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FOREIGN AID AND INSURRECTION

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This paper analyses the allocative and distributive effects of foreign aid within a positive theory of insurrections. In this theory, foreign aid causes a reallocation of resources from production to an intensified struggle over distributive shares. Moreover, although the ruler of the recipient economy regards foreign aid as just another possible source of income for his parasitic clientele, the threat of insurrection induces a policy response that increases the income of the general population. The analysis shows how these allocative and distributive effects depend on the technology of insurrection.

KEY WORDS: Foreign aid, insurrection, income distribution, resource allocation.

INTRODUCTION

The effects of foreign aid on resource allocation and income distribution are controversial. Some analysts argue that foreign aid creates a disincentive for recipient economies to utilize their own productive potential effectively. Other observers complain that in practice foreign aid does not benefit the general population, but instead ends up enhancing the income of the clientele of the ruling political authority.

This paper analyses the allocative and distributive consequences of foreign aid within a positive political-economic model of resource allocation and income distribution. Political pressure in this model involves the threat of a successful insurrection, a generic term for any activity that challenges the established system of property rights and taxation. The model builds on a theoretical analysis of potential and actual insurrection in a closed economy developed in a complementary paper (Grossman, 1991).

The principals in this theory are a ruler and a large number of peasant families. The ruler's objective is to maximize the expected income that he can distribute to his clientele, a politically favored group of parasites that is distinct from the peasant families. The ruler's policies include taxing or subsidizing the production of the peasants. The ruler also employs peasants as soldiers in order to reduce the probability of a successful insurrection. In the absence of a successful insurrection, the ruler's powers of taxation give him control over the distribution of income. Accordingly, the analysis treats foreign aid, without loss of generality, as a gift from foreign donors to the ruler.

The peasant families respond to the ruler's policies by allocating their labor time either to production or to soldiering or to participation in an insurrection. Their

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objective is to maximize their expected income. The theory assumes that in a successful insurrection, the insurgents take as booty all of the ruler's revenue from taxation and foreign aid. The theory also assumes that only active insurgents share in this booty.

The interaction between the ruler and the peasants generates an allocation of labor time among production, soldiering, and insurrection and a probabilistic distribution of income among income received by the ruler's clientele, net earnings of productive labor, wages of soldiering, and booty taken by insurgents. By emphasizing the allocation of labor time, the present theory goes beyond other choice-theoretic analysis of insurrection, such as Roemer (1985), Usher and Engineer (1987), and Usher (1989), that consider only distributive consequences. Moreover, in analyzing the behavior of individual producers, the present theory differs from other general-equilibrium models of the allocation of resources between productive and appropriate activities, such as Garfinkel (1990), Hirshleifer (1991), and Skaperdas (1992), that focus only on the interactions between a pair of large collective decision makers. But, in modelling the success of an insurrection and the resulting distribution of income as probabilistic, the present theory abstracts from the idiosyncratic stochastic events, emphasized in complementary literature such as Kuran (1989), that determine the actual outcomes of particular insurrections.

The equilibrium of allocation and distribution, which is modelled as a noncooperative solution to a one-shot game between the ruler and the peasants, depends on the amount of foreign aid and on the technological parameters that govern production and insurrection. The technology of insurrection relates the probability of a successful insurrection to the amounts of time allocated to insurrection and its suppression. The analysis of this equilibrium shows how the threat of insurrection encourages the ruler to use foreign aid to increase the income of the peasants and, more generally, how this threat helps to determine the allocative and distributive effects of foreign aid. The analysis also shows how foreign aid increases political instability as measured by the probability of a successful insurrection.

By defining insurrection generically and by considering only a one-shot game, the model abstracts from the distinction between rebellion and revolution, terms that suggest an attempt to seize powers of sovereignty in order to effect a once-for-all alteration of property rights and taxation, and banditry and piracy, terms that suggest attempts to alter the income distribution associated with existing property rights and taxation. From a formal perspective, we could even interpret what follows as an abstract model of electoral competition. If insurrection encompasses peaceful political pressure, then the term soldiering would include any nonproductive use of resources to maintain the ruler's control over the distribution of income.

For simplicity, the analysis abstracts from dynamic considerations. It focuses only on current income and its distribution and it considers only foreign aid in the form of consumption goods. An interesting extension would be to consider foreign aid that consists of producer goods or is intended to finance capital formation and the effects of such aid on economic growth and the distribution of its benefits.

THE ECONOMY AND THE RULER

Consider a simple production economy in which each of a large number of small identical peasant family units can divide the labor time of its family members among a non-negative fraction l devoted to production, a non-negative fraction s devoted to soldiering, and a non-negative fraction i devoted to participation in an insurrection.

The Pareto optimal allocation of time in this economy—that is, the allocation that maximizes total production—is $(L, S, I) = (1, 0, 0)$, where L, S, and I represent the non-negative fractions of time that families on average devote to production, soldiering, and insurrection, respectively. Any time devoted either to soldiering or to insurrection, although it can be privately useful in influencing distributive shares, is socially wasteful. The condition $(L, S, I) = (1, 0, 0)$ obtains if and only if $(l, s, i) = (1, 0, 0)$ for all peasant families.

The income of the ruler's clientele, measured per peasant family, is either $v + r - wS$ with probability $1 - \beta$ or zero with probability β, $0 \leqslant \beta \leqslant 1$, where v is the nonnegative amount of aid that the ruler receives per family from foreign donors, r represents the amount per family of either taxes collected from the peasants or subsidies paid to the peasants, w is the nonnegative wage rate of soldiers set by the ruler, and β is the probability of a successful insurrection. As noted above, this setup assumes that in a successful insurrection the insurgents take as booty all of the revenues of the ruler and his clientele.

Production per family is a linear function λL, where λ is a positive technological parameter that measures productivity. Thus, $r = x\lambda L$, $x \leqslant 1$, where x represents either the tax rate or the subsidy rate. If production is taxed, then x and r are positive. If production is subsidized, then x and r are negative. To mitigate disincentive problems, the ruler always makes transfers to the peasants in the form of subsidies to production.

The ruler's objective is to maximize M, the expected income of his clientele, where, on the above assumptions,

$$M = (1 - \beta)(v + r - wS) = (1 - \beta)(v + x\lambda L - wS). \tag{1}$$

Equation (1) says that M equals foreign aid plus tax revenue, or minus subsidy payments, minus wage payments to soldiers times the probability of there not being a successful insurrection. The ruler's policy instruments are x, w, and S. [This setup abstracts from the requirement that the announced tax or subsidy rate must be time consistent. For complementary analyses that allow for a binding time-consistency constraint, see Grossman & Noh (1990, 1991).] In making his policy choices, the ruler takes as given the amount of foreign aid, the behavioral responses of the peasant families to his policies, the technology of production, summarized by the parameter λ, and the technology of insurrection.

THE PEASANT FAMILIES

A peasant family can obtain income from production, from soldiering, or from participation in an insurrection. A family's net income from production is $(1 - x)\lambda l$. A family's income from soldiering is either ws with probability $1 - \beta$ or zero with probability β. This setup assumes that soldiers are able to draw their pay only if there is not a successful insurrection. Finally, a family's income from participation in an insurrection is either $(v + r)i/I$ with probability β or zero with probability $1 - \beta$. This setup assumes that insurgents divide their booty among family units proportionately to the time devoted by each family to the insurrection. At this stage of the analysis, it is important to distinguish i, the time allocated to insurrection by an individual peasant family, from I, the time allocated to insurrection by the average peasant family, because the individual family chooses i taking I as given.

The analysis does not attempt to explain how the distribution of the booty taken by insurgents is enforced and, more generally, it takes the organizational structure and cohesion of insurrections as given. But, in assuming that only active insurgents share in the booty taken in a successful insurrection, the present theory contrasts sharply from theories that assume that successful insurrections produce mainly social benefits from which active insurgents cannot include nonparticipants. The present setup also assumes that the only cost associated with insurrection is the production foregone by devoting time to the insurrection.

Each peasant family takes x, λ, β, v, w, r, and I as given and chooses l, s and i, subject to the constraint $l + s + i = 1$, to maximize its expected income, e. On the above assumptions, e is given by

$$e = (1 - x)\lambda l + (1 - \beta)ws + \beta(v + r)i/I. \tag{2}$$

Given equation (2), the Kuhn-Tucker conditions for family choices imply that the allocation of time to production by each and every peasant family satisfies

$$l = \begin{cases} 0 & \text{for } (1 - x)\lambda < Y \\ [0, 1] & \text{for } (1 - x)\lambda = Y \\ 1 & \text{for } (1 - x)\lambda > Y \end{cases} \tag{3.1}$$

where $Y \equiv \max[(1 - \beta)w, \beta(v + r)/I]$, that the allocation of time to soldiering by each and every peasant family satisfies

$$s = \begin{cases} 0 & \text{for } w < W \\ [0, 1] & \text{for } w = W \\ 1 & \text{for } w > W \end{cases} \tag{3.2}$$

where $(1 - \beta)W \equiv \max[(1 - x)\lambda, \beta(v + r)/I]$, and that the allocation of time by each and every peasant family to participation in an insurrection satisfies

$$i = \begin{cases} 0 & \text{for } \beta(v + r)/I < Z \\ [0, 1] & \text{for } \beta(v + r)/I = Z, \\ 1 & \text{for } \beta(v + r)/I > Z \end{cases} \tag{3.3}$$

where $Z = \max[(1 - x)\lambda, (1 - \beta)w]$.

Equations (3.1), (3.2), and (3.3) indicate, among other things, that a family would devote none of its time to any activity—production, soldiering, or insurrection—whose expected return is less than the expected return from either of the other activities and would devote all of its time to any activity whose expected return is more than the expected returns from both of the other activities. [We could generalize the peasants' problem by making production risky or subject to diminishing returns or by introducing risk aversion, but these complications would not alter the main results derived below.]

THE TECHNOLOGY OF INSURRECTION AND ITS SUPPRESSION

To model the probability of a successful insurrection, β, a natural assumption is that β is an increasing function of I, the fraction of peasant time allocated to insurrection,

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and a decreasing function of S, the fraction of peasant time allocated to soldiering. A plausible form for this function is

$$\beta = \frac{I^{1-\theta}}{S^{\sigma} + I^{1-\theta}}, \quad 0 \leqslant \theta < 1, 0 < \sigma < 1. \tag{4}$$

Given the form of equation (4), β is bounded between zero and unity. The parameters θ and σ in equation (4) represent the technology of insurrection. For given values of I and S between zero and unity, β is larger the larger is θ and the larger is σ. Moreover, the assumption that θ is less than unity implies that β is positive if and only if I is positive and that β is increasing in I. The possibility that θ equals zero presents, as we shall see, an interesting special case. The assumption that σ is positive implies that, if I is positive, then β is less than unity if and only if S is positive and that β decreasing in S. The assumption that σ is less than unity insures, as we shall see, that a positive value of M is feasible.

The elasticity of β with respect to I equals the non-negative fraction $(1-\theta)(1-\beta)$ and the elasticity of β with respect to S equals the non-positive fraction $-\sigma(1-\beta)$. Thus the ratio $(1-\theta)/\sigma$ represents the percentage increase in the fraction of time devoted to soldiering that is needed to counteract the effect on β of a one percent increase in the fraction of time devoted to insurrection.

According to the specification of the expected income of a peasant family given by equation (2), the expected return to a family from time allocated to insurrection equals $\beta(r+v)/I$. From equation (4), we calculate that

$$\frac{\beta(r+v)}{I} = \frac{r+v}{I^{\theta}S^{\sigma} + I}. \tag{5}$$

Equation (5) implies that, for given values of I and S, and $r + v > 0$, the expected return to insurrection is larger the larger is θ [unless I equals zero], the larger is σ [unless S equals zero], and the larger is v. Moreover, the effect of v on the expected return to insurrection is larger the larger is β/I and, hence, the larger is θ [unless I equals zero] and the larger is σ [unless S equals zero]. Equation (5) also implies that with $\theta > 0$ the expected return to insurrection evaluated at $I = 0$ would be infinite, but that with $\theta = 0$ the expected return to insurrection evaluated at $I = 0$ equals $(r+v)S^{-\sigma}$, which for $S > 0$ would be finite.

Although in the present analysis θ and σ are parameters, an interesting extension would be to introduce foreign military aid to the ruler and to the insurgents as factors influencing θ and σ. An extended analysis also could relate θ and σ to such factors as qualitative human characteristics, geography, and the quantity and quality of armaments.

POLICY CHOICES

The ruler's problem is to choose the policy instruments—x, w, and S—to maximize M, as given by equation (1), subject to the constraints given by equations (3.1), (3.2), (3.3), and (4). This problem is equivalent to the problem of choosing L, S,

and I to maximize M, subject to $(L, S, I) \geqslant (0, 0, 0)$ and $L + S + I = 1$, where equations (3.1), (3.2), and (3.3) relate x and w to L, S, and I and equation (4) relates β to S and I. The Kuhn-Tucker first-order conditions for this problem are

either

$$\frac{\partial M}{\partial L} = \frac{\partial M}{\partial S} = \frac{\partial M}{\partial I} \quad \text{with } (L, S, I) > (0, 0, 0), \text{ and } L + S + I = 1, \tag{6.1}$$

or

$$\frac{\partial M}{\partial L} \leqslant \frac{\partial M}{\partial S} = \frac{\partial M}{\partial I} \quad \text{with } L = 0, (S, I) > (0, 0), \text{ and } S + I = 1, \tag{6.2}$$

or

$$\frac{\partial M}{\partial I} \leqslant \frac{\partial M}{\partial L} = \frac{\partial M}{\partial S} \quad \text{with } I = 0, (L, S) > (0, 0), \text{ and } L + S = 1, \tag{6.3}$$

or

$$\frac{\partial M}{\partial S} \leqslant \frac{\partial M}{\partial L} = \frac{\partial M}{\partial I} \quad \text{with } S = 0, (L, I) > (0, 0), \text{ and } L + S = 1, \tag{6.4}$$

or

$$\frac{\partial M}{\partial S} \leqslant \frac{\partial M}{\partial L} \geqslant \frac{\partial M}{\partial I} \quad \text{with } I = S = 0 \text{ and } L = 1, \tag{6.5}$$

or

$$\frac{\partial M}{\partial L} \leqslant \frac{\partial M}{\partial I} \geqslant \frac{\partial M}{\partial S} \quad \text{with } L = S = 0 \text{ and } I = 1, \tag{6.6}$$

or

$$\frac{\partial M}{\partial L} \leqslant \frac{\partial M}{\partial S} \geqslant \frac{\partial M}{\partial I} \quad \text{with } L = 1 = 0 \text{ and } S = 1. \tag{6.7}$$

To begin analyzing these Kuhn-Tucker conditions, note that we can rule out conditions (6.4) and (6.6), because, with $I > 0$, $S = 0$ would imply $\beta = 1$ and, hence, $M = 0$. If the peasants were devoting positive time to insurrection, the ruler would not choose zero soldiering time.

Next, we observe that we can rule out condition (6.5), because from equation (5) the ratio $\beta(r + v)/I$ evaluated at $r + v > 0$ and $I = S = 0$ would be infinite. Thus, $I = S = 0$ would contradict equations (3.1) and (3.3). If the peasants were devoting zero time to both insurrection and soldiering, the expected return from insurrection would be larger than the return to production.

To continue the analysis of the Kuhn-Tucker conditions, it is necessary to distinguish the case of $\theta = 0$ from cases in which θ is positive. With $\theta > 0$, we also can rule out conditions (6.3) and (6.7), because the ratio $\beta(r + v)/I$ evaluated at $r + v > 0$ and $S \supset I = 0$ again would be infinite. Even with a positive amount of soldiering time, if the peasants were devoting zero time to insurrection, the expected

return from insurrection would be larger than the return from production. Thus, with $\theta > 0$, only conditions (6.1) or (6.2) can be relevant.

With $\theta = 0$, conditions (6.3) and (6.7) also can be relevant, because, as noted above, from equation (5) the ratio $\beta(r + v)/I$ evaluated at $I = 0$ equals $(r + v)S^{-\sigma}$, which for $S > 0$ would be finite. Thus, even if the peasants were devoting zero time to insurrection, for a low enough tax rate (or high enough subsidy rate) the expected return from insurrection would not be larger than the expected returns from production and soldiering.

If Kuhn-Tucker condition (6.1) is relevant, each and every peasant family cannot be choosing either l, s, or i equal to either zero or unity. If Kuhn-Tucker condition (6.2) is relevant, each and every peasant family is choosing l equal to zero, but cannot be choosing either s or i equal to either zero or unity. If Kuhn-Tucker condition (6.3) is relevant, each and every peasant family is choosing i equal to zero, but cannot be choosing either l or s equal to either zero or unity. If Kuhn-Tucker condition (6.7) is relevant, each and every peasant family is choosing s equal to unity. Thus, given that either condition (6.1), (6.2), (6.3), or (6.7) is relevant, equations (3.1), (3.2), and (3.3) imply

$$(1 - x)\lambda \leqslant (1 - \beta)w \tag{7}$$

with the equality obtaining for $L > 0$, and

$$\beta(v + r)/I \leqslant (1 - \beta)w \tag{8}$$

with the equality obtaining for $I > 0$.

Equation (7) indicates that as long as the peasants are devoting positive time to production the ruler faces an elastic supply of soldiering time at a wage rate for soldiers such that the expected return from soldiering equals the return from production. Equation (8) indicates that the fraction of time that families on average allocate to insurrection, if positive, is such that the expected return from insurrection equals the expected return from soldiering. Combining equations (4), (7), and (8) with equation (1), we calculate the partial derivatives

$$\frac{\partial M}{\partial L} \leqslant \frac{\lambda(I - \beta v/\lambda)}{(I + \beta L)^2}[(1 - \beta)I - \beta S] \tag{9.1}$$

with the equality obtaining for $L > 0$,

$$\frac{\partial M}{\partial S} \geqslant \frac{\lambda\beta(L + v/\lambda)}{I + \beta L}\left[\frac{\sigma(1 - \beta)I}{(I + \beta L)S} - 1\right] \tag{9.2}$$

with the equality obtaining for $S < 1$, and

$$\frac{\partial M}{\partial I} \leqslant \frac{\lambda\beta(L + v/\lambda)}{(I + \beta L)^2}[(1 - \beta)L + S - (1 - \theta)(1 - \beta)] \tag{9.3}$$

with the equality obtaining for $I > 0$.

EQUILIBRIUM

Although we cannot readily derive the full implications of the Kuhn-Tucker conditions for policy choices analytically, the qualitative effects of the amount of foreign aid on

the equilibrium allocation of time are readily apparent from conditions (9.1), (9.2), and (9.3). Observe that, for given values of λ, L, S, and I, the larger is v the smaller is the rhs of condition (9.1), the larger is the rhs of condition (9.2), and the larger is the rhs of condition (9.3). These effects indicate that, given the productivity of time allocated to production, a larger amount of foreign aid would cause less time to be allocated to production [unless condition (9.1) is satisfied as an inequality], more time to be allocated to soldiering, and more time to be allocated to insurrection [unless condition (9.3) is satisfied as an inequality].

It is also worth noting that in conditions (9.1), (9.2), and (9.3) the amount of foreign aid, v, appears only in the ratio v/λ and the productivity parameter, λ, appears only in the ratio v/λ and as a common factor. Consequently, a change in λ accompanied by an equiproportionate change in v would not affect the solution to the Kuhn-Tucker conditions (6.1)–(6.7) and, hence, would not affect the equilibrium allocation of time. Moreover, a change in λ, holding v fixed, would not affect the equilibrium allocation of time if v is zero. These results obtain because, given L, S, I, and x, such changes would alter the return from production and the expected return from insurrection equiproportionately. The only policy response would be an equiproportionate increase in w. Thus, historical evidence, such as that presented by Tong (1988) for premodern China, that regional insurrections were more likely to occur during local famines suggests that potential booty included famine relief shipped in from other regions. With such shipments either held constant or increased, a reduction in λ would have reduced the return from production proportionately more than it would have reduced the expected return from insurrection.

By replacing l, s, and i in equation (2) with L, S, and I, we calculate the average peasant family's expected income, denoted by E, to be

$$E = (1 - x)\lambda L + (1 - \beta)wS + \beta(v + x\lambda L). \tag{10}$$

Then, combining equation (10) with equations (7) and (8), we find that, in an equilibrium with $L > 0$, and with either $I = 0$ or $I \geqslant 0$, E and x have the simple inverse relation,

$$E = (1 - x)\lambda. \tag{11}$$

[Because $I = 0$ would imply $\beta = 0$, with $I = 0$ each peasant family's realized income would equal $(1 - x)\lambda$ with probability one.]

By adding E, as given by equation (10), to M, the expected income of the ruler's clientele, as given by equation (1), we confirm that total income, measured per peasant family, is

$$E + M = \lambda L + v. \tag{12}$$

Dividing equation (11) by equation (12), we calculate that with $L > 0$ the peasants' expected share of total income is

$$\frac{E}{E + M} = \frac{1 - x}{L + v/\lambda}. \tag{13}$$

[With $I = 0$ and, hence, $\beta = 0$, the peasants' realized share of income would equal $(1 - x)/(L + v/\lambda)$ with probability one.]

Simulated solutions to the problem of maximizing M show more fully how the equilibrium allocation of resources and probabilistic distribution of income depend

on the amount of foreign aid and on the parameters of the technology of insurrection, θ and σ. To highlight the important results, Table 1 reports simulated solutions for $v = 0$ and selected values of θ and σ and Table 2 reports simulated solutions for $v = \lambda$ and the same values of θ and σ. These tables compare equilibria with no foreign aid to equilibria with an amount of foreign aid sufficient to double potential total income. In interpreting these results it is useful to recall that the Pareto optimal allocation of resources for this economy—that is, the allocation that maximizes total production and income—is $(L, I, S) = (1, 0, 0)$.

The top block in each table shows solutions for $\theta = 0$. With $\theta = 0$ Kuhn-Tucker condition (6.3) is relevant. It is optimal, as well as feasible, for the ruler to choose a combination of policies, which includes a large enough amount of soldiering time and a low enough tax rate, that induces the peasants to devote no time to insurrection. Moreover, with I equal to zero, β equals zero.

Table 1 Simulated equilibria for $v = 0$

σ	θ	L	I	S	x	β	$\frac{M}{\lambda}$	$\frac{E}{\lambda}$	$\frac{E}{M+E}$	
0.01	0	0.997	0	0.003	0.487	0	0.484	0.513	0.515	
0.50	0	0.856	0	0.140	0.303	0	0.163	0.693	0.810	
0.99	0	0.766	0	0.234	0.237	0	0.003	0.763	0.997	
0.01	0.1	0.941	0.056	0.0033	0.448	0.073	0.389	0.552	0.587	✓
0.50	0.1	0.780	0.114	0.107	0.326	0.302	0.105	0.675	0.865	✓
0.99	0.1	0.1229	0.838	0.039	0.877	0.955	0.0001	0.1228	0.999	**
0.01	0.5	0.744	0.254	0.0025	0.495	0.349	0.239	0.505	0.679	✓
0.50	0.5	0.524	0.407	0.070	0.523	0.707	0.047	0.477	0.910	*
0.99	0.5	0.0335	0.952	0.015	0.967	0.985	0.0000	0.0335	0.999	**
0.01	0.9	0.607	0.391	0.0021	0.567	0.492	0.174	0.433	0.713	✓
0.50	0.9	0.393	0.550	0.057	0.637	0.798	0.030	0.363	0.924	*
0.99	0.9	0.0204	0.970	0.010	0.980	0.990	0.0000	0.0204	0.999	**

Table 2 Simulated equilibria for $v = \lambda$

σ	θ	L	I	S	x	β	$\frac{M}{\lambda}$	$\frac{E}{\lambda}$	$\frac{E}{M+E}$	
0.01	0	0.995	0	0.005	−0.027	0	0.970	1.025	0.514	
0.50	0	0.817	0	0.183	−0.459	0	0.358	1.459	0.803	
0.99	0	0.704	0	0.294	−0.698	0	0.007	1.697	0.996	
0.01	0.1	0.887	0.108	0.005	−0.077	0.125	0.811	1.076	0.570	✓
0.50	0.1	0.612	0.243	0.146	−0.359	0.423	0.253	1.359	0.843	✓
0.99	0.1	0	0.926	0.075	0.001	0.924	0.001	0.999	0.999	**
0.01	0.5	0.528	0.468	0.004	0.070	0.420	0.598	0.930	0.609	✓
0.50	0.5	0.086	0.780	0.134	0.086	0.707	0.173	0.913	0.841	*
0.99	0.5	0	0.974	0.026	0.001	0.974	0.001	0.999	0.999	**
0.01	0.9	0.298	0.699	0.004	0.228	0.505	0.526	0.772	0.595	✓
0.50	0.9	0	0.884	0.116	0.159	0.743	0.159	0.841	0.841	*
0.99	0.9	0	0.983	0.017	0.001	0.983	0.001	0.999	0.999	**

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Even though in this case insurrection is completely deterred, both the possibility of insurrection and the technology of insurrection influence the allocation of time between production and soldiering and the distribution of income. Specifically, the smaller is σ, the smaller is the value of S associated with a given value of $S^{-\sigma}$—that is, the more effective is soldiering time in deterring insurrection. Consequently, the chosen tax rate, x is negatively related to σ and the chosen amount of soldiering time, S, is positively related to σ.

With I equal to zero, because S is positively related to σ, the amount of time allocated to production, L, is negatively related to σ. Moreover, the simulations show that in the limit as σ approaches zero, S approaches zero and, hence, with I equal to zero, L approaches unity. In other words, an equilibrium allocation that is Pareto optimal occurs in this economy only as a limiting case that is approached as soldiering time becomes extremely effective in deterring insurrection and, consequently, the amount of soldiering time needed to deter insurrection completely approaches zero.

Tables 1 and 2 report equilibrium values of M and E normalized by λ—that is, as ratios of potential total production, which is the value of $M + E$ associated with $L = 1$. Because x is negatively related to σ, E/λ is positively related to σ. Thus, as the tables confirm, with $\theta = 0$ it must be that the peasants' share of income, $E/(M + E)$, is not only positively related to σ, but increases with σ even faster than L decreases. In fact, as σ approaches unity, $E/(M + E)$ also approaches unity. The important result is that the less effective is soldiering time in deterring insurrection the smaller is total income, but the larger is the income of the peasants.

Because for a smaller σ the peasants receive a much smaller share of a larger total income, the income of the ruler's clientele, M/λ, is negatively related to σ and, hence, positively related to L. Thus, as the equilibrium allocation approaches Pareto optimality, the income distribution becomes both absolutely and relatively more favorable to the ruler's clientele. Tables 1 and 2 show that, as σ approaches zero, $E/(E + M)$, $M/(E + M)$, and M/λ all approach one-half.

Comparing the top block of Table 2 with the top block of Table 1, we see that with a positive amount of foreign aid the ruler would choose a lower tax rate and a larger amount of soldiering time. The ruler makes these adjustments because foreign aid would increase potential booty for insurgents and, hence, as implied by equation (5), would increase the expected return to insurrection. In fact, Table 2 shows that with $\theta = 0$ and $v = \lambda$ the optimal policy of fully deterring insurrection requires a negative tax rate—that is, a subsidy to production. Moreover, as also implied by equation (5), the larger is σ, the more that foreign aid would increase the expected return to insurrection. Accordingly, the larger is σ, the larger would be both the reduction in the tax rate and the increase in soldiering time associated with positive foreign aid.

The ruler's policy responses to foreign aid increase the income of the peasants, but only by a fraction of the increase in total income associated with the foreign aid. Tables 1 and 2 show that with $\theta = 0$ foreign aid has little effect on the value of $E/(M + E)$. But, the larger amount of soldiering time associated with $v = \lambda$ than with $v = 0$ means that with $v = \lambda$ the equilibrium amount of time allocated to production is smaller. The top block in Table 3, which is calculated from Tables 1 and 2, shows that with $\theta = 0$ this decrease in production would be small for small values of σ, but that it would exceed six percent of the amount of foreign aid for large values of σ. Thus, the average peasant's income would increase by less than the amount of foreign aid both because the peasants receive only a fraction of total

Table 3 Effect of increase in foreign aid from $v = 0$ to $v = z$ on production and peasants' expected income

σ	θ	$\frac{\Delta L}{\Delta v}$	$\frac{\Delta E}{\Delta v}$	$\frac{\Delta \frac{E}{M+E}}{\Delta v}$
0.01	0	−0.002	0.513	−0.001
0.50	0	−0.039	0.763	−0.007
0.99	0	−0.062	0.937	−0.001
0.01	0.1	−0.054	0.523	−0.017
0.50	0.1	−0.168	0.684	−0.022
0.01	0.5	−0.216	0.425	−0.070
0.01	0.9	−0.309	0.340	−0.118

income and because total income itself would increase by less than the amount of foreign aid. Table 3 shows that with $\theta = 0$ the increase in the average peasant's income would be barely more than one-half of the amount of foreign aid for low values of σ, but, despite the decrease in production, still would exceed ninety percent of the amount of foreign aid for high values of σ.

The lower three blocks in Tables 1 and 2 give solutions for $\theta > 0$. With $\theta > 0$ it is not feasible for the ruler to deter insurrection completely and, accordingly, he chooses a combination of policies that are consistent with a positive value for I. As a result, the equilibrium value for β is positive and the distribution of income is probabilistic.

We see from Tables 1 and 2 that for some combinations of θ and σ, both being between zero and unity, the equilibrium probability of a successful insurrection would be so large as to be inconsistent with a viable political structure. For example, with θ positive and σ close to unity, as in the rows in the table that are marked with a double asterisk, the peasants in equilibrium would allocate most of their time to insurrection. As a result, the probability of a successful insurrection would be close to unity and the ruler's policies would be able to achieve for his clientele at most a negligible expected income. The rows in Tables 1 and 2 that are marked with a single asterisk, in which, although σ is not close to unity, the sum of θ and σ is relatively large, are also problematic with regard to political viability, because they also would involve large equilibrium values of β.

Thus, with $\theta > 0$ the cases that might be empirically relevant would seem to be the rows in Tables 1 and 2 that are marked with a check. In these rows, the sum of θ and σ is relatively small and the equilibrium probability of a successful insurrection does not exceed one-half. In each of these cases, Kuhn-Tucker condition (6.1) obtains and, accordingly, the peasants allocate positive amounts of time to production, to soldiering, and to insurrection. [Table 2 indicates that Kuhn-Tucker condition (6.2), in which the ruler's policies induce the peasants to devote no time to production, would obtain only in cases in which β would be implausibly large.]

As we noted above, equations (4) and (5) imply that, for given values of I and S, both β and the expected return to time allocated to insurrection, $\beta(r + v)/I$, are larger the larger is θ and the larger is σ. Consequently, for given choices of x and S, with $\theta > 0$ the larger is either θ or σ the larger must be I and, hence, the smaller must be L in order to equate the expected return to insurrection to the expected

returns to production and soldiering. As Tables 1 and 2 confirm, the first-order effect of either larger θ or larger σ would be that peasant families allocate more time to insurrection and less time to production. The larger value of I also would add to the direct effects of both larger θ and larger σ in increasing β. Moreover, the negative relation between L and both θ and σ, reinforced by the positive relation between β and both θ and σ, means that the expected income of the ruler's clientele, M/λ, is negatively related to both θ and σ.

As also noted above, the elasticity of β with respect to I equals $(1-\theta)(1-\beta)$. Consequently, the larger is θ the smaller is the effect of increments in I on β and the less is the ruler concerned at the margin with deterring insurrection. Accordingly, as Tables 1 and 2 confirm, for a larger θ the ruler would choose a smaller S and a higher x. These policy responses would reinforce the positive effect of θ on I and β. Moreover, because x is positively related to θ, we know that E/λ is negatively related to θ. In sum, as Tables 1 and 2 confirm, with $\theta > 0$ the larger is θ the smaller is total income, the expected income of the ruler's clientele, and the expected income of the peasants.

Tables 1 and 2 also show that with $\theta > 0$, in the cases that might be empirically relevant, for a larger value of σ the ruler again would choose a larger S and a lower x. And, in these cases, because σ and x are negatively related, σ and E/λ again are positively related. Thus, although total income and the expected income of the peasants would change in the same direction in response to a change in θ, with $\theta > 0$, as with $\theta = 0$, total income and the expected income of the peasants would change in opposite directions in response to a change in σ.

Comparing Table 2 with Table 1, we see that, in the cases that might be empirically relevant, the equilibrium values of I, S, and β are positively related to v, whereas the equilibrium values of x and L are negatively related to v. Positive foreign aid, because it increases potential booty and the expected return to insurrection, causes the ruler to demand more soldiering time and to set a lower tax rate, and even to subsidize production, if θ is sufficiently small. These optimal responses, however, are not sufficient to prevent an increase in time allocated to insurrection. Moreover, although the ruler demands more soldiering time, the increase in time allocated to insurrection results in a higher probability of a successful insurrection.

These effects imply that, if differences in v/λ were responsible for differences in x, we would observe a negative correlation between x and I, even though the partial effect of an increase in x is to increase I. Moreover, if differences in v/λ were responsible for differences in S, we would observe a positive correlation between S and β, even though the partial effect of an increase in S is to decrease β.

As implied by equation (5), the larger is θ the more that foreign aid would increase the expected return to insurrection. Consequently, the decrease in production associated with positive foreign aid would be larger the larger is θ. Specifically, Table 3 shows, again focusing on the cases that might be empirically relevant, that for larger values of θ the decrease in L associated with an increase from $v = 0$ to $v = \lambda$ could result in a reduction in production that offsets as much as thirty percent of the foreign aid. Table 3 also shows that for large values of θ an increase from $v = 0$ to $v = \lambda$ would reduce $E/(M + E)$ by more than ten percent of income. Thus, in these cases, even though the ruler both decreases the tax rate and demands more soldiering time, the peasants' expected income increases by much less than the amount of foreign aid. Specifically, in the cases that might be empirically relevant, the increase in the peasants' expected income would be barely more than one-third of the amount

of foreign aid for high values of θ, but would exceed two-thirds of the amount of foreign aid for low values of θ and moderately high values of σ.

SUMMARY AND CONCLUSIONS

This paper has analyzed the allocative and distributive effects of foreign aid within a positive theory of insurrections. This theory treats insurrections and its deterrence as economic activities that compete with production for scarce resources. The analysis assumed that the decision to participate in an insurrection depends on the alternative costs and expected payoff to active peasant insurgents and that the policies of the ruler reflect the costs and expected benefits to his clientele from deterring or suppressing insurrection.

Because foreign aid increases the potential booty for insurgents, the introduction of foreign aid causes the ruler to lower the tax rate in order to deter insurrection. In fact, the ruler even could choose to subsidize production instead of taxing production. This policy response effectively distributes part of the foreign aid as increased income of the peasants.

Positive foreign aid also causes the ruler to demand more soldiering time in order to deter and/or to suppress insurrection and, thereby, to maintain his clientele's income share. But, despite the ruler's policy responses, except in those cases in which the ruler's optimal policy combination deters insurrection completely, the introduction of foreign aid also would cause the peasants to allocate more time to insurrection in an intensified effort to increase their income share. Thus, foreign aid causes both the ruler and the peasants to reallocate resources from production to an intensified struggle over distributive shares. Moreover, unless insurrection is completely deterred, foreign aid increases political instability as measured by the probability of a successful insurrection.

Given these responses by the ruler and the peasants, the effect of foreign aid on the expected income of the peasants would be composite of three factors. First, with or without foreign aid, the ruler's policies leave the peasants with an expected share of total income that, depending on the parameters of the technology of insurrection, is greater than one half but less than unity. The simulated equilibria show that, given the amount of foreign aid and the value of the parameter θ, this expected share is larger the larger is the parameter σ—that is, the less effective are soldiers in deterring insurrection.

Second, foreign aid decreases the peasants' expected share of total income. In this sense, foreign aid, even though it increases the expected income of the peasants, "worsens" the distribution of income. The simulated equilibria show that the decrease in the peasants' expected share of total income would be small if the parameter θ is small—that is, if time allocated to insurrection has a large effect on the probability of a successful insurrection—but would be more than ten percent of income if θ is large.

Third, because foreign aid causes time to be reallocated from production to an intensified struggle over distributive shares, total income increases by less than the amount of foreign aid. The reduction in production would be larger the more that foreign aid would increase the expected return to time allocated to insurrection. Specifically, the decrease in production would be small if θ and σ are both small, but would be in the range of fifteen to thirty percent of the amount of foreign aid if either θ or σ is large.

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The net effect of these factors is that, depending on the parameters of the technology of insurrection, the expected income of the peasants could increase by as little as barely more than one-third or by as much as more than ninety percent of the amount of foreign aid. The expected income of the peasants would increase more the larger is σ—that is, the less effective is time allocated to soldiering in deterring insurrection—and, unless insurrection is completely deterred, the smaller is θ—that is, the more effective is time allocated to insurrection in increasing the probability that an insurrection will succeed.

The main lesson of this analysis for potential donors is that in order to anticipate the allocative and distributive effects of foreign aid they must understand the political economy of the recipient country. Benevolent donors should not withhold aid until they can fool themselves into believing that the ruler of the recipient country shares their benevolent motives. Instead, benevolent donors should attempt to determine how benevolent an outcome will result from the constraints that the ruler faces despite the ruler's presumably selfish motives. The analysis in this paper has shown that, even if the ruler of the recipient economy treats foreign aid as just another potential source of income for his parasitic clientele, and even though foreign aid "worsens" the equilibrium income distribution and can increase political instability, the threat of insurrection induces a policy response that increases the income of the general population. The critical question for potential donors is whether, given the technology of insurrection in the recipient country, the increase in the income of the general population relative to the amount of foreign aid is large enough to warrant the giving of the aid.

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