Butter *and* Guns: Complementarity between Economic and Military Competition

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Abstract

This paper analyses a general-equilibrium model of the complementarity between economic competition for the allegiance of subjects and military competition for the control of land. In our model economic competition between rival rulers for the allegiance of subjects results in their subjects, whether they are producers or soldiers, receiving incomes equal to the value of the marginal product of a producer. Furthermore, abstracting from destruction, military competition for the control of land, to the extent that it shifts some subjects from producing to soldiering, increases the value of the marginal product of a producer. Consequently, as long as military competition is not too destructive, the subjects of rival rulers have higher incomes with both military and economic competition than with economic competition alone. Economic competition for the allegiance of subjects causes rival rulers to bear all of the cost of allocating production to military competition and to bear more than the cost of the foregone production of soldiers.

Rival rulers are often engaged at the same time both in economic competition for the allegiance of subjects and in military competition for the control of land. The British struggle against the Malayan communists in the 1950's epitomizes the complementarity between economic competition and military competition. According to the military historian Brigadier Richard Clutterbuck,

> *...General Sir Harold Briggs...launched a plan for victory that not only won the war in Malaya but has been copied ever since in other countries facing similar emergencies...Briggs put his finger on what the war was really about - a competition in government. He aimed not only to resettle the squatters but to give them a standard of local government and a degree of prosperity that they would not wish to exchange for the barren austerity of life under the Communists' parallel hierarchy; in other words, to give them something to lose.* (Clutterbuck, 1966, pages 56-57)

The recent Peruvian experience provides another striking example. In 1980, the Shining Path insurgency, formed by a handful of academics from a local university, started to operate in Ayacucho, one of the most economically backward regions of Peru. In a few years the insurgent movement gained momentum and support in rural areas and by 1990 had won the allegiance of perhaps one quarter of the Peruvian population and had effective control over about one third of the territory of Peru. The response of the Peruvian government to the Shining Path was to provide peasants with better economic conditions at the same time as it mounted an astringent military repression of the insurgents. These complementary policies enabled the government over time both to regain the allegiance of the peasants who had supported the Shining Path and to regain control of the land that the Shining Path had conquered.[1]

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[1]For fuller accounts of the Shining Path insurgency, see Cynthia McClintock (1998) and Gustavo Gorriti Ellenbogen (1999).

Of course, Malaya and Peru are only two of many examples of complementarity between economic competition and military competition. In their classic study of the economic development of the West, Douglass North and Robert Thomas (1973) stress the historical importance of economic competition for subjects by European states alongside their endemic military competition for the control of land. According to Thomas Martin (1984), the American revolutionary leader John Adams, later second President of the United States, argued that the outcome of the American Revolution was not decided only militarily, but also by winning the "minds and hearts of the people". During the Vietnam War American and Vietnamese leaders understood from the beginning the complementarity between gaining the allegiance of the people and gaining control of land. In 1965 President Lyndon B. Johnson said, "We must be ready to fight in Vietnam, but the ultimate victory will depend on the hearts and minds of the people who actually live there". (Michael Bibby, 1996, page 1) The policies that Adams and Johnson advocated show that they understood that hearts and minds are won economically.

This paper begins by analysing a general-equilibrium model of economic competition between rival rulers to attract subjects to live and to work on the lands that they control. We then extend the analysis to allow these rulers also to compete militarily for control over land.[2] Our most interesting finding is that, as long as military competition is not too

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[2]Existing economic models of competition between rival rulers focus either on economic competition for subjects or on military competition for territory or resources. Examples of models of economic competition for subjects include Dennis Epple and Allan Zelenitz (1981), who study competition among jurisdictions in setting property taxes and in the provision of local public goods, Ravi Kanbur and Michael Keen (1993), who study international competition in setting tax rates, and Herschel Grossman (1995), who studies competition between the mafia and the state in the provision of public services. Examples of economic models of military competition include Michelle Garfinkel (1990), Grossman (1991, 1999), Ronald Findlay (1996), and Bruce Bueno de Mesquita, et al (1999). The historian Paul Kennedy (1987) is known for emphasizing the connection between military strength and economic strength, but he has little to say about economic competition for subjects.

destructive, the subjects of rival rulers have higher incomes with both military and economic competition than with economic competition alone.

To focus on the allocative and distributional effects of competition between rival rulers, we model both economic competition for the allegiance of subjects and military competition for control of land in a highly abstract manner. For example, in modelling economic competition we assume that the rival rulers compete only on a single dimension, which we denote as the net income of the subjects. In modelling military competition we specify a "contest success function" that is a black box and that does not distinguish between a negotiated settlement under the threat of force and the violent application of force. Our analysis also ignores the peculiarities of the outcomes of actual competitions between rival rulers. For simplicity we assume a symmetrical interaction in which in equilibrium each ruler has the allegiance of the same number of subjects and has control of the same amount of land.

1. Economic Competition for Subjects

Assume that there are two rulers, ruler 1 and ruler 2. Ruler 1 controls the fraction L_1 of the given quantity of arable land, and ruler 2 controls the fraction L_2, where $L_1 + L_2 = 1$. Assume for now that the two rulers have amicably agreed to divide the land equally. Hence, $L_1 = L_2 = 1/2$. Given this amicable division of the land, the two rulers compete only for the allegiance of subjects.

Ruler 1 offers a net income of w_1 to anyone who farms on his land. He recruits the fraction N_1 of the given population to be his farmer subjects. Ruler 2 offers a net income of w_2 to anyone who farms on his land. He recruits the fraction N_2 of the given population to be his farmer subjects.

Production on the lands of ruler 1 and of ruler 2, denoted by Y_1 and Y_2, is

(1) $$Y_1 = N_1^\alpha L_1^{1-\alpha} \quad \text{and} \quad Y_2 = N_2^\alpha L_2^{1-\alpha},$$

where $0 < \alpha < 1$. The incomes of ruler 1 and of ruler 2, denoted by R_1 and R_2, are

(2) $$R_1 = Y_1 - w_1 N_1 \quad \text{and} \quad R_2 = Y_2 - w_2 N_2.$$

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Each person wants to be a subject of the ruler who offers the highest income to his subjects. If w_1 and w_2 are equal, then each person is indifferent between being a subject of ruler 1 or ruler 2.

Assume that each ruler takes as given the income that the other ruler offers to his subjects. Given this assumption, and given how people respond to the incomes offered by the rulers, each ruler perceives that he can recruit as many subjects as he wants, up to the total population, as long as the income that he offers his subjects is as large as the income that the other ruler offers to his subjects.[3]

Ruler 1 chooses w_1 and N_1 to maximize R_1, and ruler 2 chooses w_2 and N_2 to maximize R_2. With each ruler perceiving that he faces an infinitely elastic supply of subjects at the income that the other ruler offers to his subjects, neither ruler would offer subjects a higher income than the other ruler. Thus, in equilibrium the rulers' choices of w_1 and w_2 satisfy

$$(3) \qquad\qquad\qquad\qquad w_1 = w_2.$$

In addition, equations (1) and (2) imply that the rulers' choices of N_1 and N_2 satisfy

$$(4) \qquad \frac{\partial R_1}{\partial N_1} = \alpha\left(\frac{L_1}{N_1}\right)^{1-\alpha} - w_1 = 0 \quad \text{and} \quad \frac{\partial R_2}{\partial N_2} = \alpha\left(\frac{L_2}{N_2}\right)^{1-\alpha} - w_2 = 0.$$

Equations (4) say that each ruler recruits a number of farmer subjects such that the value of the marginal product of a farmer equals the income of a farmer. To clear the market for subjects, w_1 and w_2 must be such that

$$(5) \qquad\qquad\qquad\qquad N_1 + N_2 = 1.$$

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[3]The analysis implicitly assumes that people can costlessly switch their allegiance from one ruler to the other. This assumption allows us to avoid having to specify an initial distribution of allegiances. If switching allegiance requires physical movement, as is sometimes the case, then it could be important to extend the analysis to allow for costs of mobility.

We can solve equations (3), (4), and (5) together to determine the outcome of economic competition for subjects. Given the symmetry of the model, including $L_1 + L_2 = 1/2$, economic competition for the allegiance of subjects results in an equal division of the people between the two rulers, $N_1 = N_2 = 1/2$, and equal production on the lands of each ruler, $Y_1 = Y_2 = 1/2$. More importantly, with economic competition for subjects the income of each subject of either ruler 1 or ruler 2 equals a farmer's competitive share of total production — that is,

$$(6) \qquad w_1 = \alpha \frac{Y_1}{N_1} = \alpha \quad \text{and} \quad w_2 = \alpha \frac{Y_2}{N_2} = \alpha.$$

The incomes of the two rulers equal the value of the marginal products of their lands, $R_1 = (1 - \alpha)Y_1$ and $R_2 = (1 - \alpha)Y_2$.

2. Military Competition for Land

This section drops the assumption of amicable division of the land. Now, the two rulers, in addition to competing economically for the allegiance of subjects, also compete militarily for the control of land. The amounts of land over which ruler 1 and ruler 2 gain control are given by a standard "contest success function", such that

$$(7) \qquad L_1 = \frac{M_1}{M_1 + M_2} \quad \text{and} \quad L_2 = \frac{M_1}{M_1 + M_2},$$

where M_1 is the military strength of ruler 1 and M_2 is the military strength of ruler 2. Equations (7) imply that the ratio of the land controlled by ruler 1 to the land controlled by ruler 2, L_1/L_2, equals the ratio of the military strength of ruler 1 to the military strength of ruler 2, M_1/M_2.

Assume for now that military strength of each ruler depends only on the amount of production that he allocates to military competition. Specifically, assume that the military strength of ruler 1 and ruler 2 is given by $M_1 = G_1$ and $M_2 = G_2$, where G_1 is the amount that ruler 1 spends on military competition and G_2 is the amount that ruler 2 spends on

military competition. Both G_1 and G_2 are measured in units of production. After taking into account spending on military competition, the incomes of ruler 1 and of ruler 2 are

$$(8) \qquad\qquad R_1 = Y_1 - w_1 N_1 - G_1 \quad \text{and} \quad R_2 = Y_2 - w_2 N_2 - G_2.$$

Assume now that each ruler takes as given both the income that the other ruler offers to his subjects and the military spending of the other ruler.[4] Ruler 1 chooses w_1, N_1, and G_1 to maximize R_1, and ruler 2 chooses w_2, N_2, and G_2 to maximize R_2. The choices of ruler 1 and ruler 2, made subject to equations (1), (2), and (7), as before satisfy equations (3), (4), and (5), and now also satisfy

$$(9) \qquad \frac{\partial R_1}{\partial G_1} = (1 - \alpha) \left(\frac{N_1}{L_1}\right)^\alpha \frac{\partial L_1}{\partial G_1} - 1 = 0 \quad \text{and} \quad \frac{\partial R_2}{\partial G_2} = (1 - \alpha) \left(\frac{N_2}{L_2}\right)^\alpha \frac{\partial L_2}{\partial G_2} - 1 = 0,$$

where, from equation (7), given $M_1 = G_1$ and $M_2 = G_2$,
we have $\partial L_1 / \partial G_1 = G_2/(G_1 + G_2)^2$ and $\partial L_2 / \partial G_2 = G_1/(G_1 + G_2)^2$.

We can solve equations (3), (4), (5), and (9) together to determine the outcome of economic competition for subjects combined with military competition for land. Most importantly, economic competition again results in an income for each subject equal to the value of his marginal product as a farmer, which still equals α, as given by equation (6). This result tells us that, assuming that military strength depends only on the amount of production allocated to military competition, adding military competition for land to economic competition for the allegiance of subjects has no effect on the incomes of the subjects.

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[4]This assumption implies that we abstract from the possibility that one ruler, by competing more aggressively for the allegiance of subjects, could constrain the other ruler's spending on military competition. More generally, we abstract from "liquidity constraints" that would require a ruler to finance his spending on military competition out of production by his own subjects on his existing lands. To rationalize the absence of liquidity constraints, we can suppose that, if necessary, each ruler would be able to finance his spending on military competition by borrowing from outside sources, although, as specified by equations (8), he would have to repay this borrowing out of production by his subjects on the lands over which he gains control. In the atemporal equilibrium that we analyse, in which everything happens at once, rulers do not have to borrow. But, their ability to borrow supports the equilibrium.

In addition, given the symmetry of the model each ruler allocates the same fraction, which in this example is one half, of the value of the marginal product of his lands to military competition, an allocation that implies $G_1 = (1-\alpha)Y_1/2$ and $G_2 = (1-\alpha)Y_2/2$, and military competition results in an equal division of the land between the two rulers, $L_1 = L_2 = 1/2$. Furthermore, economic competition again results in an equal division of the people between the two rulers, $N_1 = N_2 = 1/2$. Also, the combination of economic and military competition results in equal production on the lands of each ruler, $Y_1 = Y_2 = 1/2$, as with only economic competition.

In this setting the social cost of military competition is the amount of production allocated to military competition. With the incomes of the subjects unchanged, the rulers bear this entire social cost. In this example, because each ruler dissipates one half of his income on military competition, the incomes of the rulers are $R_1 = (1-\alpha)Y_1/2$ and $R_2 = (1-\alpha)Y_2/2$.

3. Military Competition with Soldiers

To add an element of realism, assume now that the military strength of each ruler depends on the number of soldiers in each ruler's army. For simplicity, and without loss of generality, abstract from the allocation of production to military competition, and assume that the military strength of ruler 1 and ruler 2 is given by $M_1 = S_1$ and $M_2 = S_2$, where S_1 is the number of soldiers in the army of ruler 1 and S_2 is the number of soldiers in the army of ruler 2.

To form his army each ruler hires some people to be soldiers, with soldiers receiving the same net income as his farmer subjects.[5] The incomes of ruler 1 and of ruler 2, again denoted by R_1 and R_2, are now

(10) $$R_1 = Y_1 - w_1(N_1 + S_1) \quad \text{and} \quad R_2 = Y_2 - w_2(N_2 + S_2).$$

Assume now that each ruler takes as given both the income that the other ruler offers

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[5]If being a soldier were either more onerous or more dangerous than farming the land, then rulers would have to provide soldiers with a larger net income than farmers. We abstract from this complication.

to his subjects and the size of the army of the other ruler.[6] Ruler 1 now chooses w_1, N_1, and S_1 to maximize R_1, and ruler 2 chooses w_2, N_2, and S_2 to maximize R_2. These choices, again made subject to equations (1), (2), and (7), as before satisfy equations (3), (4), and (5), and now also satisfy

$$\frac{\partial R_1}{\partial S_1} = (1 - \alpha) \, (\frac{N_1}{L_1})^\alpha \, \frac{\partial L_1}{\partial S_1} - w_1 = 0$$

(11)   and

$$\frac{\partial R_2}{\partial S_2} = (1 - \alpha) \, (\frac{N_2}{L_2})^\alpha \, \frac{\partial L_2}{\partial S_2} - w_2 = 0,$$

where, from equation (7), given $M_1 = S_1$ and $M_2 = S_2$,
we have $\partial L_1 / \partial S_1 = S_2 / (S_1 + S_2)^2$ and $\partial L_2 / \partial S_2 = S_1 / (S_1 + S_2)^2$.
To clear the market for subjects, w_1 and w_2 now must be such that

(12) $N_1 + S_1 + N_2 + S_2 = 1.$

We can solve equations (3), (4), (11), and (12) together to determine the outcome of economic competition for subjects combined with military competition for land, where military strength depends on the number of soldiers. Given the symmetry of the model the rival rulers choose armies of equal size — specifically, $S_1 = S_2 = (1 - \alpha)/2(1 + \alpha)$ — and military competition again results in an equal division of the land between the two rulers, $L_1 = L_2 = 1/2$. Furthermore, economic competition again results in an equal division of the people between the two rulers, now $N_1 + S_1 = N_2 + S_2 = 1/2$.

More importantly, with military strength depending on the number of soldiers, military competition for land decreases production on the lands of each ruler, because with some people in the army fewer people farm the land. Production on the lands of ruler 1 and ruler

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[6]This assumption implies that we abstract from the possibility that one ruler might induce some of the other ruler's soldiers to desert.

2 is now smaller than $1/2$, and is given by

$$(13) \qquad Y_1 = Y_2 = \frac{1}{2} \left(\frac{2\alpha}{1+\alpha}\right)^\alpha.$$

Furthermore, although economic competition again results in an income for each subject equal to the value of the marginal product of a farmer, with fewer farmers the value of the marginal product of a farmer is now larger than α. Thus, with military strength depending on the number of soldiers, adding military competition for land to economic competition for the allegiance of subjects increases the incomes of the subjects. Specifically, the incomes of the subjects are given, not by equation (6), but by

$$(14) \qquad w_1 = \alpha \frac{Y_1}{N_1} = \alpha \left(\frac{1+\alpha}{2\alpha}\right)^{1-\alpha} \quad \text{and} \quad w_2 = \alpha \frac{Y_2}{N_2} = \alpha \left(\frac{1+\alpha}{2\alpha}\right)^{1-\alpha}$$

In this setting the social cost of military competition is the foregone production of soldiers. But, with subjects receiving larger incomes than with only economic competition, the incomes of the rulers are decreased by more than this social cost.

4. Destruction

To add another element of realism we can allow for the possibility that military competition results in the violent application of force and causes the destruction of production. Assume that the amount of the production on the land of ruler 1 that is destroyed is an increasing function of the military strength of ruler 2, and vice versa. Specifically, assume that military competition destroys the fraction βM_2 of Y_1, where $0 \le \beta M_2 \le 1$, and the fraction βM_1 of Y_2, where $0 \le \beta M_1 \le 1$. Higher values of the parameter β reflect higher destructiveness of military competition.

With a positive value of β military competition decreases the value of the marginal product schedule for farmers. Accordingly, if military strength depends only on the amount of production allocated to military competition, then with a positive value of β adding military competition to economic competition decreases the incomes of the subjects of the rival rulers.

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Alternatively, if military strength depends only on the number of soldiers, then with a positive value of β adding military competition to economic competition increases the incomes of the subjects of ruler 1 only if $(1 - \beta S_2)Y_1/N_1 > 1$ and increases the incomes of the subjects of ruler 2 only if $(1 - \beta S_1)Y_2/N_2 > 1$. These conditions are equivalent to

$$(15) \qquad 1 - \beta S_2 > (1 - 2S_1)^{1-\alpha} \quad \text{and} \quad 1 - \beta S_1 > (1 - 2S_2)^{1-\alpha}.$$

Conditions (15) are satisfied for small values of β, but are violated for large values of β. Thus, as long as military competition is not too destructive, the incomes of the subjects of the rival rulers can still be higher with military and economic competition than with economic competition alone.

5. Summary

This paper has analysed a general-equilibrium model of the complementarity between economic competition for the allegiance of subjects and military competition for the control of land. In our model economic competition between rival rulers for the allegiance of subjects results in their subjects, whether they are producers or soldiers, receiving incomes equal to the value of the marginal product of a producer. Furthermore, abstracting from destruction, military competition for the control of land, to the extent that it shifts some subjects from producing to soldiering, increases the value of the marginal product of a producer. Consequently, as long as military competition is not too destructive, the subjects of rival rulers have higher incomes with both military and economic competition than with economic competition alone.

In general the social cost of military competition includes the foregone production of soldiers, the amount of production allocated to military competition, and the amount of product destroyed by military competition. We have seen that economic competition causes the rival rulers to bear all of the cost of allocating production to military competition and to bear more than the cost of the foregone production of soldiers.

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