sides of the economies are described by two revenue functions

$$R^a(p^D - t^D, p^D - t^D - t^B, \bar{L}^a - L_s^a, f(L_s^a, L_s^b, A^a, A^b)X)$$
$$\text{and} \qquad R^b(p^D - t^D, p^D - t^D - t^B, \bar{L}^b - L_s^b, (1 - f(L_s^a, L_s^b, A^a, A^b))X),$$

where $\bar{L}^i$ is the endowments of labor in country i $(i = a, b)$, t^D a 'tax' on all diamond exports by countries a and b, and t^B is an additional tax on blood diamond. All these taxes are assumed to be imposed by the international community.

All factors other than labor and land for mining blood diamond are suppressed in the revenue functions as they do not change in our analysis. As is well known, the partial derivative of a revenue function with respect to the price of a good gives the output supply

[8] As mentioned in the introduction, since we have a single and common piece of land over which both countries fight, we cannot distinguish between defensive and offensive roles of soldiers and arms.

function of that good. Similarly, the partial derivative of a revenue function with respect to a factor endowment gives the price of that factor. The revenue functions are positive semi-definite in prices and negative semi-definite in the endowments of the factors of production. For these and other properties of revenue functions see Dixit and Norman (1980). We shall make the Heckscher-Ohlin assumption that endowments do not alter factor prices. In our context, it implies that $R^a_{34} = R^b_{34} = 0$.

Some of the soldiers die in course of the war, and the representative consumers in the warring countries suffer some disutility from it. The number of soldiers that die is denoted by D^i and gives a measure of the intensity of conflict. Deaths of soldiers and the utility of the consumer u^i, in country i $(i = a, b)$ are determined by

$$D^i = \bar{g}^i(L^a_s, L^b_s, A^a, A^b), \tag{1}$$

$$u^i = \tilde{u}^i - h^i(D^i) = \tilde{u}^i - g^i(L^a_s, L^b_s, A^a, A^b),\ \ i = a, b, \tag{2}$$

where $\tilde{u}^i$ is the utility from the consumption of goods and the disutility function g^i is assumed to satisfy

Assumption 2 $g^i(L^a_s, L^b_s, A^a, A^b)$ *is additively separable, i.e.,*

$$g^i(L^a_s, L^b_s, A^a, A^b) = \bar{g}^i_a(L^a_s, A^a) + \bar{g}^i_b(L^b_s, A^b),$$

so that $g^i_{12} = g^i_{34} = g^i_{14} = g^i_{23} = 0$. *It is also assumed to satisfy* $g^i_1 > 0, g^i_2 > 0, g^a_3 < 0,\ g^a_4 > 0,$ $g^b_3 > 0, g^b_4 < 0, g^i_{11} < 0, g^i_{22} < 0, g^a_{13} < 0, g^a_{33} > 0, g^b_{24} < 0, g^b_{33} < 0, g^a_{44} < 0, g^b_{44} > 0, (i = a, b).$

The assumptions that $g^a_3,\ g^b_4,\ g^a_{13}$ and g^b_{24} are all negative capture the defensive or protective roles of military hardware. That is, military hardware is assumed to protect the lives of soldiers.[9] This is in contrast to the net gain function $f(\cdot)$ which has an aggressive role in the sense that $f^a_3,\ f^b_4,\ f^a_{13}$ and f^b_{24} are all positive.

[9]A mentioned in footnote 8, in our analysis there is no distinction between offensive and defensive roles of soldiers or military hardware in terms of the net gain function f. However, in terms of the disutility from death function, we assume that whereas arms defend soldiers against deaths to some extent, soldiers do not defend each other. A higher number of soldiers, *ceteris paribus*, exposes more soldiers to deaths from attacks from enemies. This is the rationale behind the assumption that $g^i_1 > 0$.

Given the above utility function, the consumption side of the economies is represented by the expenditure functions $E^a(u^a + g^a(\cdot))$ and $E^b(u^b + g^b(\cdot))$.[10]

The rate of return from mining blood diamond in country i is R_4^i $(i = a, b)$. We assume that a proportion λ^i of this profits from the sale of blood diamond is spent to buy arms A^i $(i = a, b)$:

$$\begin{aligned} \lambda^a f(L_s^a, L_s^b, A^a, A^b) X R_4^a &= (p^A + t^A)A^a, && (3) \\ \lambda^b (1 - f(L_s^a, L_s^b, A^a, A^b)) X R_4^b &= (p^A + t^A)A^b, && (4) \end{aligned}$$

where p^A is the international price of arms, and t^A the 'tax' on the sale of arms to the warring countries.

We assume that the expenditure on war efforts is paid for in the two warring countries by taxation of the consumers. That is, the governments' budget-balance equations are given by

$$\begin{aligned} T^a &= R_3^a L_s^a + (p^A + t^A)A^a, && (5) \\ T^b &= R_3^b L_s^b + (p^A + t^A)A^b, && (6) \end{aligned}$$

The income-expenditure balance equations of consumers in the two countries are given by:

$$\begin{aligned} E^a\left(u^a + g^a(\cdot)\right) &= R^a(p^D - t^D, p^D - t^D - t^B, \bar{L}^a - L_s^a, f(\cdot)X) + R_3^a L_s^a - T^a + F^a, && (7) \\ E^b\left(u^b + g^b(\cdot)\right) &= R^b(p^D - t^D, p^D - t^D - t^B, \bar{L}^b - L_s^b, (1 - f(\cdot))X) + R_3^b L_s^b - T^b + F^b, && (8) \end{aligned}$$

where F^i is the amount of foreign aid received by country i $(i = a, b)$.[11]

[10]We assume that diamonds are only for export and so their prices are omitted from the expenditure function. The partial derivative with respect to the utility level is the reciprocal of the marginal utility of income.

[11]Foreign aid is assumed to be completely untied. It is well established that it is very difficult for the donor countries to enforce conditionality, and foreign aid is, to all intents and purposes, highly fungible (see Pack and Pack, 1993; Khilji and Zampelli, 1994; Boone, 1996; Feyzioglu et al., 1998). For an analysis of tied aid see, for example, Lahiri and Raimondos-Møller, 1997.

The second term on the right hand side of (7) and (8) — $R_3^a L_s^a$ and $R_3^b L_s^b$ respectively — is the income of the soldiers in the two countries. The terms T^a and T^b are lump-sum taxes on the consumers in the two countries.

Substituting (6) into (7) and then differentiating it we get:

$$\begin{aligned} E_1^a du^a &= [-E_1^a g_1^a - R_3^a + (1-\lambda^a) f_1 X R_4^a] dL_s^a - X f R_4^a d\lambda^a + \alpha dA^a - \beta dA^b + dF^a \\ &\quad + [-E_1^a g_2^a + (1-\lambda^a) f_2 X R_4^a] dL_s^b + [-R_1^a - R_2^a + \lambda^a X f (R_{41}^a + R_{42}^a)] dt^D \\ &\quad + [-R_2^a + \lambda^a X f R_{42}^a] dt^B, \end{aligned} \tag{9}$$

where

$$\alpha = -E_1^a g_3^a + (1-\lambda^a) f_3 X R_4^a > 0, \quad \beta = E_1^a g_4^a - (1-\lambda^a) f_4 X R_4^a > 0.$$

The change in utility in country b can be similarly derived.

An increase in soldiers in country a has three direct effects on welfare in that country. It increases disutility from death of soldiers ($-E_1^a g_1^a$), reduces labor in the productive sector and therefore labor income ($-R_3^a$), and increases income from blood diamond (net costs of arms purchase) ($(1-\lambda^a) f_1 X R_4^a$). An increase in the proportion of profits from blood diamond used for arms purchase reduces the income of consumers from blood diamond ($-X f R_4^a$). An increase in arms purchase increases welfare by increasing profits from blood diamond and by reducing death of soldiers. Similarly, an increase in arms purchase, or in employment of soldiers, by country b reduces welfare in country a. An increase in tax on regular or blood diamond reduces income by reducing producers prices, and they also affect welfare by changing the rate of return from mining blood diamond (R_{41}^a and R_{42}^a). A tax (by the international community) on the exports of arms has no direct effect on the level of welfare in the warring countries.

3 The War equilibrium

We shall now try to determine the equilibrium levels of soldiers (L_s) and the proportion of blood diamond profits used for the purchase of arms (λ) in the two countries. In order to do so, we first of all need to derive how the levels of arms purchase (A) depends on these two variables and the tax instruments. Differentiating (3) and (4) we find

$$\left[p^A + t^A - \lambda^a X R_4^a f_3\right] dA^a - \lambda^a X R_4^a f_4 dA^b = -A^a dt^A + \lambda^a X R_4^a f_1 dL_s^a + \lambda^a X R_4^a f_2 dL_s^b$$
$$-\lambda^a X f \left[R_{41}^a + R_{42}^a\right] dt^D + X f R_4^a d\lambda^a - \lambda^a X f R_{42}^a dt^B, \tag{10}$$
$$\lambda^b X R_4^b f_3 dA^a + \left[p^a + t^A + \lambda^b X R_4^b f_4\right] dA^b = -A^b dt^A - \lambda^b X R_4^b f_1 dL_s^a - \lambda^b X R_4^b f_2 dL_s^b$$
$$-\lambda^b (1-f) X \left[R_{41}^b + R_{42}^b\right] dt^D + (1-f) X R_4^a d\lambda^b - \lambda^b (1-f) X R_{42}^b dt^B. \tag{11}$$

From (10) and (11), we solve

$$\begin{aligned}
\Delta \cdot \frac{\partial A^a}{\partial L_s^a} &= (p^A + t^A)\lambda^a X R_4^a f_1 > 0, \quad \Delta \cdot \frac{\partial A^a}{\partial L_s^b} = (p^A + t^A)\lambda^a X R_4^a f_2 < 0, \\
\Delta \cdot \frac{\partial A^a}{\partial \lambda^a} &= (p^A + t^A + \lambda^b X R_4^b f_4) X R_4^a f, \quad \Delta \cdot \frac{\partial A^a}{\partial \lambda^b} = (1-f) X^2 R_4^b \lambda^a R_4^a f_4 < 0, \\
\Delta \cdot \frac{\partial A^a}{\partial t^A} &= -A^a (p^A + t^A + \lambda^b X R_4^b f_4) - A^b \lambda^a X R_4^a f_4, \qquad (12) \\
\Delta \cdot \frac{\partial A^a}{\partial t^D} &= -\lambda^a X f (R_{41}^a + R_{42}^a)(p^A + t^A + \lambda^b X R_4^b f_4) - \lambda^b X^2 (R_{41}^b + R_{42}^b)\lambda^a R_4^a f_4 (1-f), \\
\Delta \cdot \frac{\partial A^a}{\partial t^B} &= -\lambda^a X f R_{42}^a (p^A + t^A + \lambda^b X R_4^b f_4) - \lambda^b X^2 R_{42}^b \lambda^a R_4^a f_4 (1-f),
\end{aligned}$$

and

$$\begin{aligned}
\Delta \cdot \frac{\partial A^b}{\partial L_s^a} &= -(p^A + t^A)\lambda^b X R_4^b f_1 < 0, \quad \Delta \cdot \frac{\partial A^b}{\partial L_s^b} = (p^A + t^A)\lambda^b X R_4^b f_2 > 0, \\
\Delta \cdot \frac{\partial A^b}{\partial \lambda^a} &= -f X^2 R_4^b \lambda^b R_4^a f_3 < 0, \quad \Delta \cdot \frac{\partial A^b}{\partial \lambda^b} = (p^A + t^A - \lambda^a X R_4^a f_3) X R_4^b (1-f) < 0, \\
\Delta \cdot \frac{\partial A^b}{\partial t^A} &= -A^b(p^A + t^A - \lambda^a X R_4^a f_3) + A^a \lambda^b X R_4^b f_3, \qquad (13) \\
\Delta \cdot \frac{\partial A^b}{\partial t^D} &= -\lambda^b X(1-f)(R_{41}^b + R_{42}^b)(p^A + t^A + \lambda^a X R_4^a f_3) + \lambda^b X^2 (R_{41}^a + R_{42}^a)\lambda^a R_4^b f_4 f, \\
\Delta \cdot \frac{\partial A^b}{\partial t^B} &= -\lambda^b X(1-f) R_{42}^b (p^A + t^A - \lambda^a X R_4^a f_3) + \lambda^b X^2 R_{42}^a \lambda^a R_4^b f_4 f,
\end{aligned}$$

where

$$\Delta = (p^A + t^A)^2 + (p^a + t^A) X(\lambda^b R_4^b f_4 - \lambda^a R_4^a f_3).$$

It is to be noted that $\Delta > 0$ in order for the excess demand for arms to be downward sloping.

The above results can be explained as follows. An increase in soldiers in a country increases the amount of land for mining blood diamond, and therefore the purchase of arms, in that country and reduces those in the other country. An increase in the value of λ in a country increases arms purchase in that country. This increase in arms purchase reduces the land for mining blood diamond, and therefore arms purchase, in the other country. However, the amount of arms purchased increases the amount of land for mining blood diamond, and this increases profits to purchase more arms. An increase in the tax on arms exports (t^A) reduces the amount of arms purchased in both countries. A tax on regular or blood diamond reduces the producers price of these goods and therefore reduces the rate of return to mining blood diamond (assuming $R_{42} > 0$ and $R_{41} > 0$), and these in turn affects the purchase of arms in both positive and negative ways. Reduction in arms purchase is straightforward as profits from mining blood diamond shrinks. An increase in the taxes can also increase the purchase of arms purchase in one country by reducing arms purchase in the other country.

Having derived the levels of arms purchases, we can now describe the war equilibrium. We shall do so under two scenarios. In the first, we shall assume that in both countries the entire profits from the sale of blood diamond is used to purchase arms, i.e., $\lambda^a = \lambda^b = 1$. In the second scenario, these variables are also optimally determined. The two scenarios are taken up in turn in the following two subsections.

3.1 Exogenous λ

In this subsection we shall assume that $\lambda^a = \lambda^b = 1$, i.e., the entire profits from the sale of blood diamonds is used to purchase arms. We shall consider a Nash game where each country determines the level of its soldiers, taking the number of soldiers employed by the other country as given.

From (9), we obtain the first-order condition for the determination of the number of soldiers in country a:

$$\frac{\partial u^a}{\partial L_s^a} = -E_1^a g_1^a - R_3^a + \alpha \frac{\partial A^a}{\partial L_s^a} - \beta \frac{\partial A^b}{\partial L_s^a} = 0, \tag{14}$$

where $\partial A^a / \partial L_s^a$ and $\partial A^b / \partial L_s^a$ are given in (12) and (13) respectively.

Similarly, the first-order condition for the determination of the number of soldiers in country b can be determined and then the two first-order condition together would determine the equilibrium values of L_s^a and L_s^b. Henceforth, we shall assume that countries a and b are perfectly symmetric. The implications of this assumption are formally stated as:

Assumption 3 $L_s^a = L_s^b,\ A^a = A^b,\ F^a = F^b,\ f(\cdot) = 1/2,\ f_1 = -f_2,\ f_3 = -f_4,\ g_3 = -g_4,\ f_{12} = f_{14} = f_{32} = f_{34} = 0.$

Using assumption 3, removing country-specific superscripts, the first-order condition (14) reduces to

$$(E_1 g_1 + R_3) = \frac{2E_1(-g_3)R_4 f_1 X}{\gamma}, \tag{15}$$

where $\gamma = p^A + t^A + 2XR_4 f_4$. Since $E_1 g_1 + R_3 > 0$ and $g_3 < 0$, it follows from (15) that for an interior solution of L_s, we must have $\gamma > 0$, and this follows from our earlier assumption that $\Delta > 0$.

The left-hand side of (14) is the marginal cost of employing soldiers: disutility from the death of soldiers divided by the marginal utility of income ($E_1 g_1$) and the loss of value of private sector production (R_3). The right-hand side is the marginal benefit of employing a soldier: it increases the purchase of arms in country a and reduces that in country b, and these, by the virtue of the protective nature of arms, reduces the disutility from the death of soldiers in country a.

Using assumption 3 and(15), equation (9) can be rewritten as:

$$\begin{aligned} E_1 du &= -[(g_1 + g_2)E_1 + R_3]dL_s + dF + [-R_2 + XfR_{42}]dt^B \\ &\quad + [-R_1 - R_2 + Xf(R_{41} + R_{42})]dt^D. \end{aligned} \tag{16}$$

The first term on the right hand side of (16) is the international externality of employing soldiers: an increase in soldiers employed in country b reduces welfare in country a; the own effect disappears because of the envelope theorem. The other terms have been explained before.

Differentiating (15) and using assumption 3, (15) and (16), we get

$$\begin{aligned} \Delta_l dL_s &= \left[(E_1 g_1 + R_3)(1 - 4A^2 f_{44}) - \frac{A}{p^A + t^A}\{\gamma E_1 g_{13} + 2R_4 E_1 X(g_3 f_{13} + f_1 g_{33})\}\right] dt^A \\ &\quad - \frac{\gamma R_3 E_{11}}{(E_1)^2} dF + [-2R_{42}X(E_1 g_1 + R_3)(f_4 + Af_{44}) - \gamma R_{32} - 2g_3 E_1 X f_1 R_{42} \\ &\quad - \frac{XfR_{42}}{p^A + t^A}\{\gamma E_1 g_{13} + 2R_4 E_1 X(g_3 f_{13} + f_1 g_{33})\} - \frac{\gamma R_3 E_{11}(-R_2 + XfR_{42})}{(E_1)^2}\Big] dt^B \\ &\quad + [-2(R_{41} + R_{42})X(E_1 g_1 + R_3)(f_4 + Af_{44}) - \gamma(R_{31} + R_{32}) \\ &\quad - 2g_3 E_1 X f_1 (R_{41} + R_{42}) - \frac{Xf(R_{41} + R_{42})}{p^A + t^A}\{\gamma E_1 g_{13} + 2R_4 E_1 X(g_3 f_{13} + f_1 g_{33})\} \\ &\quad - \frac{\gamma R_3 E_{11}(-R_1 - R_2 + Xf(R_{41} + R_{42}))}{(E_1)^2}\Big] dt^D \end{aligned} \tag{17}$$

where

$$\Delta_l = \frac{-\gamma (R_3)^2 E_{11}}{(E_1)^2} - 2g_3 f_{11} R_4 E_1 - \gamma E_1 g_{11} - 2(E_1 g_1 + R_3) R_4 f_{42} - 2E_1 X f_1 R_4 g_{31} < 0,$$

in order fro the second-order condition to be satisfied.

We first examine the effect of an increase in foreign aid. From (17), we find that $dL_s/dF > 0$. That is, foreign aid unambiguously increases the employment of soldiers. This effects work only via income effect. An increase in income (because of foreign aid) decreases the marginal utility of income, and this increases both the marginal cost and marginal benefit of the employment of soldiers (identified after (15)). At the equilibrium, the later effect dominates. As for the effect on arms purchase, because of (12), we have

$$\begin{aligned} \frac{\partial A^a}{\partial j} &= \frac{\partial A^a}{\partial j} + \left[\frac{\partial A^a}{\partial L_s^a} + \frac{\partial A^a}{\partial L_s^b} \right] \cdot \frac{\partial L_s}{\partial j} \\ &= \frac{\partial A^a}{\partial t^i}, \ (j = F, t^A, t^B, t^D). \end{aligned} \tag{18}$$

However, from (12) we note that foreign aid has no direct effect the equilibrium value of A because income effects do not get into the determination of A (equations (3) and (4)), and the indirect effect via changes in L_s^a and L_s^b cancel each other out. Note that the only strategic variable available to the warring countries is the employment of soldiers and the purchase of arms are determined from their revenue constraints. In this respect, the mechanism via which the war equilibrium is attained in this paper is fundamentally different from that in the exiting literature (see, for example, Becsi and Lahiri (2007b) and Lahiri (2009)), and this is because the issue of blood diamond comes with its own specific modeling strategy. The above results are summarized in the following proposition.

Proposition 1 *When the entire profits from blood diamond is used to purchase arms, an increase in foreign aid to the symmetric warring parties unambiguously increase the employment of soldiers, but leaves the levels of arms imports unchanged.*

Turning to the effect of an tax on arms exports, it does not affect the factor prices but works via marginal disutilities from death of soldiers g_1 and g_3 and marginal contest functions f_1 and f_4. Since t^A does not have a direct effect on welfare, no income effect is present in this case. If the protective nature of arms, given by $-g_3$, is sufficiently high, then the marginal benefit of employing soldiers goes down significantly with reduced arms imports caused by an increase in t^A, and an increase in t^A would decrease the equilibrium level of L_s. As for the effect on arms imports, it follows from (12) and (18) that dA/dt^A is unambiguously negative. Formally,

Proposition 2 *When the entire profits from blood diamond is used to purchase arms, an increase in the tax on arms exports by the international community unambiguously decreases the level of arms imports, and lowers the employment of soldiers if arms are sufficiently protective of soldiers' lives.*

Ass opposed tax on arms exports, a tax on blood diamond or regular diamond affects the employment of soldiers via changes in factor prices R_3 and R_4. Income effect also plays a role here. In fact, if factor prices are not very sensitive to producer prices, i.e., $R_{31} = R_{32} = R_{41} = R_{42} \simeq 0$, then the only effect that remain is the income effect. For example, an increase in the tax on blood diamond imports from conflict areas, reduces income in the warring countries by the amount $R_2 dt^B$. This increases marginal utility of income and reduces marginal costs and benefits of employing a soldier. In this case, the next effect on soldier employment is negative. From (12) and (18), we find that an increase in t^B reduces arms imports if an increase in producer price of blood diamond increases returns to the mining blood diamond, i.e., $R_{42} > 0$, and it has no effect if $R_{42} \simeq 0$. Formally,

Proposition 3 *When the entire profits from blood diamond is used to purchase arms, an increase in the tax on imports of blood diamond from the conflict areas by the international community decreases the employment of soldiers when factor prices are insensitive to pro-*

ducer price of diamond, and lowers the imports of arms if a decrease in producer price of blood diamond increases returns to the mining of blood diamond.

3.2 Endogenous λ

In this subsection we consider a situation where both warring countries have two instruments at their disposal: employment of soldiers and the proportion of profits from the mining of blood diamond allocated to the purchase of arms. AS before, we consider a Nash game in which each country chooses L_s and λ, taking these in the other country as given. From (9), we obtain the first-order condition for the determination of L_s^a and λ^a:

$$\begin{aligned}
\frac{\partial u^a}{\partial L_s^a} &= -E_1^a g_1^a - R_3^a + (1-\lambda^a) f_1 X R_4^a + \alpha \frac{\partial A^a}{\partial L_s^a} - \beta \frac{\partial A^b}{\partial L_s^a} = 0, \\
\frac{\partial u^a}{\partial \lambda^a} &= -X f R_4^a + \alpha \frac{\partial A^a}{\partial \lambda^a} - \beta \frac{\partial A^b}{\partial \lambda^a} = 0, \qquad (19)
\end{aligned}$$

where $\partial A^a/\partial L_s^a$, $\partial A^b/\partial L_s^a$, $\partial A^a/\partial \lambda^a$, and $\partial A^b/\partial \lambda^a$ are given in (12) and (13).

Using assumption 3 (symmetry), removing country-specific superscripts, the first-order conditions (19) reduce to

$$\begin{aligned}
E_1 g_1 + R_3 &= (1+\lambda) R_4 f_1 X, \\
-E_1 g_3 - (1+\lambda) X R_4 f_4 &= P^A + t^A. \qquad (20)
\end{aligned}$$

The left-hand side of the first equation is the marginal cost of employing soldier, and the right hand side marginal benefit.The left hand side of the second equation is the marginal benefit of allocating more of blood-diamond profits for the purchase of arms, and the right hand side is the marginal cost.

Using assumption 3 and(20), equation (9) can be rewritten as:

$$\begin{aligned}
E_1 du &= [-(g_1+g_2)E_1 - R_3] dL_s - X R_4 (1-f) d\lambda + dF + [-R_2 + \lambda X f R_{42}] dt^B \\
&\quad + [-R_1 - R_2 + \lambda X f (R_{41} + R_{42})] dt^D. \qquad (21)
\end{aligned}$$

This equation is similar to (16) for the case of exogenous λ. There is an extra term here and this $-XR_4(1-f)d\lambda$ which is the international externality of changing λ. An increase in the value of λ is one country reduces welfare in the other country.

We shall now examine the effect of foreign aid and the three tax instruments on the war equilibrium. Differentiating (20) and using (20) and (21), we get

$$\begin{aligned} a_{11}dL_s + a_{12}d\lambda &= a_{13}dF + a_{14}dt^A + a_{15}dt^B + a_{16}dt^D, \\ a_{21}dL_s + a_{22}d\lambda &= a_{23}dF + a_{24}dt^A + a_{25}dt^B + a_{26}dt^D, \end{aligned} \tag{22}$$

where the coefficients a_{ij}'s are defined in the appendix.

Solving (22) simultaneously, we get

$$\begin{aligned} \Delta_{ll} \cdot \frac{dL_s}{dF} &= a_{22}a_{13} - a_{23}a_{12},\ \Delta_{ll} \cdot \frac{d\lambda}{dF} = a_{11}a_{23} - a_{21}a_{13}, \\ \Delta_{ll} \cdot \frac{dL_s}{dt^A} &= a_{22}a_{14} - a_{24}a_{12},\ \Delta_{ll} \cdot \frac{d\lambda}{dt^A} = a_{11}a_{24} - a_{21}a_{14}, \\ \Delta_{ll} \cdot \frac{dL_s}{dt^B} &= a_{22}a_{15} - a_{25}a_{12},\ \Delta_{ll} \cdot \frac{d\lambda}{dt^B} = a_{11}a_{25} - a_{21}a_{15}, \\ \Delta_{ll} \cdot \frac{dL_s}{dt^D} &= a_{22}a_{16} - a_{26}a_{12},\ \Delta_{ll} \cdot \frac{d}{dt^D} = a_{11}a_{26} - a_{21}a_{16}, \end{aligned} \tag{23}$$

where $\Delta_{ll} = a_{11}a_{22} - a_{12}a_{21}$. From the second-order condition, we should have $a_{11} < 0$, $a_{22} < 0$ and $\Delta_{ll} > 0$.

As opposed to the case where $\lambda = 1$, here the effect of foreign aid on the employment of soldiers is no longer unambiguously positive. As before, an increase in F increases income and therefore reduces the marginal utility of income and this increases the employment of soldiers. It is also clear that $d\lambda/dF > 0$ if arms are sufficiently protective of soldiers' lives, i.e., the absolute value of g_3 is sufficiently large. In this case, an increase in λ reduces income accruing to the representative consumers and works in the opposite direction as far as the effect of L_s is concerned. However, it can be easily verified that when $-g_3 >> 0$, $dL_s/dF > 0$

and $d\lambda/dF > 0$. As for the effect on the imports of A, Because of (12), we have

$$\begin{aligned}\frac{\partial A^a}{\partial j} &= \frac{\partial A^a}{\partial j} + \left[\frac{\partial A^a}{\partial L_s^a} + \frac{\partial A^a}{\partial L_s^b}\right] \cdot \frac{\partial L_s}{\partial j} + \left[\frac{\partial A^a}{\partial \lambda^a} + \frac{\partial A^a}{\partial \lambda^b}\right] \cdot \frac{\partial \lambda}{\partial j} \\ &= \frac{\partial A^a}{\partial j} + \frac{1}{p^A + t^A} \cdot \frac{\partial \lambda}{\partial j}, \ (j = F, t^A, t^B, t^D).\end{aligned}$$

Since $\partial A/\partial F = 0$, we find that $dA/dF > 0$ when $-g_3 >> 0$. Formally,

Proposition 4 *Suppose that the proportion profits from the sale of blood diamond used for the purchase of arms is endogenously chosen by the two symmetric warring countries along with the level of soldiers. In this scenario, when arms are sufficiently protective of soldiers' lives, an increase in foreign to the warring parties increases the employment of soldiers, the proportion of blood diamond profits allocated to the purchase of arms, and the purchase of arms.*

Turning now to the effect of a tax on arms exports, we first of need to ascertain the sign of the coefficient a_{24} which tells us how the marginal net cost of λ changes with t^A. It consists of two terms: a positive component (1) which gives the direct effect on marginal cost and a negative component which captures the indirect effect on marginal benefit. We shall make the reasonable assumption that $a_{24} > 0$. With this assumption, $dL_s/dt^A < 0$, and if, in addition, $-g_3 >> 0$, then $d\lambda/dt_A > 0$ and also $dA/dt^A > 0$. The reason why $d\lambda/dt_A > 0$ when $-g_3 >> 0$ is that a decrease in L_s induced by an increase in t^A reduces the net marginal cost of λ when $-g_3 >> 0$. Formally,

Proposition 5 *Suppose that the proportion profits from the sale of blood diamond used for the purchase of arms is endogenously chosen by the two symmetric warring countries along with the level of soldiers. In this scenario, an increase in a tax on arms exports always reduces the employment of soldiers, but increases the imports of arms when arms are sufficiently protective of soldiers' lives.*

Comparing proposition 5 (the case of endogenous λ) with proposition 2 (the case of exogenous λ), we note that the effect of t^A on the war equilibrium can be very very different in the two cases.

Finally, when factor prices are rigid to changes in producer prices of diamond income effects dominate and increase in t^B or t^D reduces income and increases the marginal utility of income. This in turn, as in the case of exogenous λ, reduces the marginal benefit of employing more soldiers or allocating more of blood diamond profits for the purchase of arms. Formally,

Proposition 6 *Suppose that the proportion profits from the sale of blood diamond used for the purchase of arms is endogenously chosen by the two symmetric warring countries along with the level of soldiers. In this scenario, an increase in the tax on imports of blood diamond from the conflict areas by the international community decreases the employment of soldiers and the imports of arms when factor prices are insensitive to producer price of diamond.*

As should be clear from the analysis above, introducing possible deaths of soldiers allow us to bring in two interesting channels via which the policy instruments affect the results, and these are the protective nature of arms given by g_3 and income effects given by the marginal utility of income. Allowing an extra instrument to the warring parties in the form of the fraction of blood diamond profits that is allocated for the purchase of arms also enriches our analysis.

4 Conclusion

Conflicts between groups of people or nations are of genuine concern for the international community as insecurity in one of the world can have security implication in a completely different part. Actions by the international community — deliberate or inadvertent — can also have implications for those conflicts. For example, by selling arms — directly or indirectly — to the warring parties the international community can exacerbate conflicts. Similarly, by buying diamonds — knowingly or unknowingly — originating from conflict areas, one can actually help finance a war. The two together — buying blood diamonds from, and then selling arms to, warring parties are a whole lot worse. To help the international community in these respects, the United Nations introduced a certification process whereby non-blood diamonds can be identified and consumers in the international community can buy them with a clear conscience and without any fear of flaming the fires of conflicts. Similarly, the Obama administration "announced recently that the U.S. would reverse Bush administration opposition to global small arms negotiations, paving the way for the U.N. 'Conference on the Arms Trade Treaty' which could lead to export limitations within three years."[12]

In this paper, we develop a theoretical model to examine a number of policy options for the international community in situations where two nations or groups are involved in a capital-intensive war using sophisticated military hardware and finance them by selling natural resources such as diamonds captured during the war itself. The policy options we consider are foreign aid, a tax on arms exports (proxy for export restrictions on arms to conflict areas), a tax on blood diamond (proxy for sanctions on trade in blood diamond), and a tax on export of diamonds (blood or otherwise) from war zones.

One of our findings is that foreign aid (which is supposed to raise the opportunity cost of war) is unlikely to work. This is because when there is disutility from the death of soldiers, an increase income would increase the opportunity cost of war but would also induce the warring parties to obtains more arms to protect the lives of soldiers. We also find that the degree of protective nature of arms is a very important variable and some of the well-meaning policies can be counter-productive if this variable takes a very large value.

[12]See http://www.examiner.com/x-2698-Charlotte-Gun-Rights-Examiner y2009m10d31-With-US-support -UN-negotiates-global-small-arms-export-restrictions

Appendix

$$
\begin{aligned}
a_{11} &= \frac{g_1 E_{11} R_3}{E_1} - E_1 g_{11} + x(1+\lambda) R_4 f_{11} < 0, \quad a_{13} = \frac{g_1 E_{11}}{E_1} > 0, \\
a_{12} &= \frac{g_1 E_{11} X R_4 (1-f)}{E_1} + X f_1 R_4 - \frac{A}{\lambda} \cdot [E_1 g_{13} - X(1+\lambda) R_4 f_{13}] > 0, \\
a_{14} &= -\frac{A}{p^A + t^A} \cdot [E_1 g_{13} - X(1+\lambda) R_4 f_{13}] > 0, \quad a_{23} = \frac{g_3 E_{11}}{E_1} < 0, \\
a_{15} &= -R_{32} + X f_1 (1+\lambda) R_{42} - \frac{R_{42} A}{R_4} \cdot [E_1 g_{13} - X(1+\lambda) R_4 f_{13}], \\
a_{16} &= -R_{31} - R_{32} + X f_1 (1+\lambda)(R_{42} + R_{41}) - \frac{(R_{41} + R_{42}) A}{R_4} \cdot [E_1 g_{13} - X(1+\lambda) R_4 f_{13}], \\
a_{21} &= -E_1 g_{31} - X R_4 (1+\lambda) f_{42} + \frac{g_3 R_3 E_{11}}{E_1}, \\
a_{22} &= -X R_4 f_4 + \frac{g_3 E_{11} X R_4 (1-f)}{E_1} - \frac{A}{\lambda} \cdot [E_1 g_{33} + X R_4 (1+\lambda) f_{44}], \\
a_{24} &= 1 - \frac{A}{p^A + t^A} \cdot [E_1 g_{33} + X R_4 (1+\lambda) f_{44}], \\
a_{25} &= -(1+\lambda) f_4 X R_{42} + \frac{E_{11} g_3}{E_1} \cdot [-R_2 + \lambda X f R_{42}] - \frac{R_{42} A}{R_4} \cdot [E_1 g_{33} + X R_4 (1+\lambda) f_{44}], \\
a_{26} &= (1+\lambda) f_4 X (R_{41} + R_{42}) + \frac{E_{11} g_3}{E_1} \cdot [-R_1 - R_2 + \lambda X f (R_{41} + R_{42})] \\
&\quad - \frac{(R_{41} + R_{42}) A}{R_4} \cdot [E_1 g_{33} + X R_4 (1+\lambda) f_{44}].
\end{aligned}
$$

References

[1] Anderton C.H., (1995) “Economics of Arms Trade”, In *Handbook of Defense Economics, Vol. 1*, K. Hartley and T. Sandler (eds.), 523-561, Amsterdam, North-Holland.

[2] Anderson, James E. and Douglas Marcouiller (2005), “Anarchy and Autarky: Endogenous Predation as a Barrier to Trade,” *International Economic Review*, 46 (1), 189-213.

[3] Anderton, Charles H., Roxane A. Anderton and John R. Carter (1999), “Economic Activity in the Shadow of Conflict,” *Economic Inquiry*, 37 (1), 166-79.

[4] Basu, Arnab, Nancy Chau and Ulrike Grote (2006) “Guaranteed Manufactured without Child Labor: The Economics of Consumer Boycotts, Social Labeling and Trade Sanctions,” *Review of Development Economics*, 10(3): 466-491.

[5] Blattman, Christopher (2005), “Commodities and Collective Violence: A Reexamination of the Facts,” University of California Berkeley mimeo.

[6] Becsi, Zsolt and Sajal Lahiri (2006), “The Relationship Between Resources and Conflict: A Synthesis,” Discussion Paper No. 2006-03, Department of Economics, Southern Illinois University Carbondale.

[7] Becsi, Zsolt and Sajal Lahiri (2007a), “Bilateral War in a Multilateral World: Carrots and Sticks for Conflict Resolution”, *Canadian Journal of Economics*, 40, 1168-1187.

[8] Becsi, Zsolt and Sajal Lahiri (2007b), “Conflict in the Presence of Arms Trade: Can Foreign Aid Reduce Conflict?” pp. 3-15 in: S. Lahiri (editor), Theory and Practice of Foreign Aid, Elsevier, The Netherlands.

[9] Boone, P. (1996), “Politics and the effectiveness of foreign aid,” *European Economic Review*, 40, 289-330.

[10] Brito, Dagobert L. and Michael D. Intriligator (1985), "Conflict, War, and Redistribution," *American Political Science Review*, 79 (4), 943-957.

[11] Brzoska, Michael (2001), "Taxation of the arms trade: An overview of the issues," Paper prepared for the United Nations ad hoc Expert Group Meeting on Innovations in Mobilizing Global Resources for Development, 25-26 June 2001.

[12] Collier, Paul and Anke Hoeffler (1998), "On Economic Causes of Civil War," *Oxford Economic Papers,* 50, 563-573.

[13] Collier, Paul and Anke Hoeffler (2004), "Greed and Grievance in Civil War," *Oxford Economic Papers,* 56 (4), 563-595.

[14] Collier Paul and Anke Hoeffler (2005), "Civil War," Draft Chapter for the *Handbook of Defense Economics,* University of Oxford mimeo.

[15] Das, Satya P. and Sajal Lahiri (2006), "A Strategic Analysis of Terrorist Activity and Counter-Terrorism Policies," *Topics in Theoretical Economics (B.E. Journals in Theoretical Economics)*, vol. 6: Iss. 1.

[16] Das, Satya P. and Sajal Lahiri (2007), "Visa Screening and Collateral Import of Terrorism," *The B.E. Journal of Economic Analysis & Policy* (Contributions), Vol. 7: Iss. 1.

[17] 08-04: Satya P. Das and Prabal Roy Chowdhury (2008), "Deterrence, Preemption and Panic: A Common-Enemy Problem of Terrorism," Discussion Paper Number 08-04, Planning Unit, Indian Statistical Institute, Delhi Center.

[18] Dixit, Avinash K. and Victor Norman (1980), *Theory of International Trade*, Cambridge University Press.

[19] Fearon, James D. (2005), "Primary Commodities Exports and Civil War," *Journal of Conflict Resolution,* 49 (4), 483-507.

[20] Feyzioglu, T., V. Swaroop, and M. Zhu (1998), "A panel data analysis of the fungibility of foreign aid," *The World Bank Economic Review* 12, 29-58.

[21] Findlay, Ronald and Mohamed Amin (2000),"National Security and International Trade: A Simple General Equilibrium Model," Columbia University, Department of Economics.

[22] Garfinkel, Michelle R., Stergios Skaperdas, and Constantinos Syropoulos (2004), "Globalization and Domestic Conflict," mimeo.

[23] Gleditsch, Kristian (2004), "A Revised List of Wars Between and Within Independent States, 1816–2002," *International Interactions,* 30 (3), 231 - 262.

[24] Grossman, Herschel I. and Minseong Kim (1996), "Swords or Plowshares? A Theory of the Security of Claims to Property," *Journal of Political Economy*, 103 (6), 1275-1288.

[25] Hirshleifer, Jack (1988), "The Analytics of Continuing Conflict," *Synthese*, 76, 201-233.

[26] Hirshleifer, Jack (1995), "Anarchy and its Breakdown," *Journal of Political Economy*, 103 (1), 26-52.

[27] Hufbauer, Gary C., Jeffrey J. Schott and Kimberley Ann Elliott (1990), *Economic Sanctions Reconsidered: History and Current Policy*, Second Edition, Washington, DC: Institute for International Economics.

[28] Khilji, N.M. and E.M. Zampelli (1994), "The fungibility of U.S. military and non-military assistance and the impacts on major aid recipients," *Journal of Development Economics*, 43, 345-362.

[29] Lahiri, S. and P. Raimondos-Møller (1997), "On the tying of aid to tariff reform," *Journal of Development Economics*, 54, 479-491.

[30] Lahiri, Sajal (2009), "Arms Trade and Conflict Resolution: A Trade-Theoretic Analysis," in: Banasri Basu, Bikas K. Chakrabarti, Satya R. Chakravarty, and Kausik Gangopadhyay, eds., *Econophysics & Economics of Games, Social Choices and Quantitative Techniques*, Springer-Verlag, Italia.

[31] Lederman, Daniel and William F. Maloney (2003), "Trade Structure and Growth," World Bank Policy Research Working Paper 3025.

[32] Levine, Paul and Ron Smith (1995), "The Arms Trade and Arms Control," *Economic Journal*, 105 (2), 471-484.

[33] Neary, Hugh M. (1997), "A Comparison of Rent-Seeking Models and Economic Models of Conflict," *Public Choice*, 93 (3/4), 373-388.

[34] Pack, H. and J.R. Pack, (1994), "Foreign aid and the question of fungibility," *Review of Economic and Statistics*, 75, 258-265.

[35] Sandler, T. and K. Siqueira (2006), "Global Terrorism: Deterrence Versus Pre- Emption," *Canadian Journal of Economics*, 39, 1370-1387.

[36] Skaperdas, Stergios (1992), "Cooperation, Conflict, and Power in the Absence of Property Rights," *American Economic Review,* 82 (4), 720–739.

[37] Skaperdas, Stergios and Constantinos Syropoulos (1996), "Competitive Trade with Conflict," in Michelle R. Garfinkel and Stergios Skaperdas, ed., *The Political Economy of Conflict and Appropriation*, Cambridge: Cambridge University Press, 73–96.

[38] Skaperdas, Stergios and Constantinos Syropoulos (2001), "Guns Butter, and Openness: On the Relationship Between Security and Trade," *American Economic Review, Papers and Proceedings,* 91 (2), 353–357.

[39] Skaperdas, Stergios and Constantinos Syropoulos (2002), "Insecure Property and the Efficiency of Exchange," *Economic Journal*, 112 (January), 133-46.

[40] Syropoulos, Constantinos (2004), "Trade Openness and International Conflict," presented at the conference 'New Dimensions in International Trade: Outsourcing, Merger, Technology Transfer, and Culture,' held at Kobe University, Japan during December 11-12, 2004.

[41] Stijns, Jean-Philippe (2005), "Natural Resource Abundance and Human Capital Accumulation, " Notheastern University Working Paper No. 05-002.