The Philosophy of Locational Competition

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While Standortswettbewerb may be a familiar term in the German economics literature, with a long tradition in location theory going back to von Thunen and Losch, its English counterpart "locational competition" does not ring any bells, at least to me. One possible meaning, it would seem, is the choice of sites by firms at which to locate various production or marketing facilities to maximize their profits, given what their competitors are doing. It would thus constitute the geographical dimension of competition between oligopolists and as such would bring into play the full panoply of the location theorist's exotic arsenal of hexagons, isodapones, and whatever else have you.

Somehow I do not think that this is what Professor Horst Siebert had in mind when he invited me to write a paper on this subject, which is the theme of our conference. What he appears to want us to understand by this phrase is rather competition between nations, not firms, to attract within their borders as much as possible of global pools of internationally mobile factors, thus raising the incomes of complementary immobile factors confined within those borders. In any case, this is the sense in which I will interpret the term in this paper.

Before undertaking the analysis of this problem, however, it is necessary to examine the question of whether it is legitimate to consider nations as competing between themselves at all, in the sphere of trade and economic matters in general, as opposed to traditional geopolitical conflict of interest. In the classical theory of international trade it was until recently taken for granted that the basis of trade was mutual gain or "win-win," a context in which it is an absurd fallacy to imagine that one party's gain might be at the expense of the other party's loss. The

economist's vision of international relations, from Ricardo and Mill to Meade and Ohlin, has been a benign and peaceful one in which the concept of competition is applicable only to firms and not between nation-states.

And yet there are major exceptions to this generalization. In the case of the "optimal tariff" argument, the imposing nation gains and its passive partner loses, just as in poker or war. The possibility of retaliation raises all of the standard issues in the analysis of conflict that we are familiar with from the literature of game theory. No wonder that Edgeworth wanted to label "poison" the article in which he first noted the possibility of an "optimum" tariff! Recently there has been an extensive literature on so-called "strategic trade policy" in which nation-states each back their own oligopolists in a global competition for rents and profits. We thus seem to be back in the world of the Mercantilists, with Britain, France, and Holland blending trade policy with naval policy in their struggle over the profits of the East Indian spice trade and the riches of the New World.

While competition between nations is a highly controversial and dubious topic in the scholarly academic literature, it is a staple of the thriving popular literature on "what's wrong with America" or "why is, or is it *was*, Japan No. 1." A number of writers, such as Lester Thurow, Michael Porter, James Fallows and Edward Luttwak have all examined various aspects of American economic performance, and recommended adopting sundry foreign practices, such as the German apprenticeship system, or MITI-type policies of industrial intervention, as antidotes for what they perceive to be its grave deficiencies. Paul Krugman (1994), who has certainly been the most creative academic contributor to arguments for activist trade and industrial policies, has recently scathingly attacked all of these writings for shallowness, irrelevance, and being just plain wrong factually and logically.

Despite its fair share of such errors and other infelicities, a well-known popular book of this genre, The Work of Nations by Robert Reich (1991), conceives of the American economic problem in precisely the framework of "locational competition" that we have as our agenda for this conference. Contrary to some of his earlier writings, he here eschews protectionism, industrial policy, and other attempts to "pick winners." He does, however, advocate policies to refurbish the country's decaying physical infrastructure and to improve the system of public education. These measures, he feels, will attract a higher share of global capital, entrepreneurship, and new technology to the country and raise the living standards of the American worker as a result.

Since Robert Reich is Secretary of Labor in the Clinton administration, and a highly influential member of his inner circle in addition, his views are of considerable interest as a possible framework for the administration's approach to its global economic strategy. In Europe and Japan also specific trade interventions and industrial regulations are getting to be out of fashion, as well as being inconsistent with the thrust of GATT and other global and regional agreements. Infrastructure and public education are increasingly coming to the fore as major components of a new, market-friendly type of governmental activism that is not at all inconsistent with what Adam Smith long ago regarded as the right and proper "duties of the sovereign."

The question now becomes what are the determinants of the levels of physical infrastructure and public education in the general allocation of economic resources between productive sectors in a world of international capital mobility and free trade in goods and services. What impact do they have on production, trade, and the prices of the factors of

production? What are the international implications of national measures to influence the levels of these variables?

It is surprising that there does not exist at the moment, at least to my knowledge, any readily available framework within which these issues can be discussed.[1] There is of course an extensive literature on each aspect of the problem, such as international capital mobility, human capital, and public goods such as "physical" infrastructure, but they have not been combined together in an integrated whole. I have therefore found it a major intellectual challenge to attempt to put together, if only within a very simple and highly stylized structure, a framework within which the interplay of these factors may be considered.

The model that I will now attempt to sketch is meant to be purely exploratory and is defective in many obvious respects. I am congenitally incapable, however, of thinking without the discipline of some such analytical construct. The components of the model will be drawn from some of my previous work, on human capital and trade in Findlay and Kierzkowski (1983) and Findlay (1993), and on public inputs, infrastructure, trade, and capital mobility in Clarida and Findlay (1991, 1992, 1994), which in turn draw on a model of government and the economy first presented in Findlay and Wilson (1987).

Let us consider an economy that produces two final private goods, one of which , X, is a "high-tech" sector that uses physical capital K and skilled labor S as inputs in a constant returns to scale production function, with diminishing returns to each factor with a fixed amount of the other and complementarity in production between the factors, so that an increase in the quantity of one raises the marginal productivity of the other. The other branch of the private sector of production, Y, uses physical capital and ordinary unskilled labor L as inputs in a production function with the same formal properties as X.

So far our specification corresponds to the familiar Ricardo-Viner model of Jones (1971) with physical capital as the common "generic" factor and skilled and unskilled labor as the "specific" factors.[2] We depart from this familiar world, however, to follow the specification of Clarida and Findlay (1992) that the productivity of both branches of the private sector of the economy is enhanced by government expenditures on a public intermediate input, "infrastructure." Furthermore, the "high-tech" sector X is more responsive to the public input than the other sector Y. This makes the marginal rate of transformation between the two goods, and not just the level of productivity, a function of the level of the public input. It will be convenient to assume specific functional forms for the two production functions, which are that

$$X = A(L_A)[K_x^{(1-\alpha)}S^\alpha] \qquad (1)$$

and

$$Y = A(L_A)^\mu[K_Y^{(1-\alpha)}L_Y^\alpha] \qquad (2)$$

We also assume that

$$A'(L_A) > 0, A''(L_A) < 0, A(0) = 1$$

and

$$0 < \mu < 1$$

K_X and K_Y are the amounts of physical capital used in each sector, S is the economy's stock of skilled labor, all of which is used in X, and L_A and L_Y are the amounts of unskilled labor used in the public input and the Y sector.[3] In addition, unskilled labor L_G is used to provide final public services or amenities.

Ordinary or unskilled labor can transform itself into skilled labor by undergoing a costly process of education or human capital formation. We define the rate of return on human capital

formation, ρ, as

$$\rho = \rho[\theta, S] \tag{3}$$

where θ is the ratio of the skilled wage v to the unskilled wage w. By arguments familiar

from the labor economics literature, and demonstrated explicitly in a general equilibrium context

in Findlay and Kierzkowski (1983), equation (3) has the properties that

$$\frac{\partial \rho}{\partial \theta} > 0, \frac{\partial \rho}{\partial S} < 0$$

i.e. a rise in the wage differential raises the return to human capital formation and a rise in the

amount of skilled labor available reduces it.[4] The manpower constraints for the economy are that

$$S + L = N \tag{4}$$

and

$$L_A + L_G + L_Y = L \tag{5}$$

where N is the fixed number of workers of both types, with the division between skilled S and

unskilled L being endogenous.

We assume that the economy is a "small open economy," with the relative price $\bar{p}$ of X

and the rate of interest $\bar{r}$ given by world markets. Perfect competition and international capital

mobility then result in:

$$\bar{p} \frac{\partial X}{\partial K_X} = \bar{p}(1-\alpha)A(L_A)(\frac{S}{K_X})^{\alpha} = \bar{r} \tag{6}$$

$$\frac{\partial Y}{\partial K_Y} = (1-\alpha)A(L_A)^{\mu}(\frac{L_Y}{K_Y})^{\alpha} = \bar{r} \tag{7}$$

i.e. the marginal value product of physical capital in each sector will be equal to the world rate of

interest. Since the input ratios uniquely determine the marginal value products of skilled labor in

X and unskilled labor in Y as well, we have

$$\bar{p} \frac{\partial X}{\partial S} = \bar{p}\alpha A(L_A)(\frac{K_X}{S})^{(1-\alpha)} = v \tag{8}$$

$$\frac{\partial Y}{\partial L_Y} = \alpha A(L_A)^{\mu}(\frac{K_Y}{L_Y})^{(1-\alpha)} = w \tag{9}$$

as the equilibrium values of v and w in the small open economy.

Since θ is defined as the ratio of v to w, it follows that

$$\frac{\partial \theta}{\partial L_A} = \frac{\theta(1-\mu)A'(L_A)}{A(L_A)} > 0 \tag{10}$$

i.e. the wage ratio is an increasing function of the level of the public intermediate input, because the "high-tech" sector X, which uses skilled labor, is more responsive to infrastructure expenditures than the other sector Y that uses unskilled labor, as reflected in the fact that μ is less than unity.

The rate of return on human capital formation, in the steady state, must also be equal to the world rate of interest. We therefore have

$$\rho[\theta(r,L_A),S] = \bar{r} \tag{11}$$

We now turn to the specification of preferences and demand. Suppose that all agents have identical and homothetic utility functions with respect to their consumption of the two final goods

$$u = u(c_x, c_y) \tag{12}$$

where c_x and c_y refer to the per capita consumption of two goods in the economy. We can think of u itself as being a sub-utility function embedded in a broader utility function

$$W = L_G^{\lambda} u^{(1-\lambda)} \tag{13}$$

where L_G is the level of final public services provided by the government. Total public expenditure is

$$E = w(L_G + L_A) \tag{14}$$

which we initially assume to be financed by lump-sum taxes, the consequences of more realistic

taxes being left till later.

We now turn to the solution of the model. It is convenient to initially fix L_G , the level of public services. For any value of L_A , the public intermediate input, the production functions (1) and (2), and the marginal productivity equations (6) to (9) all assume standard form. In Figure 1 we depict factor-price frontiers VV and WW for X and Y respectively, showing the skilled unskilled wages v and w as negative functions of the rate of interest r. The world rate of interest $\bar{r}$ then determines $v(\bar{r})$ and $w(\bar{r})$ as the corresponding values of the skilled and unskilled wages, and hence also determine their ratio $\theta(\bar{r})$. From (11) this determines the amount of skilled labor S in the economy as $S(\bar{r})$ as well. From (4) we then get L and from (5) L_Y as well, since L_G and L_A are given. Knowing S and L_Y we can determine K_X and K_Y and hence X and Y from the production functions and marginal productivity equations. We therefore know the value of tradable output at world prices which is

$$T = \bar{p}X + Y \tag{15}$$

This gives us the budget constraint for tradable goods consumed, C, as

$$C = (\bar{p}c_x + c_y)N = \bar{p}X + Y + \bar{r}\Delta K \tag{16}$$

where ΔK is the net capital-inflow or outflow of the small open economy which is

$$\Delta K = K_x + K_y - K_d \tag{17}$$

the difference between the demand for capital $(K_x + K_y)$ and the amount of capital K_d owned by domestic residents, assumed constant. The per capita consumption levels c_x and c_y , and hence exports and imports, are determined by consumers maximizing the utility function (12) subject to the budget constraint (16).

We have thus been able to find the level of per capita utility u corresponding to any given value of L_A. We now investigate the consequences of varying the level of L_A, while continuing to hold that of L_G fixed. From (6) and (7) we see that increasing L_A must lead to declines in the ratio of S to K_x in X and L_Y to K_y in Y, since the marginal product of capital in each sector must continue to be equal to the level of the world interest rate $\bar{r}$. From (8) and (9) we see that the rise in the ratio of capital to skilled and unskilled labor respectively in the two sectors, combined with the rise in L_A itself, must lead to increases in both v and w, the real wages of each type of labor. From (10) we see that although both v and w rise the ratio θ of v to w must increase since the high-tech sector X is more responsive to infrastructure expenditures than the other sector Y. This raises the rate of return on human capital formation ρ and so the amount of skilled labor S in this economy must increase to drive ρ back to equality with the world rate of interest $\bar{r}$. Since S and L_A increase, and L_G is constant, it follows that L_Y must fall. The output of the high-tech sector X must increase since L_A and S both increase and the ratio of K_x to S must rise. The output of Y, however, may rise or fall since the fall in L_Y may be off-set by the rise in L_A and possibly K_y, since the ratio of K_y to L_Y must rise. We can, however, readily compute the new values of tradable output T and consumption expenditure and hence the level of per capita utility u corresponding to the new level of L_A .

In terms of Figure 1 the effect of the increase in L_A is to shift both VV and WW to the right but VV proportionately more than WW so that the ratio θ of v to w is increased, as indicated by the steeper slope of the line OO as compared to OO' in the lower right-hand quadrant.

In Figure 2 we depict the level of per capital utility u corresponding to each value of L_A . It is drawn as the concave function HH', which begins at the utility level $\bar{u}$ when L_A is equal to

zero, then rising to the maximum level $\bar{u}$ at L_A equal to $\tilde{L}_A$ and then falling thereafter. The

utility level $\bar{\bar{u}}$ is what is attained with zero infrastructure, which is obviously too little. On the

other hand it is clear that too high a level of L_A will result in too little labor being available for

production in the private sector, and hence too low a level of per capita utility from private

consumption. Thus there is some intermediate level $\tilde{L}_A$ of the public input that is optimal in

terms of this outcome for the given level of L_G, which is the level $\bar{u}$ at the peak of the

function in Figure 2.

In Figure 3 we plot each such $\bar{u}$ corresponding to each possible level of L_G as the

concave frontier GG. It is clear that raising L_G must reduce the labor available for S , L_A and

L_Y and so the optimal $\bar{u}$ for each L_G must be less the higher is L_G. To obtain the full optimum

of the whole model we now need only superimpose the indifference map in (u, L_G) space defined

by the full utility function $W(L_G, u)$ as specified in (13). The point of tangency Ω in Figure 3

determines the optimal values L_G^* and u^*. Given L_G^* we can now obtain the corresponding

values of $L_A^*, S^*, L_Y^*, K_x^*, K_y^*, X^*$ and Y^*. We also get the optimal level C^* of consumption

expenditure as

$$C^* = \bar{p}X^* + Y^* - \bar{r}\Delta K^* \tag{18}$$

from which the optimal per capita consumption c_x^* and c_y^* can be obtained by maximizing (12)

subject to (18). Denoting total consumption of X and Y by C_X^* and C_Y^* , after multiplication of

the per capita values by N, we get exports $(X^* - C_x^*)$ and imports $(C_Y^* - Y)$, assuming that the

small open economy has a comparative advantage in the high-tech good X.

It will now be necessary to consider the interpretation of the "broad" utility function W,

that has the ordinary utility function u for private consumer goods and public services L_G as

separate arguments. One possibility is that this function represents the "true" preferences of all the individuals, who are exactly alike, and that the government which has to choose L_G and L_A is the obedient agent of its principal, the citizens. In this case there is no doubt that the outcome is indeed the optimal one, and that the levels of L_G, L_A and hence all other variables are exactly what they should be to maximize the utility of each citizen. The choice between being an unskilled or a skilled worker, if all individuals are equally endowed with ability, becomes irrelevant since life-time opportunities would then be equal, the greater earnings of the skilled being only enough to compensate them for foregone earnings and the direct costs of education.

Suppose, however, that people have identical preferences for private consumer goods, i.e. everybody has the same u, but that they differ in λ, the parameter that defines the relative weight on public services relative to consumption of private goods in their over-all welfare. How then would the system determine whose preferences were to count?

A popular option in the literature on political economy is the "median voter" theorem, which states that the decision would be made, in a representative democracy under suitable simplifying assumptions, by the voter whose preferences "break the tie" between those to his "left" and to his "right."

More interesting, and also more realistic, is the possibility that there is, at least to some degree, an "autonomy of the state" due to information asymmetries, transaction costs and so on. Under these circumstances the ideology of the government would come into play in determining the outcome for the allocation of resources in the society. We consider two sharply differing approaches. One, which we may identify with the Scandinavian or British Labor Party type of "welfare state" would lay great stress on public services, i.e. would have a high value of λ in its W function (13). The other is what Chalmers Johnson (1982) calls a "capitalist developmental

state," of the East Asian variety, which seeks to enhance productivity of the private sector, and to promote "high-tech" production and exports. Rather than using the distortionary, and hence inefficient tools of tariffs or subsidies, however, it merely has a low value of λ, i.e. skimps on the welfare state type of public services.

As we can see from Figure 3, having the same resources and technology would make both governments have the same concave opportunity locus GG between L_G, and u, but the tangents to GG of the highest W function would imply a high L_G^* in the welfare state and a low L_G^* in the developmental state.

What are the consequences of "locational competition" of these two contrasting choices? In the Welfare State L_G^* is high so L_A^*, and hence S, will both be low. Total factor productivity in both sectors X and Y will not be high, because $A(L_A)$ will be low. Internationally mobile capital will enter the economy, but investment will be relatively low since infrastructure and skilled labor, the complementary factors, are relatively scarce. The wage differential θ, however, will also be relatively small, because of the low level of infrastructure, which narrows the spread between the marginal products of skilled and unskilled labor. Given p, and u, comparative advantage would tend to favor the "traditional" Y sector rather than the "high tech," since infrastructure and skilled labor are not so plentiful because of the preference for L_G.

For the "Capitalist Developmental State" on the other hand the skimping on L_G frees resources for allocation to L_A, L_Y, and S, thus raising efficiency and wages in both sectors, but relatively more in the high-tech sector X. This also serves to attract more internationally mobile capital into the economy. With the same technology and endowment this economy will have a greater comparative advantage in high-tech production than the egalitarian welfare state.

The implication of our analysis is thus that even in the absence of any selective interventionist policies government policy can have a significant effect on production, trade, and factor prices and hence on the endogenously determined level of human capital formation. Notice that there is no reason to consider the Capitalist Developmental State as being superior to the egalitarian Welfare State, even though it performs better on the criteria of labor force quality and total factor productivity in the private sector. The "price" for these achievements is the reduction in the availability of public amenities and thus the over-all quality of life may not be preferred by its own citizens, were they but able to express their "true" preferences accurately.

Up to now we have been assuming that government expenditure on the public intermediate input and final public services are financed by "lump-sum" taxes. It is time to briefly consider the implications of more realistic alternatives. First, suppose that the sole tax is a proportional tax on wage income, whether skilled or unskilled. Since the capital-intensities of production in both sectors are tied down by the requirement that the marginal product of capital be equal to the world rate of return, the gross earnings of labor in both sectors will remain the same, given the value of L_A, so the ratio θ of v to w will remain unchanged. Thus the same value of L_A will correspond to the same value of skilled labor S. The concave frontier GG in Figure 3 will remain unchanged and so therefore will the optimal values L_G^*, and u^*. In other words, a general proportional tax on labor will actually be fully "neutral" in its impact on the general equilibrium of the whole economy and thus will behave exactly like a "lump-sum" tax. The reason is intuitively clear. The total labor force is fixed and immobile, and the fact that the tax is proportional means that it does not discriminate between skilled and unskilled labor and therefore does not affect the rate of human capital formation.

A general tax on physical capital will, however, have severe deleterious effects on the

economy. Since the after-tax rate of return must be equal to the given world rate of interest the inflow of capital into each sector will be reduced to raise the before-tax rate of return by the amount of the tax. Holding L_A and L_G constant at their optimal levels L_A^* and L_G^* we know that the utility of consumption of private goods must fall because of the reduction in physical capital. Over-all utility must therefore fall, even after L_G^* is reduced and L_A^*, S^*, and L_Y^* are raised in the attempt to compensate for the reduction in physical capital when these variables are at their original levels. Note that the incidence of the tax on capital is fully borne by domestic labor, both skilled and unskilled, since this is in perfectly inelastic supply, but capital is in the opposite situation of being perfectly elastic at the world rate of interest.

Let us now turn to consider selective subsidies and taxes. A popular measure associated with the "Capitalist Developmental State," a good example of which is Singapore, is a subsidy to capital investment in the "high-tech" sector. It is clear from our model that this will drive down the marginal product of capital in X but raise the marginal product of skilled labor and hence the skilled wage. Since the unskilled wage remains determined by the marginal product of capital in the Y sector, still equal to the world rate of return, the return to human capital formation is increased because of the rise in θ, and thus the economy is induced to have a larger stock of skilled labor, inducing a further inflow of world capital into the domestic "high-tech" sector. Not only is more capital attracted simply because of the subsidy but L_A^* and S^* are raised as well, making this sector of the economy even more attractive. The selective subsidy is therefore a powerful tool for a "Capitalist Developmental State" that wants to enhance its high-tech production and exports. Over-all utility will of course fall as a result of this intervention, but the government might justify its actions on the grounds of dynamic externalities and "learning by

doing" associated with the "high-tech" sector.

Subsidies to education could be another favorite device for an interventionist government. By raising the stock of skilled labor they would serve to induce more capital to enter the economy as well, thus enhancing "high-tech" production and exports even further.

I could go on further and extend the model in a number of ways. Determining relative prices and the world rate of interest endogenously would be obvious candidates, as well as introducing population growth and technological change. I have thought it better, however, to concentrate first on the simplest possible model that allows us to discuss the impact of such relatively unfamiliar measures as infrastructure spending and education subsidies on the pattern of production and trade, since these are indicative of the novel issues that our conference attempts to tackle under the rubric of "locational competition."

To avoid misunderstanding I should make it clear that I have no wish to necessarily endorse any of the specific measures or the general approach that I have discussed in this paper. While a serious and responsible case for market-friendly government intervention can be made, at least in the East Asian context, as by Wade (1990) for example, the jury still appears to be out on the true efficacy and applicability of these measures, even in the region where they have been alleged to be the most successful.

Endnotes

1.   An important exception to this statement, of which I only became aware at the Kiel conference itself, is the work of the late Stefan Sinn (1993) of the Kiel Institute. The approach to the problem that he adopts is in the same spirit as the one that I develop in this paper. The models that we use, however, are substantially different. He uses a two-period, one-good Fisherian framework with a distinctly "macro" orientation while I adopt a trade-theoretic structure with more emphasis on relative product and factor prices and a more explicit modeling of government and its impact on the economy. A synthesis of the two approaches would be of great interest.

2.   This specification of the Ricardo-Viner model is adopted in the Ph.D. dissertation of my student Filippo Cartiglia (1992).

3.   We assume that the share of physical capital is the same in each sector to avoid unnecessary taxonomy on which of the two sectors is the more capital-intensive.

4.   The reason I have in mind is that a higher level of skilled labor, in the steady state, requires a higher inflow of students into the educational system, raising costs at the margin and so lowering the rate of return. For an explicit analysis see Findlay and Kierzkowski (1983).

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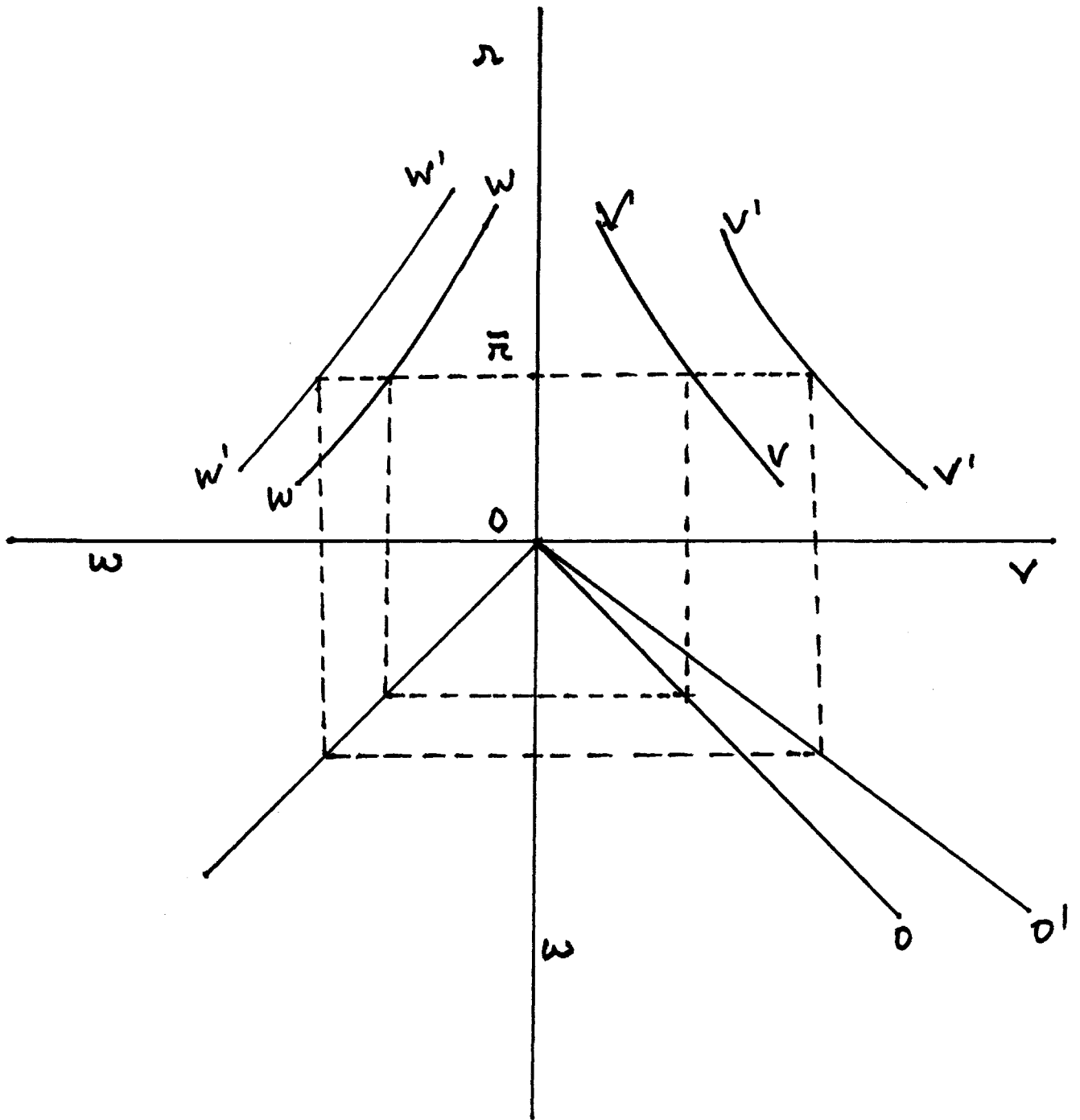
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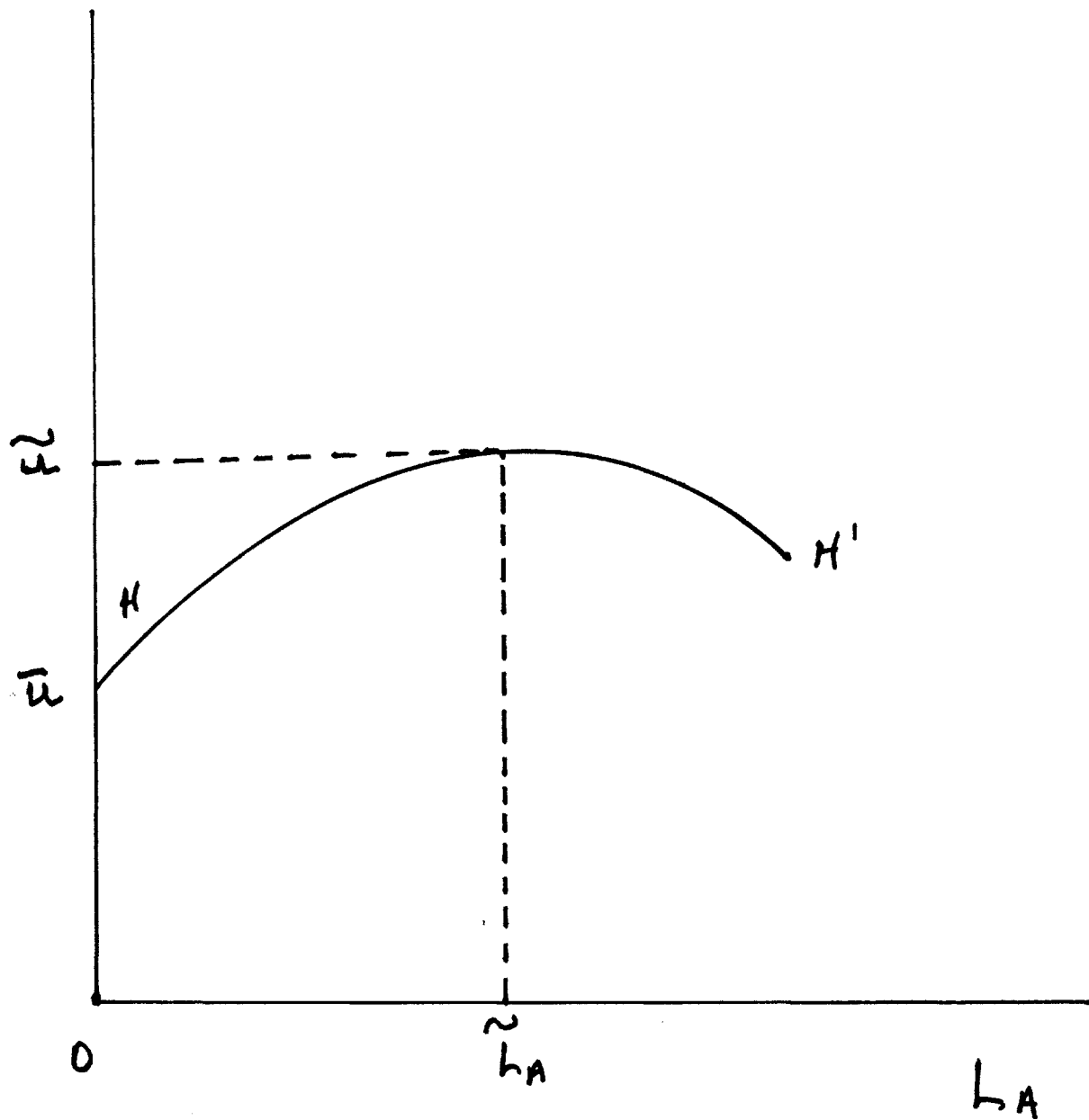
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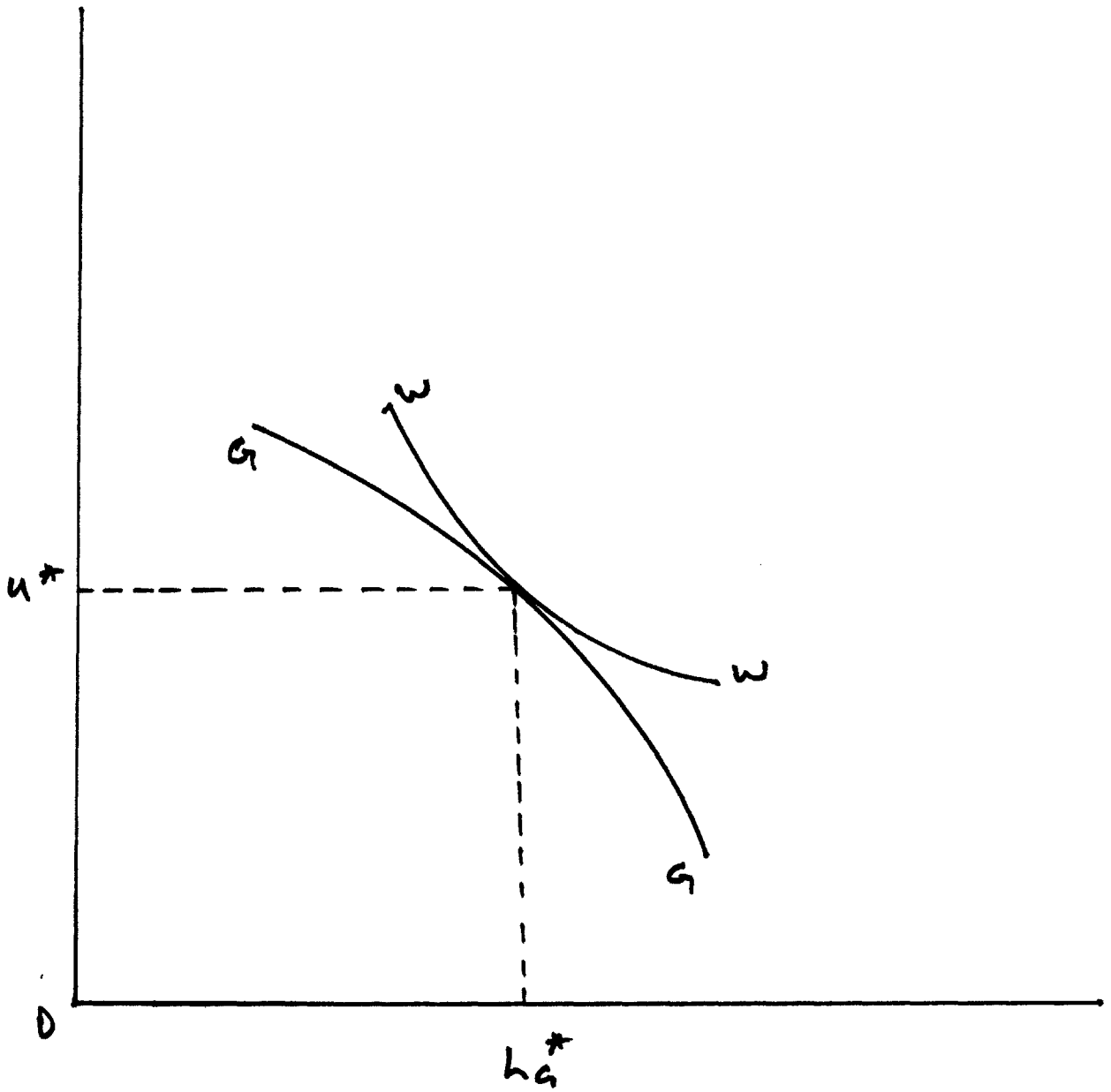
FIGURE 3

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