Globalization and Civil War

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Abstract. A simple model of trade and appropriative civil war is framed to address questions of the relationship between globalization and civil violence. Among the conclusions are that the system is prone to abrupt discontinuities in equilibrium, so that a small change in the international environment can lead to sudden beginning or end of a destructive civil conflict; multiple equilibria are common; and globalization can make war either more or less likely, depending on the *type* of globalization.

Very preliminary and incomplete. Comments most welcome.

Civil war is endemic in large parts of the Third World. While some such conflicts are of course caused by ethnic or other non-economic factors, a growing body of research has identified links between economic factors and civil conflict. For example, Collier and Hoeffler (1998) examine the effect of per capita income and primary commodity dependence on the likelihood of conflict. Ross (forthcoming) studies the effect of commodities on civil war through case studies. Theoretical approaches to the economic roots of civil war include Grossman (1999) and Collier (2000a), as well as others. To summarize an important strain of the argument, civil wars often take the form of wars of pillage, effectively a contest over control of some important economic resource, usually a tradable primary commodity. The importance of diamonds in recent civil wars in West Africa is well documented. The Biafran war in Nigeria in the 1970's had control of oil-rich territory at its heart. The disastrous civil conflicts in El Salvador in the 1930's have been attributed to a rise in the value of coffee-growing lands, and consequent competition for them between Indians and whites (North, 1981, pp. 35-9). A survey of many examples in the popular press is found in Fishman (2002), and a survey of many of these issues is found in Collier (2000b).

This paper offers a theoretical analysis of the link between international trade and the problem of economic civil war. This link is emphasized fervently by some critics of globalization, who argue that globalization itself is responsible for much of the current prevalence of war in the world ('...the freeing up of world financial markets and world trade has spread an epidemic of violence,' in the words of Fishman (2002, p.41)). The link has received some formal attention as well. For example, Collier (2000) examines economic civil war as the outcome of a general-equilibrium model that emphasizes strategic interaction between the government and a rebel group that wishes to steal a primary commodity resource. A key variable is the value of the primary commodity resource, which is of course affected by world markets. (Panagariya and Shibata (2000) and Skaperdas and Syropoulos (2001) study the relationship between trade and war *between* countries.)

The present paper follows ideas in the literature, but emphasizes a mechanism that has not been emphasized yet. The argument is that two forces reinforce each other. First, weak demand for unskilled labor promotes civil violence, by providing abundant cheap labor for opportunistic insurgent groups to hire. Second, violence leads to weak labor demand, by chasing away footloose foreign capital and promoting capital flight among domestic citizens, thus hollowing out the manufacturing sector. The mutually reinforcing nature of these two forces leads to multiple equilibria and to dramatic discontinuities in a simple open general equilibrium model, which do not seem to have been discussed in other work but that may be important in practice.

In more detail, the heart of this paper is a simple trade model with the following elements: (i) An exportable primary resource, which can be stolen through organized violent conflict. (ii) Free entry by 'warlords' into competition for this resource. (iii) Agriculture and manufacturing compete with war as sources of employment for labor. The opportunity cost of participating in war has been argued by many authors to be a crucial determinant of whether or not war will occur (see Collier and Hoeffler (1998) for empirical evidence of its importance; Bradsher (2002) describes how a boom in employment due to tuna killed off several guerrilla movements in Mindanao). (iv) The demand for manufacturing workers is sensitive to the prevalence of violence. A large body of evidence confirms the common-sense expectation that the proximity of war discourages investment. We interpret this as the problem of 'stray bullets' raising manufacturing costs. Since most of the countries of interest are small, we assume a small open economy and take the world prices of the tradeable goods as given. It is useful to speak in terms of 'border prices,' which (for a given world price) will rise for exported goods and fall for imported goods when trading costs fall.

With these elements together, we find that *ceteris paribus*, a sufficiently high border price for the tradable resource guarantees civil war, while the opposite condition guarantees peace. (All statements made for the border price of the tradable resource hold in the opposite direction for manufactures.) In the intermediate ranges, however, it is possible to have two equilibria, one with devastating war that drives manufacturing out of the country, and the other with a robust manufacturing sector that bids the workers away from war and prices the warlords out of business. For this reason, it is possible, as the system moves from one region of the parameter space to another, that a small change in border prices will set off a dramatic change in outcomes. In addition, an improvement in the country's terms of trade can have profoundly perverse welfare implications, by plunging the country into the maelstrom of a ruinous internal war.

1. The Model.

The elements of the model are as follows. There is a fixed supply of homogenous labor, $\overline{L}$, which can be used in the agricultural sector, manufacturing, or in the service of warlords. There is an extractable resource, whose border price is P^D (think of 'diamonds'). The border prices of agriculture and manufactures are denoted P^A and P^M respectively. These prices are taken to be exogenous, and agriculture is the numeraire, so $P^A \equiv 1$. There is a fixed unit supply of the resource, and it requires no labor to extract.

Agricultural goods are produced with a constant-returns-to-scale production function $F(L^A, T)$, where L^A is the labor employed in agriculture and T is the fixed supply of land. This gives a labor market equilibrium condition $F_1(L^A, T) = \omega$, where ω denotes the wage, and this implies a downward-sloping agricultural demand schedule $L^A(\omega)$. Assume that $L^A(\omega) \to 0$ as $\omega \to \infty$ and that $L^A(\omega) \to \infty$ as $\omega \to 0$.

Manufactures are also produced with constant returns to scale, using capital and labor, with the unit cost function given by $c^M(\omega, r, L^W)$, where r denotes the cost of capital and L^W denotes the total number of workers (that is, soldiers) employed by warlords, and thus the extent of fighting. The open-economy setting requires that r be equal to the exogenous return on capital, r^*, in the rest of the world in order for footloose capital to be supplied to this economy. The function c^M is strictly increasing in its third argument, capturing the 'stray bullets' problem. The country's total supply of labor is L, and the workers are mobile across the three employment sectors.

Denote by $\phi^M(P^M, r^*, L^W)$ the solution for ω of $c^M(\omega, r^*, L^W) = P^M$. This is the reservation wage for manufacturers, below which they will not hire. It is clearly increasing in P^M, and decreasing in r^* and L^W.

If there are n warlords competing for the resource, and each warlord j employs a force of L^j workers, then the probability that warlord i will be the winner of the resource is given by $\phi(L^i)/[\sum_{j=1}^{n} \phi(L^j)]$, where ϕ, $\phi' \geq 0$; $\phi'(0) = 0$; $\phi''' < 0$; and $\phi''(L) > 0$ for $L < L^*$, $\phi''(L) < 0$ for $L > L^*$ for some $L^* > 0$. This provides for some indivisibility in warfare, with the result that a finite number of warlords will enter, each with a finite size army. The decision-making of an army can be modelled in many different ways, but it is convenient for our purposes to assume that each army divides the spoils evenly among its members, and chooses its size to maximize the expected payoff per member.

Given this structure, an equilibrium can be defined as follows. It is a value for L^W, n, and ω such that the following hold. (i) Setting L^i equal to L^W/n maximizes $P^D\phi(L^i)/\{[\phi(L^i) + (n-1)\phi(L^W/n)]\} - \omega L^i$ (profit-maximizing warlords). (ii) Either entry by a warlord is unprofitable and $L^W = 0$, or $P^D/L^W = \omega$ (the free-entry condition). (iii) Either $L^W + L^A(\omega) < L$ and $c^M(\omega, r, L^W) = P^M$ (in which case the manufacturing sector is functioning), or $L^W + L^A(\omega) = L$ and $c^M(\omega, r, L^W) \geq P^M$ (in which case the manufacturing sector has shut down). Of course, 'war' is an equilibrium with $L^W > 0$, while 'peace' is an equilibrium with $L^W = 0$.

It is useful to divide the uses for labor into the 'productive sector,' consisting of agriculture and manufactures, and the 'non-productive sector,' consisting of violent warlordism. We will first examine the demand for labor by the productive sector, then examine the supply of labor to the productive sector (the residual of labor supply net of the demand by warlords), then examine the equilibria of the system as a whole.

2. Demand for labor in the productive sector.

Suppose for the moment that we know for exogenous reasons that there will be no violence in this economy. Then for a wage below $\phi(P^M, r^*, 0)$, the manufacturing sector would have a boundless demand for labor, while for a wage above that level, the only productive sector labor demand would be from agriculture. This would be a quantity of labor that would equate the marginal value product of labor in agriculture with the wage. The result is a demand for labor curve such as is indicated by the kinked broken curve in Figure 1, where labor is measured along the horizontal axis, wages are measured along the vertical axis, and the length of the box is the economy's total labor supply, $\overline{L}$. The downward sloping curve traces the marginal value product $F_1(L^A, T)$ of agriculture, and the horizontal line traces the manufacturing reservation wage.

Note that only one point on this diagram could be consistent with equilibrium: $L^W = 0$ implies that all labor is used in the productive sector, so that the equilibrium point must be on the rightmost edge of the diagram. This implies a wage of $\phi(P^M, r^*, 0)$, with positive manufacturing employment.

Next, we can consider a small positive level of violence, as depicted in Figure 2. Again, the productive-sector demand for labor conditional on the assumed positive value for L^W is given by the kinked broken line, and again that level of L^W is consistent with only one point in the diagram. That point is marked as A, the point on the kinked curve from which the distance rightward to the end of the box is equal to L^W. Note that the wage is equal to $\phi(P^M, r^*, L^W)$, with positive manufacturing employment.

Increasing L^W somewhat leads to the outcome in Figure 3. Here, the horizontal line is lower than in Figure 2, reflecting the higher cost of manufacturing in the presence of a more violent environment and the consequent need for lower wages to break even. Again, the productive-sector demand for labor conditional on L^W is given by the broken, kinked line, and again only one point on that line is consistent with the assumed value of L^W. Here, that point is marked as B, which is right at the kink. In this case, manufacturing employment is at zero, and the wage is equal to $\phi(P^M, r^*, L^W)$.

Finally, consider a higher value of L^W still, as depicted in Figure 4. Here, L^W is equal to the distance between point C and the rightmost axis of the figure, so that point on the broken kinked curve is the only one consistent with labor market equilibrium. Note that C is to the left of the kink, indicating that there is zero manufacturing employment, and that the wage is strictly above the breakeven wage for manufacturing. The wage is now equal to $F_1(\overline{L} - L^W, T)$, and the market clears with only agricultural employment. Note that since each increase in L^W moves the kink rightward (by lowering $\phi(P^M, r^*, L^W)$) and moves the point on the curve consistent with L^W leftward, there is a critical value of L^W such that for values below that, the equilibrium point is to the right of the kink, while for values above it, the equilibrium is to the left of the kink. Thus, sufficient levels of violence will definitely crowd out the manufacturing sector.

This is all summarized in Figure 5, which shows the locus DD of all points consistent with equilibrium in the productive-sector labor market as L^W is varied from 0 to $\overline{L}$. It has a downward-sloping portion, to the left of B, consistent with high violence and zero manufacturing employment, and an upward-sloping portion, to the right of B, consistent with low violence and positive manufacturing employment. This locus will henceforth be called the 'demand curve for productive-sector labor.'

3. Supply of labor to the productive sector.

Turning now to equilibrium in the unproductive sector of the economy, we can derive L^W from P^D and ω. This will then imply a value for $\overline{L} - L^W$, the labor supply available to the productive sector.

Taking the derivative of warlord i's profit with respect to L^i:

$$P^D\phi(L^i)/\{[\phi(L^i) + (n-1)\phi(L^W/n)]L^i\} - \omega L^i$$

and setting equal to zero yields:

$$\frac{P^D\phi'(L^i)\sum_{j\neq i}\phi(L^j)}{\left(\sum_j \phi(L^j)\right)^2} = \omega.$$

Using the symmetry of the problem that implies $L^i = L^W/n$ in equilibrium, plus the free-entry condition $P^D/L^W = \omega$, implies that:

$$\left(1 - \tfrac{1}{n}\right)\eta^i = 1,$$

where η^i denotes the elasticity of the ϕ function with respect to L^i. Focussing on the case in which n is large, this implies (to a close approximation) a fixed scale L^{**} for each army, regardless of demand and supply conditions, determined by setting the elasticity of ϕ equal to 1. Note that the free-entry condition is $L^W = P^D/\omega$. Thus, holding P^D constant, L^W is a decreasing function of the wage. Subtracting this from $\bar{L}$ yields the supply of labor to the productive sector.

4. Equilibrium.

Putting together the demand for labor by, and supply of labor to, the productive sector gives us the full equilibrium, in which the wage and L^W are both endogenized. This is shown in Figure 6. The upward-sloping supply is given by the curve SS, and the demand curve is given by DD as derived earlier. Any intersection of the two is an equilibrium. Note that an increase in P^D will shift SS up; an increase in r^* will shift DD down, and an increase in P^M will shift DD up.

It can now be seen that within this framework there can be as many as three equilibria, two of them stable and welfare ranked. The good equilibrium, marked G, has low L^W and high ω, with a low level of violence, a high level of capital and manufacturing employment, and high wages. The bad equilibrium, marked E, has high L^W and low ω, with a high level of violence, capital flight and no manufacturing employment, together with low wages. These are clearly welfare-ranked because the output prices are the same in both cases, but national income is lower for E, due to withdrawal of more labor from the productive sector. However, they are not Pareto-ranked: Workers are worse off at E, capitalists are indifferent, and landowners are better off at E. (Of course, we have assumed that landowners are not troubled by the 'flying bullets' problem, which is not realistic.)

Further, a sufficient increase in P^D or r^* or decrease in P^M will eliminate the good equilibrium, while a sufficient movement of any of these prices in the opposite direction will eliminate the bad equilibrium. This is illustrated by Figure 7 for changes in P^D. This can lead to sharp discontinuities in outcomes; for example, as P^D moves from a very low to a very high value, we must at some point have a discontinuous increase in L^W.

The implications of 'globalization,' then, can be seen to depend on the *type* of globalization experienced. A reduction in transport and transaction costs and opening of new markets could imply an increase in P^D, the local border price of the resource. This will make civil war more likely. If manufactures are a net export, the same logic means globalization could mean that P^M rises, making war *less* likely. On the other hand, if manufactures are a net import, globalization would mean that P^M falls, making war *more* likely. Finally, a reduction in international transaction costs lowering the local cost of capital could mean that r^* falls, making war less likely.

Note what these discontinuities imply for the time-series behavior of the system. Assume for simplicity that if we allow the world prices facing this economy to fluctuate over time, then if it is in the 'good' equilibrium, it will remain in the 'good' equilibrium for the current parameter values until parameters shift so much that the 'good' equilibrium no longer exists. Make the parallel inertial assumption for the 'bad' equilibrium. Then an example of a possible history of this system is depicted in Figure 8. Here, only P^D is fluctuating. The system is initially in the good equilibrium (which is referred to in the figure for simplicity as 'peace,' although there is always some violence). The threshold P' is the value for P^D below which the bad equilibrium does not exist, and the threshold P'' is the value above which the good equilibrium does not exist. Peace persists, with varying low levels of violence, as P^D rises from below P' all the way up to P''. When it crosses that threshold, suddenly the economy moves from G to E in Figure 6, and the economy suffers an explosion of catastrophic violence. It make take observers by surprise, because the underlying parameters have changed only gradually. The disastrous war will persist until long after P^D has fallen below the level at which war broke out; indeed, it must fall all the way back down to P'.

Thus, the model predicts a kind of inertia, both in peace and in war. It also provides support for the efforts to clamp down on sales of diamonds from civil-war-torn areas of Africa, and for trade measures such at the US government's African Growth and Opportunities Act and the European Union's Anything But Arms initiative, which both promise to increase the demand for labor-intensive manufactured exports from Third World areas affected by civil strife. Further, it suggests that any measure that makes foreign capital more available to a country with a potential civil instability problem may (by lowering r^*) have a potentially enormous role in switching the economy from the bad equilibrium to the good one, apart from its familiar incremental role of raising domestic incomes.

5. Extensions.

Possible extensions include the following.

(i) A monopolistic warlord, who can appropriate a large fraction of the resource if he hires more workers/soldiers. It seems likely that this would eliminate multiple equilibria but not the discontinuities observed in this model.

(ii) A resource sector that requires labor to extract, thus having a direct effect on the demand for labor. This might conceivably allow for the possibility that a *drop* in P^D could have a positive effect on war, which seems to have been important in the Salvadoran case (North, 1981, pp. 35-9).

(iii) The possibility of government response to insurgents, by arming itself, thus setting up a Nash equilibrium between government and insurgents. This is explored in detail in Collier (2000a), in a model without the particular general equilibrium effects highlighted here. It would make sense to ask what the interactions between the two sets of effects might be.

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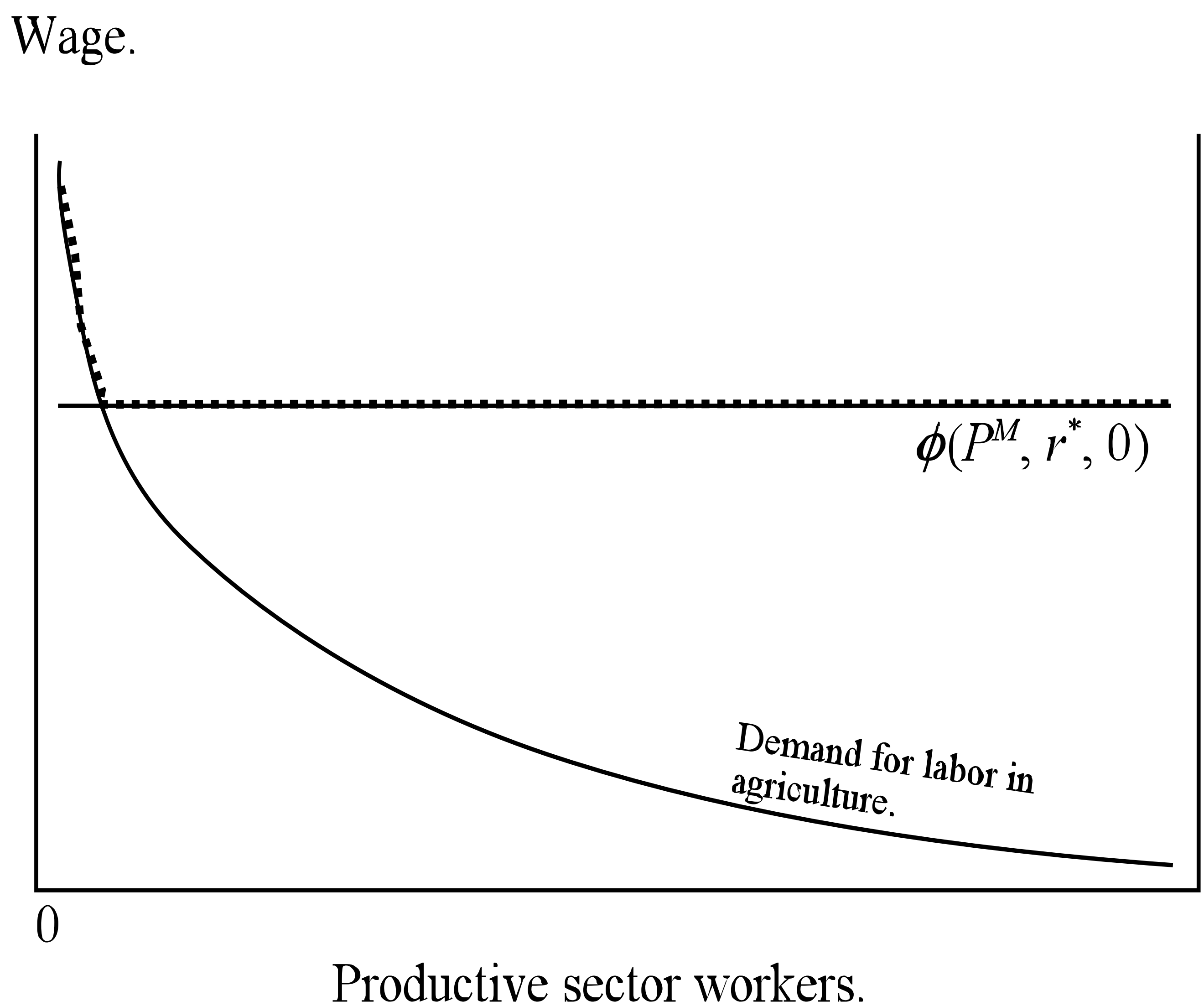

Figure 1: Productive sector labor demand in the absence of violence.

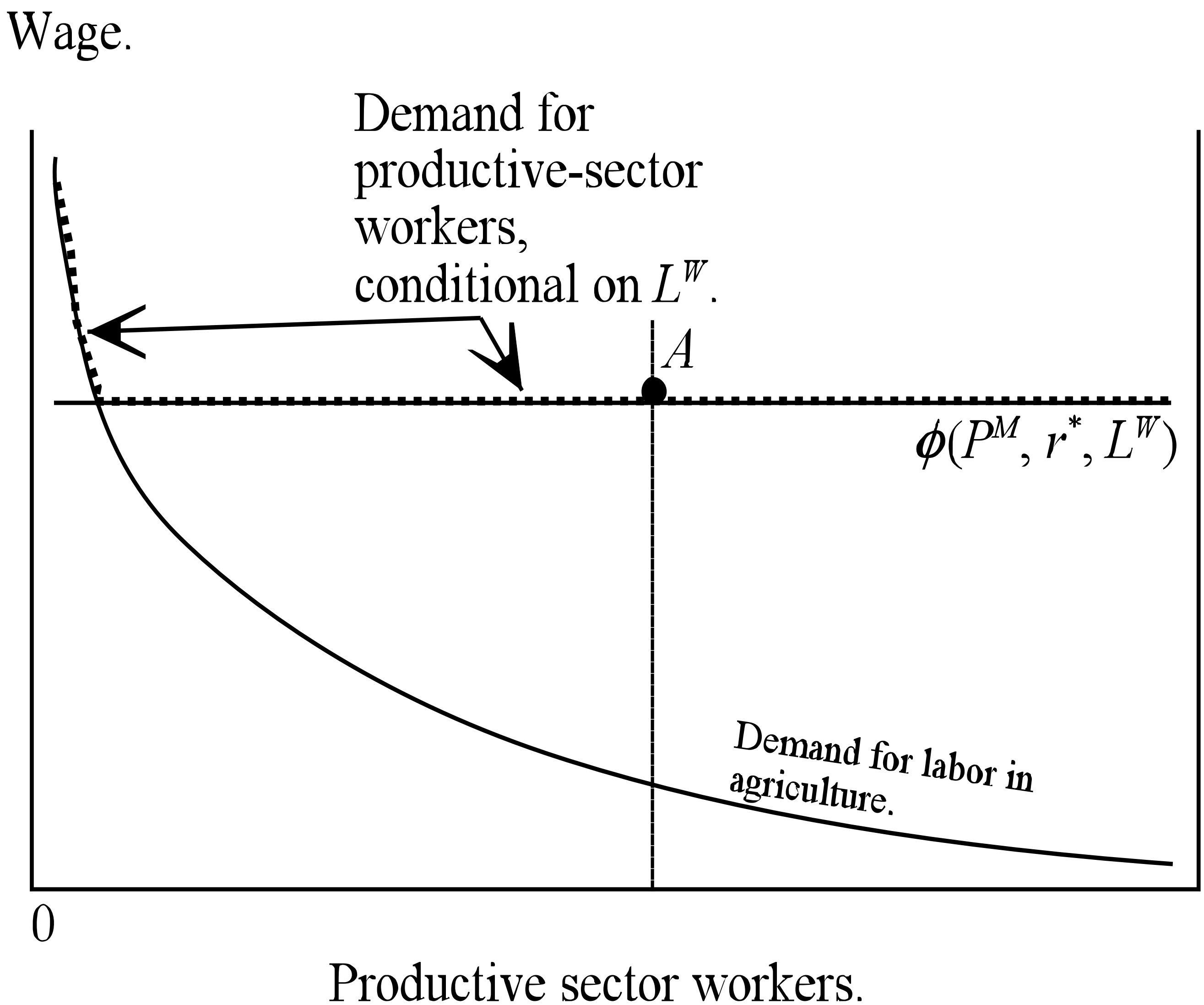

Figure 2: Productive sector labor demand: Low level of violence.

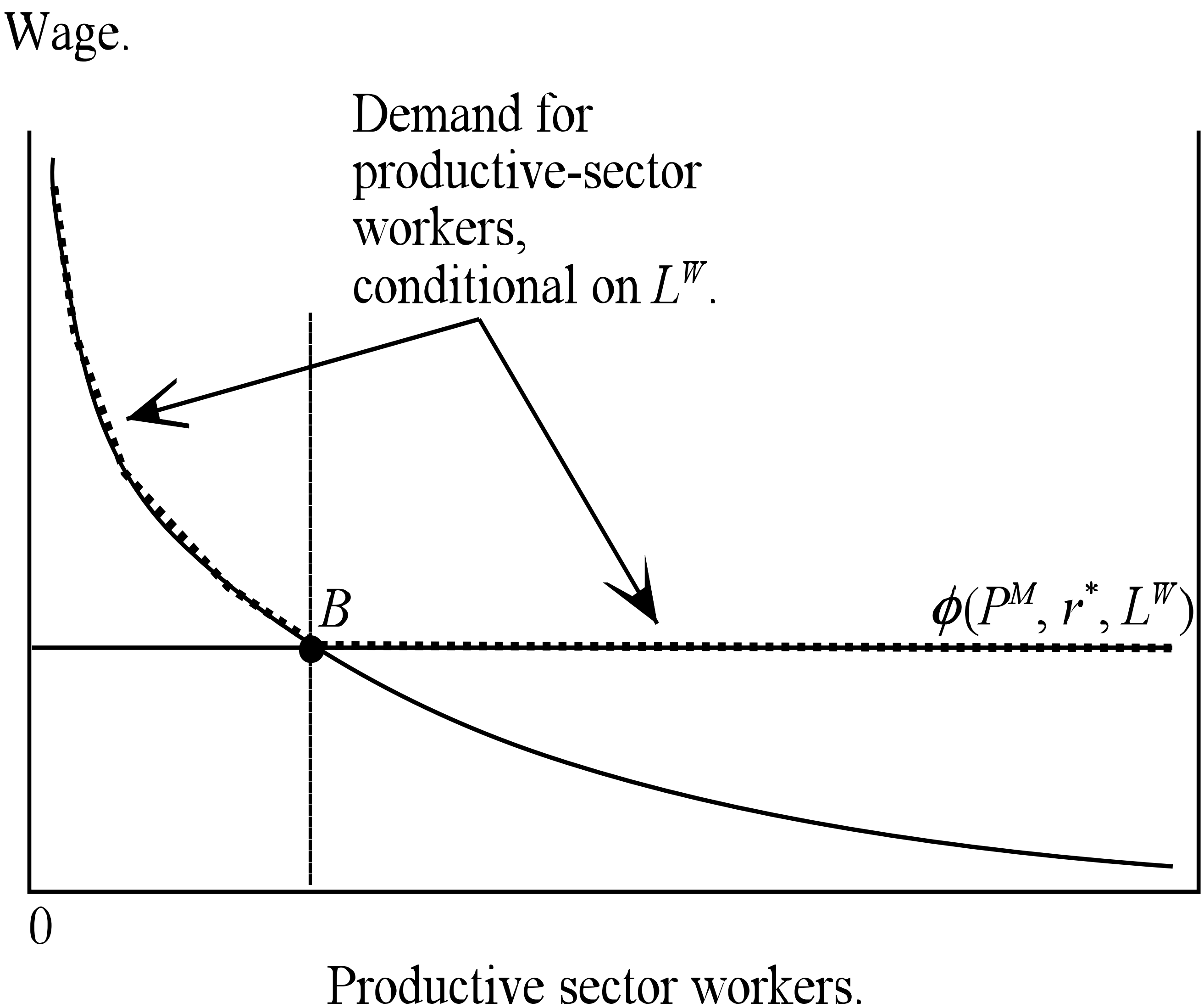

Figure 3: Productive sector labor demand: Intermediate level of violence.

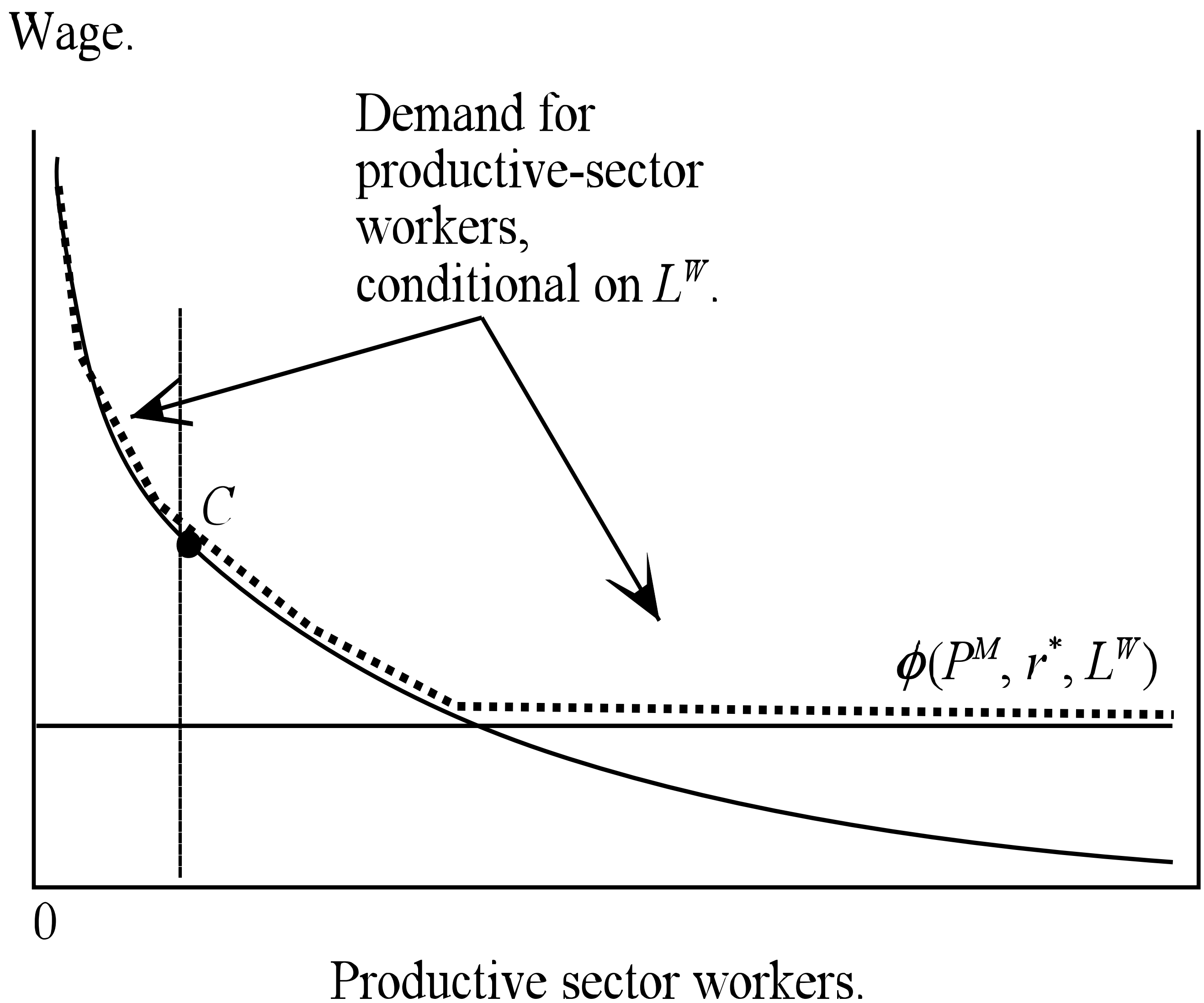

Figure 4: Productive sector labor demand: High level of violence..

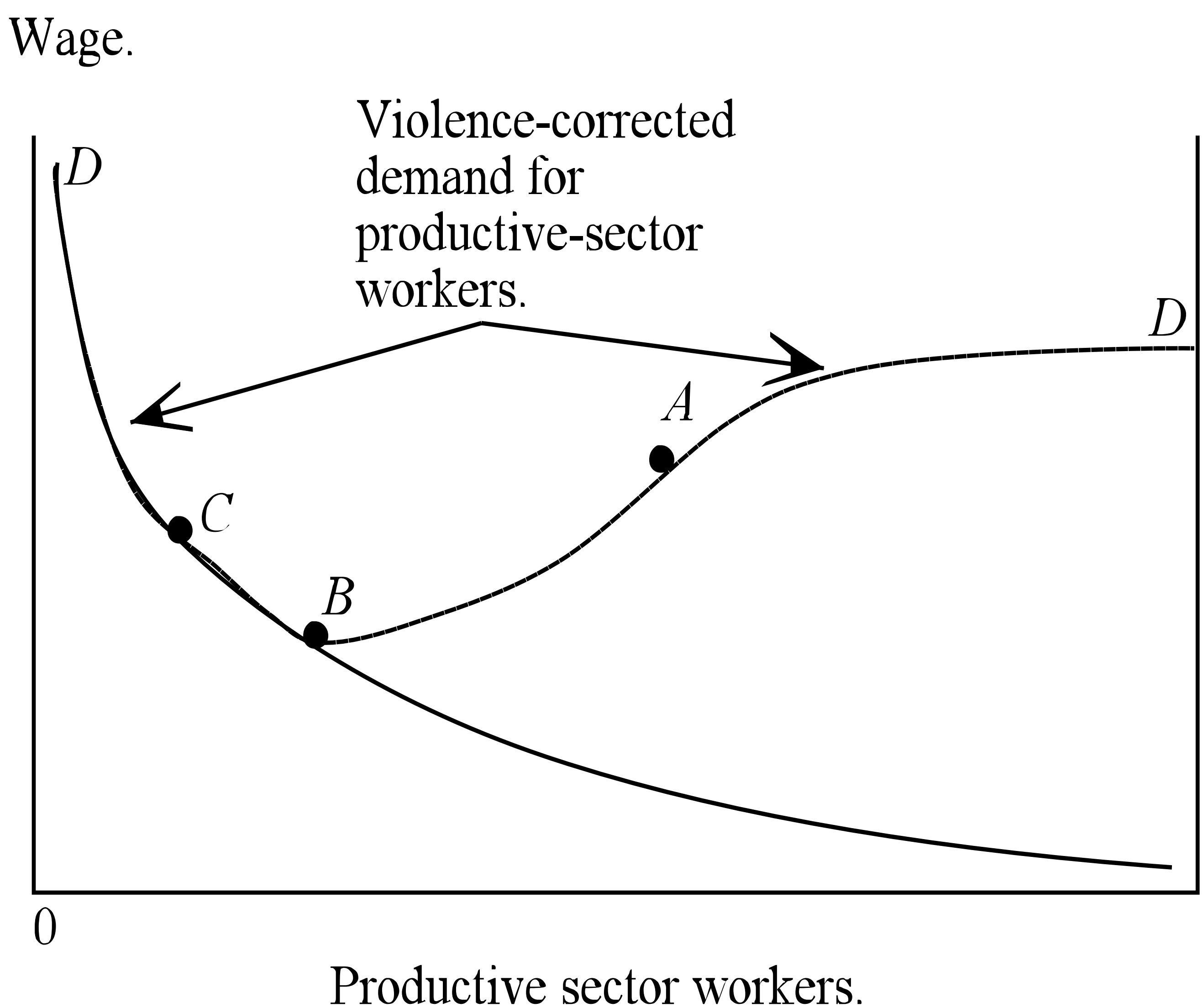

Figure 5: Productive-sector labor demand curve, correcting for violence.

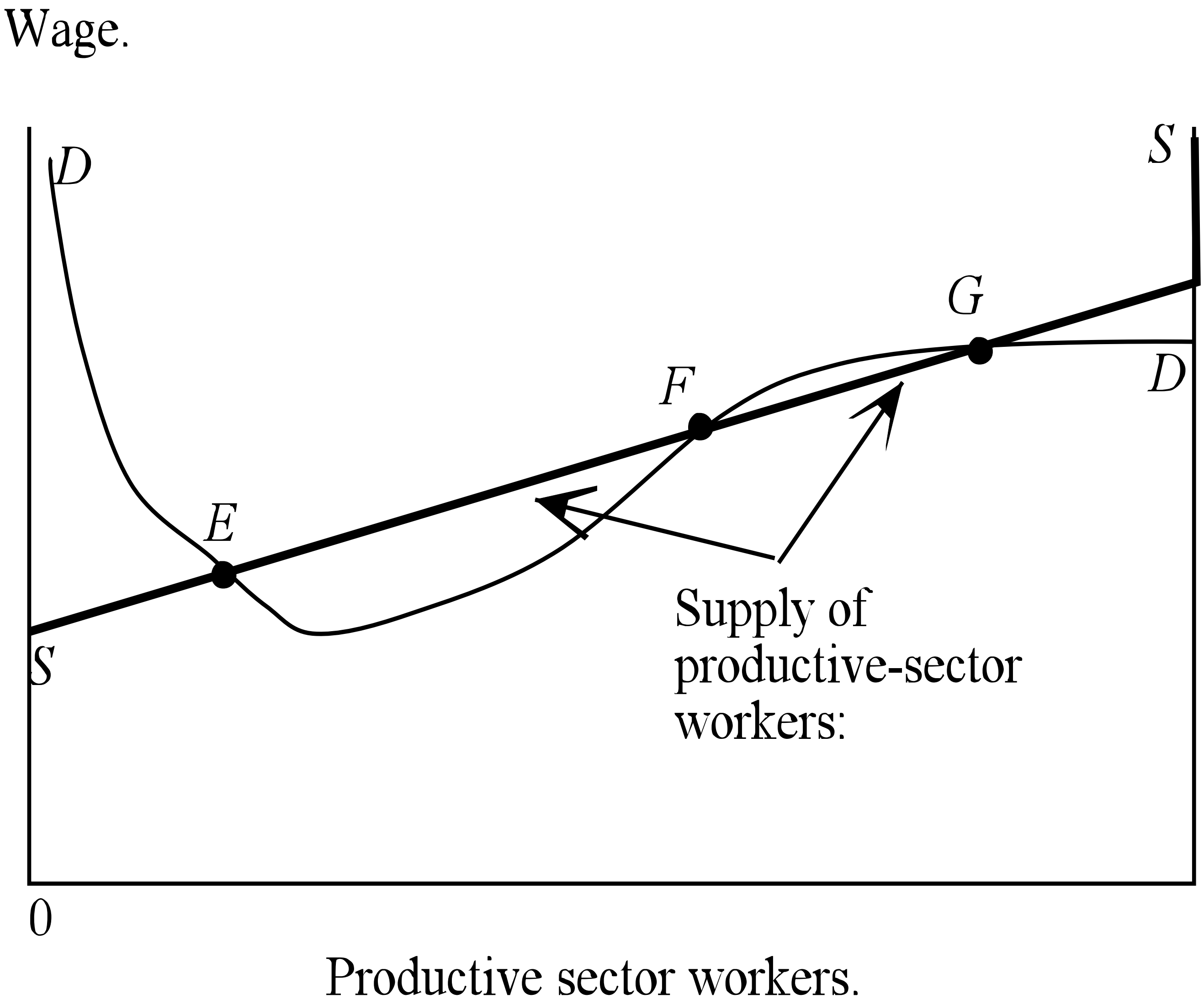

Figure 6: Equilibrium.

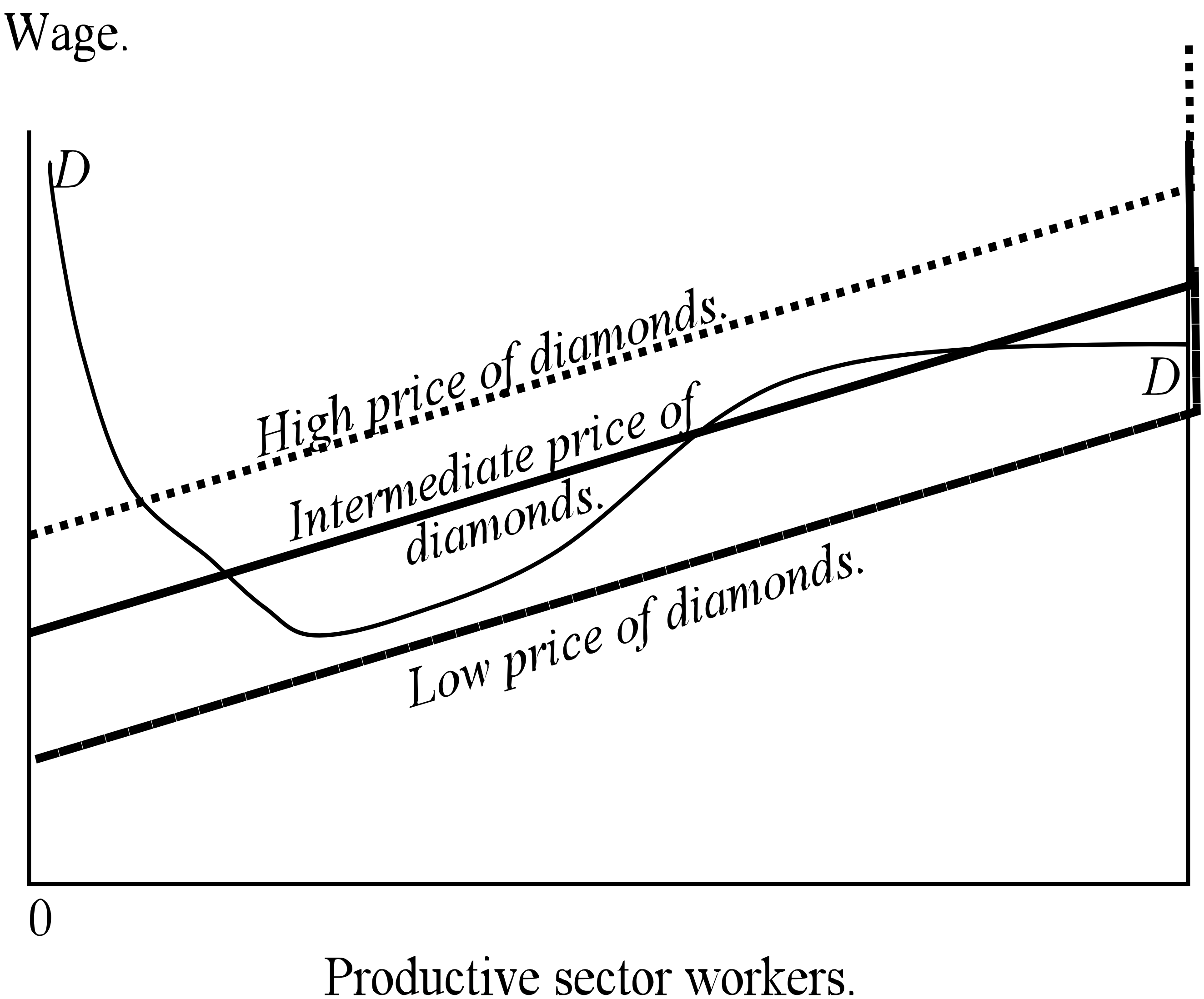

Figure 7: Effect of changing the price of diamonds, holding other world prices constant.

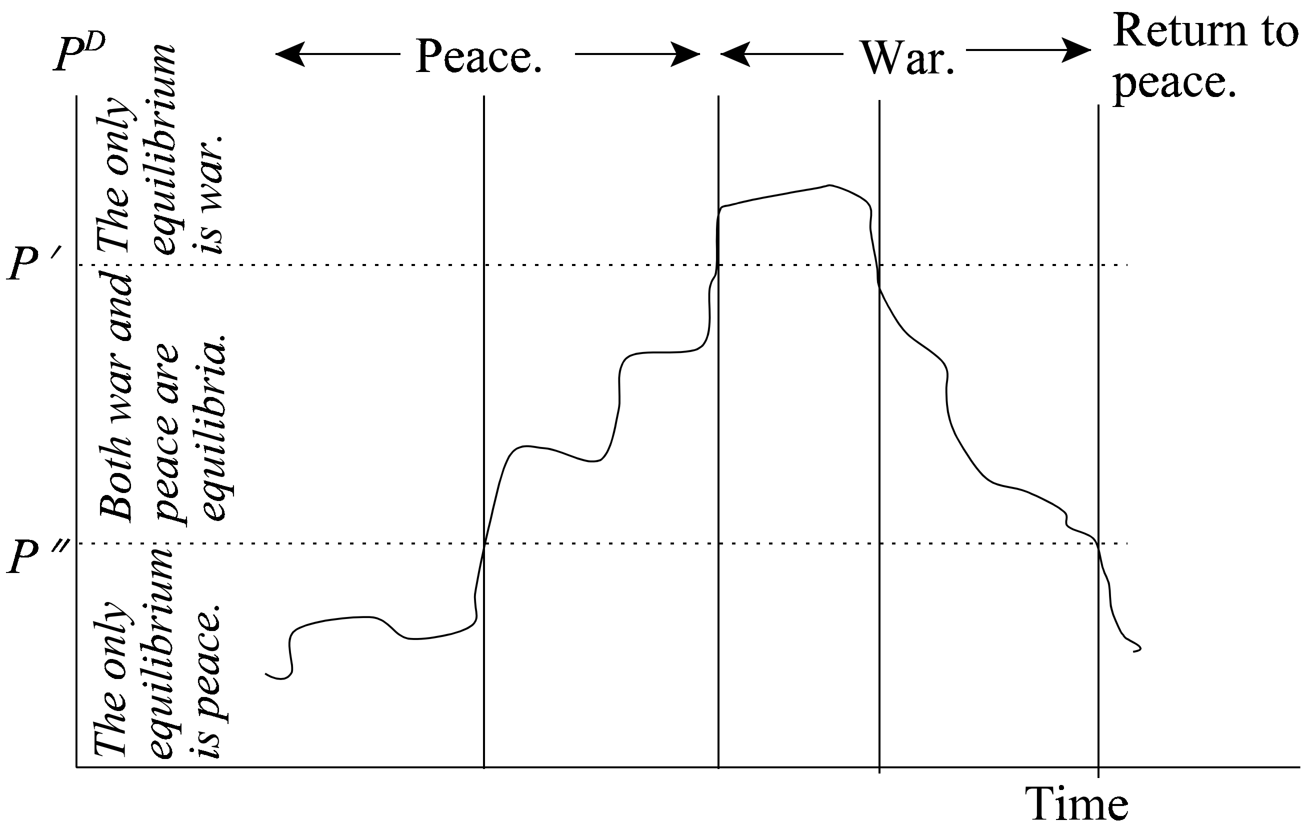

Figure 8: An example of how these forces might play out over time.