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OBSOLETE FACTORS IN THE INTERNATIONAL ECONOMY*

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For over half a century, economic theory has neglected to analyze the growing international disparities in labor, land and capital productivity. Its excuse has been Heckscher and Ohlin's factor endowment theory, which attributed international cost advantage only to differing relative proportions of labor, capital and land, not do differences in relative factor productivity as in Ricardian trade theory.

The factor endowment theory rested upon four unrealistic assumptions. First of all, labor, capital and soil productivity among nations were presumed identical, so that one country's labor, capital and soil resources were each as productive as those of any other country on a per unit basis. No country's capital investment could displace that of another country because of superior technological productivity, but only because of its greater relative abundance which directly resulted in its receiving lower profit rates relative to wage and rent levels. Furthermore, no cross competition existed among the various factors of production: increased capital investment in one country could not displace, say, another country's labor. Labor, capital and soil each provided a unique service of production which other factors could not provide, and each category of commodity production was characterized by some optimum labor/capital or labor/land ratio. There was no international factor mobility, no international investment or emigration, or even trade in intermediate goods such as food, fuels or machinery. Finally, all factors in each country were presumed fully employed, except for temporary dislocations which prevented the optimum use of resources. It was also presumed that international demand conditions were such that no single category of goods produced by some specific mix of labor and capital was in chronic oversupply. On the basis of these assumptions, international advantage was held to be relative, not absolute. Every country had some advantage in producing some class of commodities. Demand for these various classes of commodities was presumed roughly proportional to their supply, so that countries tended to maximize their earning power by specializing in the production of commodity classes in which they had a comparative advantage.

The vast amount of theorizing that has been built upon these assump-

tions in recent decades is not deserving of the attention that has been bestowed upon it. Least deserving of all is the income theory drawn from these assumptions, which Paul Samuelson has termed the factor-price equalization theorem. This theorem purports to demonstrate how international wage levels, rents and profits tend to equalize under free trade. It advises low-income countries to dismantle their tariff barriers, and to export goods in which they have a comparative advantage at any given moment of time. Countries with much labor relative to capital, particularly if they have high rates of unemployment, should concentrate in the production of labor-intensive commodities. Countries with extensive mineral or soil resources should concentrate in primary production, maximizing the opportunity for world gains from trade. This doctrine is the mainstay of today's international economics.

There is at present no school of thought which inquires why factor returns are diverging among nations rather than converging, or why some nations are being priced out of the international marketplace for agricultural and industrial products alike. Few have inquired into the nature of economic obsolescence in the backward countries that has created dualism between their domestic and export sectors. It is therefore the purpose of this paper to investigate these problems. It is shown how capital competes increasingly with labor across national boundaries, driving lower forms of labor from the world marketplace as it has driven this labor, along with horses and other noneconomic inputs, from the marketplace in the developed nations.

Obviously, international wage levels are not equalizing. Countries whose labor forces are characterized by low-paid, obsolete manual labor are becoming poorer and poorer, and are able to compete with foreign countries in fewer and fewer product lines. The low industrial wage levels which once seemed to promise industrial advantage no longer do so, at least for regions with generally low labor skills such as Latin America. Furthermore, nations with what were originally the world's most "naturally rich" soils, those which were the first to attract foreign settlers and developers, have now become increasingly obsolete in comparison with the fertilizer-intensive agriculture of the developed nations.

Explanation for these developments is to be found in the fact that the terms of trade are moving against countries which are non-industrial or agriculturally backward not so much because of their specific commodity specialization, but because they are characterized by relatively high costs of producing industrial energy and the elements of soil fertility. They are left priced out of every market except that for scarce raw

materials, which foreign capital comes in to develop. The following analysis postulates an Obsolescence Function in the international economy to explain the manner in which labor, capital and land compete with one another to produce the ultimate economic inputs of work effort (energy) and soil fertility. It then attributes the divergence in per capita national incomes which characterizes today's international economy to the divergence in productive powers and costs, which become absolute advantages for a few nations as a result of international investment and trade in capital and intermediate goods. The result is a tendency towards creating a world ghetto in the planet's economic backwaters.

1. *Assumptions Underlying the Factor-Price Equalization Theorem, and the Effect of Dropping Them*

The factor-price equalization theorem began by assuming equal labor productivity among countries, as well as equal capital and land productivity. If we drop this assumption, and recognize that factor productivity differs among countries, and particularly if we recognize that it tends to vary in proportion to relative wage levels, then it is clear that countries with relatively low supplies of (say) labor, even if it is highly paid labor, may still be highly competitive in the world economy. For if highly paid labor is even more highly productive, it may still undersell low-paid labor on a unit-cost basis. Similarly, one nation's capital may be more productive than that of another nation, as technology is by no means identical across national boundaries. We would expect factor returns to vary directly with productivity. There would not necessarily be any tendency for productivity to equalize among nations, and in fact every social and cultural reason to expect that it might diverge in response to the external economies of national development.

Matters are further complicated for today's economists when we drop the assumption that there is no cross-competition between labor and capital in international trade (or within the domestic economy, for that matter). It is asserted that there is some optimum, stable ratio for employing labor, capital and land to produce given classes of commodities. Each factor is held to supply a unique productive service of its own. Labor-services, land-services and capital-services compete with other labor-services, land-services and capital-services respectively, but not with one another. Some textbooks, to be sure, recognize the unrealism of this assumption. Charles P. Kindleberger acknowledges that "there may be some ambiguity about the technological factor proportions involved in producing a given commodity. . . . in the production of many

commodities, there is a range within which one factor can be substituted for another. Eggs can be produced by chickens roaming the range, using land, or cooped up in batteries of nests, in which capital substitutes for land and labor. It is impossible to say that one of these commodities is more capital intensive or labor intensive than another until we know more about the possibilities of factor substitution and the factor availabilities."¹ But this observation having been made, Mr. Kindleberger and other mainstream trade theorists drop it from their analysis as if it did not exist. This is unfortunate, because pursuit of its consequences would transform their doctrine in the direction of much greater realism. The major productive service which labor and capital produce in common, for instance, is work effort, a more basic unit of factor input than man-hours or raw machine-hours. It is apparent that industrial capital can produce energy much less expensively than manual labor, as the human body is a relatively inefficient energy converter at today's food and fuel costs. We would therefore expect international energy costs to be more critical in determining international industrial advantage than per diem wage rates or machine-hour costs.

Having thus cleared the air of these two unrealistic assumptions, we may turn to that of zero international factor mobility, which Viner and others take as the very definition of international economics. In Mr. Samuelson's theory and that of his contemporaries, this mobility serves to equalize incomes. But this only if we assume equal productivity among all factors moving across national boundaries. Suppose labor- and capital-productivity to be unequal among nations. Its international mobility would then convey some nations' absolute advantage across national boundaries, by virtue of its common denominator. For costs of key inputs would no longer be relative, they would be absolute. For instance, if all food were produced in one region, then human subsistence costs (net of transport differentials) would equate for all nations. If all fuel were produced in one region, and assuming there to be only one form of fuel used to produce each commodity category (e.g., coal, oil or uranium), operating costs for most energy-intensive types of products would equate. If prices of capital goods are equal among nations through the process of international trade, then relative production advantages enjoyed by some countries, as a result of their superior labor or capital productivity, would become absolute cost advantages. A single great nation, such as the United States, might possess absolute advantage in both industrial and agricultural product lines, and produce a large enough surplus over and above its own domestic needs to drive from the market the labor and

capital and land of many less developed countries. Capital in the world economy would tend to be employed in conjunction with the most productive, lowest unit-cost labor and fuel, irrespective of the resources of the low-paid but high unit-cost manual labor possessed by various backwaters of the world economy. This would help explain chronic unemployment or underemployment in specific areas of the world economy such as Latin America.

2. *The Three Modes of Abstraction in Terms-of-Trade Analysis, and Their Policy Implications*

During Britain's Corn Law debates in the early nineteenth century, Ricardo and Mill popularized the terms of trade between industrial and agricultural exporters, urging England to become the workshop of the world. Ricardo attributed comparative advantage among nations to different factor productivities in agricultural pursuits as opposed to those in industry, as indicated by his mathematical example of the comparative labor costs of England and Portugal producing cloth and wine. A century later, Heckscher and Ohlin shifted the emphasis of international trade theory away from productivity differentials to income differentials. They implied that countries possessed comparative advantage not so much in terms of specific commodity categories as in the relative costs of their labor, capital and land. Earlier, in the late eighteenth century, Alexander Hamilton and his followers had abstracted the nature of international competition in manufactured commodities into the single common factor input of industrial energy exerted and harnessed in production. Later, in the mid-nineteenth century, following the discoveries in agricultural chemistry made by Liebig, Thaer and Lawes, the single major factor input in agricultural and mineral production was seen to be soil fertility and "extractibility." Unlike the Heckscher-Ohlin theory, which viewed labor, land and capital as mutually non-competitive, these more technological approaches to trade theory, popularized mainly in the United States, acknowledged that work effort and primary-product extractibility might be provided by labor, capital or natural resources alike, in accordance with relative cost schedules which shifted over time and which were responsive to government policy.

In recent years Raul Prebisch has revived the commodity-oriented view of international trade popularized by Ricardo and Mill. He has captured the eye of many raw-materials exporters by postulating a secular tendency for the terms of trade to move in favor of industrial exporters, against the exporters of primary products. Given his postulated tendency

(the statistical defense of which has been disputed) the solution to poverty in the low-income countries is for them to shift their production patterns away from primary production into industrial pursuits. Their problem is mainly one of producing the wrong commodities, those whose price is falling relative to the price of other internationally traded goods. Given a program to increase industrial productivity, which probably requires protective tariffs, these countries may overcome the acquired industrial advantage possessed by the more developed nations, and thereby become net beneficiaries of the shifting world terms of trade.

The Heckscher-Ohlin factor endowment theory attributes comparative advantage in given commodity lines not to relatively high factor productivity in these areas, which would seem to be the obvious explanation, but merely to international "advantage" in relative factor proportions, or more specifically, to the relative factor costs which follow *pari passu* from these proportions. Wages, rents and profits are assumed to be a direct and inverse function of relative factor supplies, and only of relative factor supplies. Thus, if some countries have a comparative advantage in producing agricultural commodities, it is not because their soil is richer than that of other countries, but simply because there is more of it relative to population and capital resources, so that their soil is low-priced relative to labor and capital. Other countries have been lucky enough to have been "endowed" with much more capital relative to labor and land: England found itself endowed with textile mills in the last century, and the United States with aircraft factories and mechanized farms in the 1960's. These countries' great relative supply of capital resources is responsible for the low cost of their capital in comparison with that of other factor inputs. For poorer countries, the indicated policy is to accumulate more capital if they want to shift their terms of trade to more remunerative lines, as capital seems to be the scarcest factor in the world economy. Implicitly, all capital is homogeneous with all labor, so that no labor-displacing tendency occurs as capital is imported by the less developed countries.

We may pause to observe that this theory has little to say about how some countries' superior capital endowments originally came into being. (My own view is that today's developed nations were endowed above all with protective tariffs.) According to it, the less developed countries have been endowed only with labor, and although they possess a comparative advantage in the production of labor-intensive commodities, the fact that so many countries are similarly endowed tends to turn the international terms of trade against them. Still, they have a consolation prize: by

definition—or more accurately, by tautology—every country has a comparative advantage in something. If it lacks capital, then it is labor-rich. Someday, if Mr. Samuelson proves correct, its wage levels and living standards may approximate those of the United States and other developed nations, thanks to natural forces at work within the international economy.

This theory says little about the terms of trade as between primary products and industrial manufactures. Some primary products are capital-intensive, particularly mineral products. Others are labor-intensive, particularly crops produced by plantation economies. The production of food crops such as grains, and even chickens, has become increasingly capital-intensive over the decades. All that the Heckscher-Ohlin theory states is that if nations wish to improve their terms of trade, they should increase their rate of capital accumulation, because capital is generally scarce in the international economy and its factor return is correspondingly high. There is of course no contradiction between this policy conclusion and that of Mr. Prebisch.

More than a century ago it was recognized that countries rich in manual labor resources and land area might still find themselves priced out of world markets both in industrial and agricultural commodity lines, as sophisticated capital and labor supplanted unskilled labor and unimproved land. International trade in industrial products was attributed to absolute advantage in the use of energy in production, with the factor contribution of labor and capital reduced to the common denominator of work effort. Similarly, trade in agricultural products found land-extensive, soil-depleting modes of agriculture competing with capital- and soil-intensive modes, with labor, land and capital being alternative technological means of producing soil fertility. This postulated competition as to the ultimate industrial factor-input, energy, and as to soil productivity in agricultural trade, attained a much higher degree of abstraction than has been matched in later international trade literature. On the basis of its policy implications, American protectionists developed national policies which helped provide the United States with world advantage in agricultural and industrial production. The nation's agriculture has substituted artificial fertilizers for virgin soil fertility with increasing success, following its earlier success in substituting steam-driven and electrically powered machinery for manual work effort. Given its surplus-producing capacity, the possibility now exists that other countries may find their unskilled labor and unimproved lands absolutely priced out of world markets. It is therefore important that

we explore the theory of cross-competition between various classes of factors in international trade.

3. *The Factor-Price Equalization (or "Pauper Labor") Argument for Protectionism in the United States*

Mr. Samuelson has stated that, "Paradoxically, valid arguments for protection seem mostly to have come from free traders, not from protectionists."² It would be nearer the truth to state that the leading, even if invalid arguments for free trade have come mainly from protectionists. This is particularly true of the factor-price equalization theorem. In 1848 the American protectionist Calvin Colton, official biographer and economic spokesman for Henry Clay, put forth a clear version of this theory, in order to argue why the workings of free trade later described by Mr. Samuelson would impair the high wages of American laborers, whose last wish was for their wage levels to equalize with those of Europe.

It is manifest, that when the products of American . . . labor are brought into the free and open market with the products of European and other foreign labor of the same kind, the labor itself is in the same market; and that the tendency is to reduce the price of American labor to that of foreign labor. We say the tendency . . . We have before indicated the reason why American labor, in such a case, will not come entirely down to the old level of European labor. The water of one cistern which is higher than that of another, will raise the other, by being let off into it, before both come to a common level. If the capacity of the two cisterns were equal, the common level would be found midway of the difference. But the American cistern is a very small one compared with all the rest of the world, and being let off, would fall immensely, while the other would scarcely seem to rise.³

This theory remained in the repertory of naive protectionist politicians for more than eighty years, and was still being voiced in the Republican National Platform as late as the 1932 elections. "The avowed object of protective tariffs," wrote Francis Amassa Walker in 1876, during the heyday of American protectionism, "has been to keep wages from sinking to the level of Europe and Asia. The allusions to 'pauper labor' which crowd the speeches of Clay, Stewart and Kelley have significance only as it is assumed that a day's labor in one place is the economical equivalent of a day's labor anywhere, and that one man's labor is effective in the same degree as that of any other man."⁴ After citing the example of an English wood-sawyer capable of perform-

ing as much work in a given period of time as thirty-two East Indians, Walker concluded that "In the contests of industry the civilized, organized, disciplined, and highly-equipped nations may safely entertain much the same contempt for barbarous antagonists as in the contests of war." The accumulation of human and material capital, not cheap labor, was responsible for the competitive cost-advantage enjoyed by sophisticated industrial powers.

We thus find, in the nineteenth century, American protectionists voicing the pauper-labor theory of wage equalization among nations in an attempt to scare U.S. workingmen into enacting protective tariffs. American free traders replied that the American workingman had nothing to fear from low-wage competition abroad, as pauper labor was ultimately more expensive on a unit-cost basis. Jacob Schoenhof, a free-trade Democrat, was employed by the State Department in Grover Cleveland's two Democratic administrations to travel around the world comparing wage rates and labor productivity, so as to confirm the thesis that variations in wage levels were more than offset by productivity differentials. His findings indicated that America's relatively highly-paid labor provided the nation with an international advantage in industrial production, obviating the need for protective tariffs to support wage rates. "It is not by reducing wages that America is making her conquests," wrote Schoenhof, "but by her superior organization, greater efficiency of labor consequent upon the higher standard of living ruling in the country. High-priced labor means better food and better living, and these supply the American workman with the energy and nerve-power for which he is so justly celebrated. High-priced labor countries are everywhere beating 'pauper-labor' countries."⁵ American industrial strategy should therefore make use of the country's high wage and productivity levels, and to foster, if possible, a kind of feedback mechanism of steadily increasing competitive advantage: the higher the wages for the U.S. laborer, the greater would be his productivity advantage over foreign workers, and the further U.S. unit production costs would decline relative to Europe's increasingly obsolete pauper labor. "The survival of the fittest," Schoenhof concluded, "is, therefore . . . the result of a high wage rate; and a high standard of living in industrial countries, becomes a prerequisite to a low cost of production."⁶

4. *The Energy Theory of Absolute Advantage among Nations*

More sophisticated American protectionists had anticipated the high-wage argument for increasing productivity. In fact, it was E.

Peshine Smith and Henry Carey that originally inspired the free-trade critics of the "pauper labor" argument for protective tariffs. Peshine Smith in particular had pressed this line of reasoning considerably further than was to be found in later literature, by emphasizing the role of superior educational attainments in securing international cost advantage. Not only did highly paid labor outperform pauper labor in most physical tasks, he observed, but insofar as higher money wages enabled the American workingman to procure superior education for himself and his children, he accumulated the industrial skills needed to utilize energy-intensive machinery. And in the final analysis, cheap foreign labor was undersold more by highly productive American machinery than by highly productive American labor qua physical labor.

"The employment of machinery," wrote Alexander Hamilton already in 1790, "forms an item of great importance in the general mass of national industry. It is an artificial force brought in aid of the natural force of man, and, to all the purposes of labor, is an increase of hands, an accession of strength, unencumbered, too, by the expense of maintaining the laborer."⁷ The impact of this concept on U.S. national strategy and its economic doctrine cannot be overestimated, although it has been neglected by virtually all twentieth century historians of economic thought. "To illustrate this last idea," added Hamilton, "let it be supposed that the difference in price in two countries of a given quantity of manual labor requisite to the fabrication of a given article is as ten, and that some MECHANIC power is introduced into both countries which, performing half the necessary labor, leaves only half to be done by hand, it is evident that the difference in the cost of fabrication of the article in question in the two countries, as far as it is connected with the price of labor, will be reduced from ten to five in consequence of the introduction of that POWER."⁸ So far as Europe's machinery depended on water for its source of power, he argued, the United States could certainly match its natural advantages by virtue of "the uncommon variety and greater cheapness of situations adapted to mill-seats with which different parts of the United States abound." Thus, America's natural resources (its water power and abundant woods) competed to some extent with Europe's capital resources (its machinery).

Water-power considerations aside, England continued to widen her industrial advantage over the United States as a result of the superior productive power of her material capital, substituting steam-driven engines for manual labor. "Mr Clay had occasion to notice, as long ago as 1824," wrote Calvin Colton, "that some British authorities

estimated the machine power of Great Britain as equal to two hundred millions of men. The number of operatives to apply this machinery has never amounted to one million. Here, then, is a nation, with a population of some twenty-five millions, with a producing power of two hundred millions. Its capabilities of producing wealth by artificial means, is so great, that its natural power is scarcely worthy of being brought into the account. . . . One man at home did the work of two hundred, less or more. . . . Science, which makes one man as powerful as two hundred, or a thousand, left to their natural powers, will and must prevail against numbers. That nation which cultivates the useful, mechanic, and manufacturing arts, all of which have their foundation in science, and which excels in them, other things being equal, will excel in strength, and maintain a superiority."⁹ Quite simply, the steam-engine could produce a manhour of work effort at a lower cost than could a man himself, as the cost of fueling and operating a machine was considerably less than feeding and sustaining the human body. This metaphor between man and machine was to permeate U.S. economic doctrine throughout the nineteenth century.¹⁰

In 1853 Peshine Smith cited Henry Mayhew's computation that the total machine power of Britain had risen to the equivalent labor-power of 600 million human beings.¹¹ This was cheap power, and the key to England's world economic supremacy. America's industrialization program was therefore promoted by protectionists on the ground that industrial technology could undersell, by a widening margin, the increasingly obsolete employment of the human body as a supplier of work effort in production—not to mention the work effort supplied by horses, oxen and other beasts of burden. Nations that did not supplant their raw labor with machine power faced a widening cost-gap between themselves and the leading industrial and agricultural powers. No matter how lowly their labor might be paid, no matter to what squalor it might be reduced, the price of sustaining it still exceeded the machine costs of supplying a comparable man-hour or kilowatt-hour of work effort. Manual labor throughout the world inevitably lost out in competition with the power-driven forces of mass production. The result was increasing economic obsolescence and poverty in the countries slow to make the changeover to modern production techniques.

A modern conceptual approach to analyzing the cost technology of producing power by alternative methods may be found in a book by Mr. Zachariah Allen on the *Philosophy of the Mechanics of Nature, and the Sources and Modes of Action of Natural Motive Power*, published in

1852. In addition to computing the alternative operating costs of producing industrial energy by horsepower, manpower and steam power (both with coal and wood as fuels), Mr. Allen introduced the land-area constraints necessary to produce these various foods and fuels. The hay and corn needed to produce a day's horsepower of mechanical energy by means of horses cost 63 cents, and required $5\frac{3}{4}$ acres for their production. The wood fuel necessary to produce an equivalent of steam power was less expensive, but required 23 acres for its production. The needed coal to produce one horsepower of machine energy cost only 24 cents per pound, less than half the price of producing animal effort (no area constraint). The internal combustion engine was later to make even further cost savings. It was apparent that horses were doomed.

The ability of machines to supplant human labor as well as work animals in the drudgery of production, freeing it for higher tasks and in fact compelling it to be thus free under pain of economic obsolescence, was emphasized in almost every nineteenth-century treatise on steam engines. In this the mechanics and other writers of the period were in advance of most twentieth century economists, although Melman and Salter have analyzed in some detail the economies of substituting mechanical energy for labor power. Melman works out the economies of trading machine-hour cost for labor-cost, specifically in the area of materials handling,¹² and observes that "the fourfold increase in productivity of industrial workers in the United States over the last half century has been matched by a fourfold increase in the horsepower of the motor-driven machines which they use."¹³ Salter analyzes the best-production technique, and specifies the point at which a changeover will occur from one mode of production to another.¹⁴

5. *The Obsolescence Function in the International Economy: I. Industry*

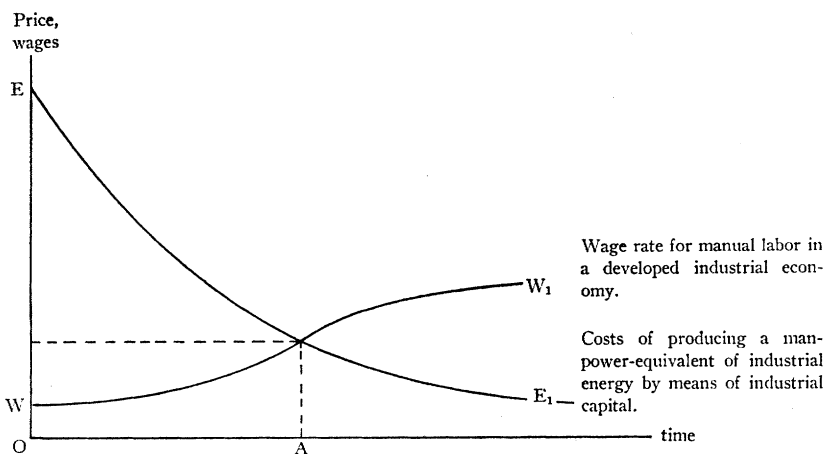
We have now seen how the factor-price equalization theorem was voiced and controverted over a century ago, and was then rediscovered and restated in what economists like to call "elegant" mathematical language and accepted on its own terms, as a geometric logical problem to be judged only on the basis of its own limiting assumptions. The thought of national trade policies being based on such an example of specious exercise is appalling. The theory's shortcoming may be indicated by posing the question of why the U.S. horse population has dwindled steadily following introduction of the internal combustion engine around the turn of the century. Economic theory seems able to

explain this, but not the obsolescence of more human forms of labor services. The world horse population has died out because, as a producer of energy, particularly transport energy, it was higher-cost than alternative sources. Horses were no longer worth the cost of their food and shelter, and became a burdensome overhead rather than a net resource.

Why, we may ask comparative advantage theorists, did horses not simply shift over to some other task? Was there no alternative work for them to perform? The answer is clear: there were no alternative tasks for horses, and countries which had hitherto grown hay to feed their horse populations found it more efficient to export this hay or related grains and to import engines and motors. This explains why world horse-incomes have not equalized with those of manual laborers, as one might perhaps expect from the factor-price equalization theorem. Countries with comparatively large horse populations have not retained any *comparative* advantage in horse-intensive commodity lines, although the theory tells us that even if their cost structures are higher across the board, they must still be *relatively* low-cost producers of some class of commodities. It is up to today's "pure" trade theorists to tell us why this has not occurred.

In the race between machine and man as economic energy suppliers and servomechanisms, the machine will drive the raw laborer from the contest at that point where its costs of supplying industrial energy fall below the average wage which must be paid for unskilled labor to perform an equivalent amount of work effort. The minimum price of this unskilled labor is set by the price of human subsistence. At a lower factor return for the provision of work effort the manual laborer must be phased out of production, to remain unemployed until such time as he may acquire the working skills necessary to elevate himself to a tool user rather than a mere energy supplier. In fact, not only does the substitution of capital for manual labor as a source of energy free labor for higher, more skilled tasks, it positively drives him to elevate his status in production, by displacing him from the more menial tasks.

Figure 1 represents the Obsolescence Function as applied to manual labor. Line WW_1 represents the wage rate for manual labor as it evolves in a developed industrial economy: it tends to rise because of the general scarcity of all labor during the early stages of industrialization, and then levels off as manual labor becomes increasingly obsolete. Line EE_1 represents the declining costs over time of producing a manpower-equivalent of industrial energy by means of capital equip-



ment. In the last century the costs of producing a manpower-equivalent of energy by means of steam and electricity fell below the cost of using the human body as an energy-converter, that is, converting his 'fuel'—his food, clothing and related necessities—into a given flow of caloric work effort. Manual labor in the factories, and later on the farm, was supplanted by steam engines, electrical generators and their related servomechanisms, and the internal combustion engine.

The economic implications of the developments are far-reaching. In Ricardo's day, when England's industrial revolution was still gaining momentum, all that was demanded of the rural migrant newly arrived in the city was the ability to exert manual effort. Children worked as servomechanisms at their looms. Today, the willingness and ability to perform similar tasks no longer qualifies the rural migrant for employment. The exodus of farmboys, which contributed so strongly to Britain's industrial power two centuries ago, represents only a burden for the less developed countries of today. Eighteenth-century labor cannot find employment and happiness in this twentieth-century world.

The theory of obsolescence as it applies to the international economy is thus much more problematic than has been recognized by neo-classical economics. According to the assumptions of this latter theory, what little advantage as may be enjoyed by the backward countries derives from their low wage levels, and only on the naive (or, as economists like to say, "heroic") assumption that labor productivity is roughly similar among all nations. However, as we have now seen, low-paid laborers cannot afford to acquire the training or education necessary to raise

their status in production at the rate required by twentieth-century technology. They therefore find themselves unemployed: rather than being productive inputs they become welfare charges on their society, banding together with their unfortunate compatriots in the urban shantytowns now gobbling up Latin America.

The converse of the Obsolescence Function is what we may term the Complementarity Function between human and material capital. In order to be employable, the human laborer overtime requires a rising complement of training and education. He finds his employability proportional to his ability to draw upon his training and acquired working skills to perform tasks which machinery could not perform at a lower cost. Already in 1853 Peshine Smith observed that, "as we rise to labour in connection with more complicated machinery, the value of general intelligence becomes distinctly apparent."¹⁵ In fact, as Schoenhof observed, "In almost every employment of an industrial nature a very great amount of training is requisite to make it effective or to make it serviceable at all. Only in times of a very great demand and scarcity of labor would any one employ crude labor in factories where skill is required."¹⁶ This minimum necessary educational level was rising over time, as labor required an increasingly intensive training and education as a precondition for employment. Thus, accumulation of material capital in the United States has been conditional upon the concurrent accumulation of human capital. Failure to acquire this human capital results in human obsolescence. This helps explain why the average education of American labor has increased steadily over the decades. It has not been a luxurious consumption good, but a precondition for capitalizing the American economy.

6. *The Obsolescence Function in the International Economy: II. Agriculture*

Not only has manual labor in the backward countries been increasingly undersold by the powers of mechanized and computerized capital in the advanced nations, but the productive powers of their soil resources have also been increasingly undersold by the far less costly powers of U.S. farm capital, that is, by the fertilizers, agricultural machinery and related farm improvements which have characterized agriculture in the more developed nations. Today, "natural" or "virgin" soil fertility has become as obsolete an economic input as raw unskilled labor. What was competitive in past centuries is no longer competitive.

The treatment of soil as an economic input has always distressed

economists. Particularly since Ricardo they have used arable land area as a proxy for *soil*, failing to recognize the extent to which soil is a bio-chemical entity whose fertility is a function of its mineral and related inputs. Land area, in the quantitative sense of acres subject to given climatic conditions, has been taken as representing the supply function of agricultural resources, particularly by proponents of the factor-proportions school. The effect of artificial fertility-inputs on the international agricultural supply function has been unduly neglected.

Ricardo was the major culprit in popularizing the erroneous concept that soil possessed 'original and indestructible powers.' Whatever fertility differentials existed in its virgin state, he believed, would remain fixed for all eternity. Any changes in yield-per-acre ratios following from capital improvements were presumed to take place proportionately on all soils within given nations—and by implication, among nations.

At least he did not treat soil as a homogeneous and uniform entity among regions, as was the treatment accorded labor. Quite the opposite. In agriculture alone, and specifically with regard to soil inputs, was the role of differential productivity recognized by Ricardo and other classical British political economists. According to their theory of comparative advantage, each nation's agriculture was characterized by some yield-per-acre ratio, subject to deterioration in this ratio at the extensive margin. The more recently settled, sparsely populated nations were presumed to have the most fertile soils, as there was less pressure on their soil resources at the extensive margin. Thus, there appeared to be some natural equitability in international trade as between crop-producers and industrial nations. The older and more densely populated nations would exchange their manufactures—the low cost of which presumably followed from their low wage levels—for the food and other primary products of the younger, less populated countries. Some countries were therefore 'naturally' suited for industry, others for raw-materials production.

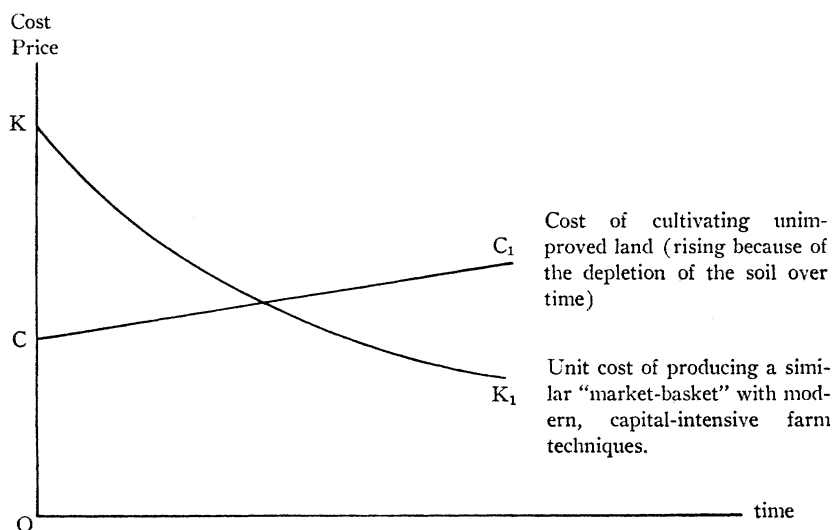
This concept of soil and natural resources was as unrealistic and static as was the classical concept of labor. By the 1840's, a more modern concept of soil as a chemical entity was being developed by Liebig, Thaer and Lawes. According to their theories, there was no such thing as original and permanent fertility. Soil could be depleted, as was clearly taking place in sparsely cultivated countries such as the United States, where the 'farm and run' practice was the rule. Transient families would 'mine the soil' in one district and then move on to another.

Conversely, soil could be augmented by the application of nutrients. Whatever original fertility differentials as existed among nations could thus be overcome by sophisticated farm-management practices.¹⁷

This explained why soil productivity in Europe, as measured by output-per-acre, was superior to that in the United States, and why this condition persists today. In Europe, labor is substituted for land, so that Europe possesses an edge in per-acre productivity, the United States an edge in agricultural labor-productivity. This also explains why Europe and other industrial nations have not become the growing market for the products of the less developed, raw-materials exporters as was so widely anticipated in the last century. Today, each year's new basket of food contains fewer inputs of rural farm labor and simple "land area" and more of capital. Because this agricultural capital may be substituted for land and rural farm labor at ever-diminishing costs, as was revealed so sharply by the response of American farmers to the Soil Bank program, the unimproved land and untrained rural labor of the backward countries no longer constitute the resource that they seemed to represent in the nineteenth century. Instead, they are a form of obsolete social-economic overhead, to be supported by economic charity, not economic markets.

Figure 2 illustrates how the costs of artificial chemical sources of fertility have declined in comparison with the costs of cultivating virgin lands. Line CC_1 represents the cost of cultivating unimproved land, which is rising over time both because of land prices generally (in relation to other prices), and because of the gradual depletion of the soil resulting from land-extensive modes of cultivation. Line KK_1 represents the unit cost of producing a similar market-basket of crops with modern, capital-intensive farm techniques. Capital supplants soil just as it has supplanted manual effort. The soil itself becomes transformed into a capital instrument, just as are its trained businessman-operatives.

This explains why it is precisely those countries which originally seemed to possess the greatest natural advantages that have today sunk into the most backward and obsolescent state. Originally fertile soils now become high-cost soils, and "naturally" rich mines tend to become high-cost mines. This is no anomaly but is the rule of economic evolution. The copper industry provides an illuminating example. As the quality of available copper ores has declined throughout the world, technological innovations have been developed to substitute capital techniques for the original richness of ore-bodies. As events have worked out, the lower the copper content—generally, of the more recently opened mines



—the lower are the unit costs of production. Thus, highly mechanized ore-bodies in the United States, whose copper content averages only 0.4 to 0.6 per cent, may be mined less expensively than the more labor-intensive copper operations of the Congo and Zambia, where 4 to 5 per cent copper is the rule. A similar development has occurred in the iron-ore industry, where pelletizing processes have been developed to exploit the lower-grade ore-bodies, with the result that the cost of iron has declined rather than risen.

These mineral examples thus parallel the evolution of food production costs over time. Contrary to the Ricardian theory of rent as applied to mining and agriculture, the lands and mines exploited in the earliest years do not find themselves recipients of any scarcity-rent, but instead suffer a negative quasi-rent (as Marshall termed it) of obsolescence. In this manner the nations least endowed with natural resources have conquered the most highly ("naturally") endowed nations.

We may now generalize our theory of limits as applied to the obsolescence function of labor and soil, as well as that of capital. Economic obsolescence in the less developed countries is a direct function of technological progress transpiring elsewhere. The more rapidly technological progress occurs in industry, agriculture and commerce, the faster will be the rate of obsolescence of all pre-existing capital, labor and soil. At some point the current operating costs of given "endowments" of man-

ual labor, plots of soil, and obsolete capital exceed their contributions to marginal sales revenue. Their charges for maintenance, repair, and fuel in the case of obsolete capital, the minimum cost of subsistence in the case of manual labor, and the cost of maintenance and seed in the case of soil, can no longer be recaptured by the price of their products. Thus, by applying the theory of limits we may specify that point at which merely low-productivity capital, labor and soil become critically obsolete and unemployable altogether.

7. *The Limited Concept of Technology Held by Most Economists*

Technology for most economists represents simply the labor/capital and labor/output ratios used in producing given classes of commodities. I have selected the following statement only on the basis of its relatively recent publication as part of a National Bureau of Economic Research conference on *The Technology Factor in International Trade*. Output changes, remarks a Mr. Ronald Jones, "could be represented by movements along a transformation curve. Technological progress is seen to complicate matters further in two ways. First, the reduction in factor requirements is seen to act like an increase in the quantity of factors available . . . Thus if factor prices were constant and only labor coefficients were reduced, the transformation schedule would be shifted outward and the output of the labor-intensive commodity would be increased while the output of the land-intensive commodity would be reduced."¹⁸ But what is it that increases, so as to displace labor in the above example? If it is energy, what are the dynamics of its introduction? What happens to pre-existing plants using old techniques, which are too concrete to shift over to any alternative use? If the increase derives from superior industrial organization, what are the relevant costs and benefits associated with this overhead expenditure?

Mr. Raymond Vernon, editor of the above volume, views technology simply as a thing-in-itself, something akin to phlogiston. In Jones' words, his concept of the "product cycle . . . argues that advanced countries tend to have comparative advantage in producing those commodities that are newly being developed. . . . In simplified terms, this suggests a three factor model: capital, 'ordinary' labor, and a third factor that comprises a host of special skills on the part of labor or of capital equipment. . . . Advanced countries, such as the United States, have a relative abundance of this third factor and hence a comparative advantage in producing new commodities at early stages of production. Later stages are associated with a shift in factor intensities toward a relatively greater role played

by capital and labor.”¹⁹ Again, this theory suffers from an inadequate definition of technology, and also of capital. Technology is conceived as mere novelty, not as the ability to substitute some new form of economic input for a pre-existing form, such as machine power for labor power and horse power, or artificial nitrates for virgin soil fertility. If labor, land or capital are displaced or economized in production, it must be obvious that this is costless at all, but reflects the substitution of some unspecified input, whose economies must be specified in order to understand the processes at work. Otherwise one cannot explain why countries have comparative advantages in research-intensive product lines, which may be subsidized by government military activities by private non-profit foundations, or other factors which today’s economic thought considers non-economic in nature.

8. *Application of the Obsolescence Function to Dual Economies: The Ghetto Function at Home and Abroad*

Increasing capital productivity in the agricultural and industrial sectors of the developed nations, in the face of stagnant productivity in the less developed countries’ domestic sectors, is the major explanation of increasing economic imbalance between rich and poor countries. Technological obsolescence of labor and land in the latter countries has been reinforced by the various forms of social and political obsolescence historically associated with backward economies. The effect of this widening imbalance is to transform the least developed countries into world mendicants. Similar forces are at work within the United States itself, as its sophisticated mainstream labor and capital compete with obsolete economic inputs.

Consider the slums that have mushroomed in the United States since the Korean War, as backward rural and black labor have been displaced from its southern agricultural regions into northern and western large cities. The relative backwardness of this minority-group labor in the United States reflects the steady economic elevation and technological progress that has characterized the non-black, mainstream labor force. Obsolete labor, finding itself culturally alien to the sophisticated urban economy into which it finds itself displaced, is not oriented towards acquiring the working skills and attitudes requisite for modern employment. Some portion of this minority labor force visibly falls too far behind its contemporaries to catch up under its own power, given existing social institutions. By this we mean that its existing incomes are insufficient to enable it to finance the educational and related social expenditures

needed to bring it up to a par with mainstream labor. Only an external transfusion of social resources can accomplish this end.

To be sure, there was prevalent misery and poverty in England's weaving towns during the first half-century of its industrial revolution. In fact, it was England's most highly skilled labor that was the first to be displaced by machines, as power looms supplanted the male hand weavers, whose jobs could then be taken over by less highly skilled women. With the introduction of even simpler machinery, women were supplanted by children. Many observers believed that the quality of life and labor would become increasingly degraded rather than elevated by the spread of machine production.

Ultimately, however, England's industrial economy entered a more advanced phase of mechanization. Its capital became increasingly skill-intensive, and called once again for trained blue-collar operatives, as well as a new white-collar complement. Contrary to the forecasts of underconsumptionists, no vast displacement of labor ensued. Instead, there developed a normal state of chronic full employment for skilled labor (the Great Depression being essentially a monetary anomaly resulting from unique postwar conditions). The Luddites and their machine-wrecker contemporaries were therefore wrong concerning the domestic economy. Technological progress elevated the social and economic status of the working class as a whole, rather than condemning it to an existence of squalid unemployment.

But this has been the case only in the advanced nations, where technological change has occurred slowly enough so that no great gap has developed between obsolescence and modernity. The ghetto function in the backward countries today, by way of contrast, is indeed a by-product of their overall obsolescence. The problem is that they are obsolescent on a nation-wide scale. Their rural exodus, displaced from its traditional living areas to flood the old industrial and commercial capital cities, becomes a social overhead. This places an exponentially increasing per capita burden upon the productive sectors of their societies. The burgeoning surplus of consumers who are not producers must somehow be supported out of domestic output—that is, they must receive some portion of society's income to finance their subsistence—or else subsist by foreign aid. In any case, private sector production costs in the backward countries are increased just as they are in New York City by the rising welfare-tax burden needed to support this obsolescent labor force. Increasing budgetary allotments are required in the form of transfer payments and welfare infrastructure expenditures. This increasing tax function further

impairs the competitive position of such areas. A diminishing social surplus is available to devote to the educational and other infrastructure activities needed to modernize their backward labor and land resources so that they may find employment in the modern twentieth-century world.

Among the developed nations this emergence of a welfare class, accompanied by the transformation of major cities into welfare reservations, is unique to the United States. Its black and other minority-group labor has been left on the land and in the shoeshine stalls a century too long, and has been degraded too far to retain what cultural integrity it may originally have possessed, and which is a prerequisite for the development of modern work attitudes. America's urban ghettos are thus the result of its artificial division of labor into two broad groups, skilled whites and unskilled blacks. The latter are a racist incident to capitalism. The American economy could well have evolved with all its citizens, black and white alike, had it not chosen to suffer the luxury of being as sharply racist as it in fact was.

Some modest effort is now being made to modernize hitherto untapped minority group resources. In the backward countries, by way of contrast, a prolonged state of immiseration seems inevitable, at least so long as an open international economy is maintained which throws obsolescent labor and land into uneven combat with more modern producers in the advanced nations. To these more modern producers the international economy promises economies of scale in production and marketing, and therefore a regenerative feedback system of increasing sales and capital accumulation. To the backward countries, however, it connotes a loss of markets, starting with their own home market. It means deprivation of economies of scale, and a virtual blocking off of balanced economic growth and self-sufficiency.

Some indication of the cruelty which this situation must inevitably breed was given a century ago in the debates over England's and Ireland's Poor Laws. Dr. James Phillips Kay, a physician who inspected the living habits of Manchester workingmen, wrote that "the introduction of an uncivilized race does not tend even primarily to increase the power of producing wealth, in a ratio by any means commensurate with the cheapness of its labour, and may ultimately retard the increase of the fund for the maintenance of that labour. Such a race is useful only as a mass of animal organization, which consumes the smallest amount of wages. The low price of the labour of such people depends, however, on the paucity of their wants, and their savage habits. When they assist the production of wealth, therefore, their barbarous habits and consequent

moral depression must form a part of the equation. They are only necessary to a state of commerce *inconsistent* with such a reward for labour, as is calculated to maintain the standard of civilization. A few years pass, and they become burdens to a community whose morals and physical power they have depressed; and dissipate wealth which they did not accumulate."²⁰ (The alternative, of course, is a transformation of their society which put them in this state.) Dr. Kay then quotes from Nassau Senior's *Letter to Lord Howick on a Legal Provision for the Irish Poor, &c., &c.*, which puts to shame the most reactionary attacks on the welfare and aid system being made today. The Poor Laws, Senior asserted, would "divide Ireland into as many distinct countries as there are parishes, each peopled by a population *ascripta gleboe* multiplying without forethought; impelled to labour principally by the fear of punishment; drawing allowance for their children, and throwing their parents on the parish; considering wages not a matter of contract but of right; attributing every evil to the injustice of their superiors; and, when their own idleness or improvidence has occasioned a fall of wages, avenging it by firing the dwellings, maiming the cattle, or murdering the persons of the landlords and overseers; combining, in short, the insubordination of the freeman with the sloth and recklessness of the slave."²¹

I have cited these quotations not as antiquarian documents of the past, but as an indication of the political response to come if foreign aid and domestic welfare expenditures continue to be viewed merely in their capacity of income transfers, rather than as capital transfers towards the end of transforming unskilled labor into human capital. It is to this problem that I will now address my concluding remarks.

9. Policy Conclusions

Three policies have been suggested for the poor countries to increase their incomes. Most popular among academic economists and factor endowment theorists remains free trade, as the poor countries are urged to modernize their economies only within the confines of *laissez-faire*. They should open their markets so that they may reap the traditional gains from trade. These are the gains which Ricardo believed would benefit Portugal as it specialized in wine-making and left England to specialize in weaving and its associated industrial branches. Unfortunately for Portugal and other primary commodity exporters, the gains from this pattern of trade seem to have accrued almost exclusively to England and other developed nations. The external economies and diseconomies of such trade, which free traders have neglected from Ricardo's day down to the present, far outweigh the short-term economies of exchange.

The most immediate problem of taking the free trade option is that backward countries have little to trade except the products of their mines and their "cheap labor." The appearance of international trade masks what is basically a transfer function: they are lent foreign-aid funds to purchase goods in the aid-lending nations, while foreign affiliates of international firms produce their exports in isolated mineral and plantation enclaves. Thus, they pay for their imports not by exporting their own representative goods and services, but with promissory notes to pay foreign governments and their aid-lending agencies, and with exports produced by foreign-controlled firms, whose factor proportions reflect those of their parent country's economy rather than that of their host country. The poorer countries' ability to attract such aid and capital inflows becomes increasingly political rather than economic in nature.

Modern capitalism began by opening up the world economy, fostering a commercial revolution whose effect was to monetize all areas of world economic activity. Now that the catalyst of money and commerce has been implanted in all societies of the globe, its workings can be completed only by the less developed countries closing themselves off into regional blocs. Suspension of free-market competition, within some political context, seems to be the only alternative to an aggravation of the Obsolescence and Ghetto Functions. For the open international economy dictates that the backward countries must remain part of the "world village," gathered like serfs at the foot of the castle. They are obliged to exchange their raw materials and to sell their domestic investment rights to foreigners, and to borrow increasing sums abroad to finance their economic backwardness and its associated trade deficit. Their cost of remaining members in good standing in the international economy ultimately involves their total submission to this economy.

The result is that increasing portions of their economies become less and less an integral part of this world economy. The bulk of their poor populations is increasingly excluded from the world of technological advance. Thus, the quality of human resources falls ever further below the rising minimum degree necessary for employment in the world economy. The more the physical productiveness of agricultural and industrial capital in the developed nations increases, the more the value of pre-existing, increasingly obsolete agricultural inputs abroad declines, and with it their factor incomes. At some point they are rendered uncompetitive altogether. Under free trade, the world economy shrinks more and more, until finally it is comprised exclusively of the developed nations and their extractive export enclaves among the raw-materials exporters.

Some economists have advocated terms-of-trade insurance for the

less developed, primary-commodity exporters. In practice, this amounts to financing their general economic backwardness, not to modernizing their economies. It enables them to go on servicing the raw-materials needs of the developed nations, neglecting to modernize their agricultural and human resources. It is just another form of income transfer, rather than the capital transfer called for.

The required capital transfer is not to be found in the poorer countries redirecting their production towards manufacturing and other commodity lines whose terms of trade appear to rise over time, a panacea endorsed by Communist planners as well as by the World Bank and other aid-lending cartels. For by seeking to industrialize some part of their economies, the poor countries may aggravate their internal obsolescence function, that is, their dual economies which mirror domestically the international dualism between rich and poor countries. For them to proceed directly to the most modern agricultural and industrial technology would be to expel their labor from the land and from the workshops, leaving it nowhere to go to offer its obsolescent labor services, except perhaps into the army. This would be the modern counterpart to England's Enclosure Movements of past centuries, only today the "hands" freed will have nowhere to go. For hands are no longer needed for employment in today's world, only brains.

The glib prescription to industrialize does not indicate what will happen to that sector of the population which must necessarily lag behind. Nor does it inquire as to which classes will reap the apparent benefits of industrialization, or how these benefits will be shared within the country, or the extent to which the new industrial islands will actually be composed in large part of foreign affiliates. The industrialization panacea has nonetheless gained some degree of popularity in the United States, as American firms have by now established affiliates in the less developed countries and find Mr. Prebisch's analysis a convenient argument for tariff barriers to guarantee profitable operations for these affiliates. Furthermore, industrialization tends to aggravate the rural exodus and the widening food deficits now plaguing the less developed countries. Partly for this reason it may well please the American farm lobby, as U.S. farm exports to these countries have mushroomed dramatically since World War II.

The thesis of this essay is that the key factor inputs in today's world are work effort and soil productiveness. The indicated policy conclusion of the foregoing analysis is protectionist. It emphasizes modernization of the backward countries' soil and human capital resources, with

labor development being concentrated on the land instead of in the cities.

A century ago, many American workingmen voted for protective tariffs in order to prevent their per-diem wages from being equalized with those of lesser-paid foreign labor. As the above analysis has shown, they were somewhat confused as to just what was being equalized by the process of international trade. It was not compensation per diem, but compensation per unit of work-effort output, as well as compensation for the costs of acquiring the labor skills necessary to operate machines which took over an increasing share of labor's manual tasks. Today, the capital-poor countries find their self-interest to lie in interfering with the free flow of international trade precisely in order to suspend the "equilibrating" factor-price equalization process between work-effort supplied by capital and that supplied by untrained labor. For a transition period, they must also suspend the international competition between artificial sources of soil fertility in the developed nations and those of their own unimproved soils worked by outmoded agrarian methods. What is to be equalized in the realm of international trade is not per-diem wage rates, or per-acre land rents, but the price of the services of supplying work energy and simple servomechanism operations, as well as soil productiveness. These services can be supplied much less expensively by inputs of capital equipment than by raw labor, much less costly by artificial fertilizers than by unimproved soil. The result is that the annual returns to labor and land in the less developed countries are not improved, towards those levels which characterize laborers and farmers in the developed nations. We may call this the Factor-Price Disparity Theorem.

Just as England's Enclosure Movements displaced people in favor of sheep, modern technology displaces people in the less developed countries from their traditional livelihoods. Technological efficiency takes precedence over humanity, and productivity becomes the new sacred cow to which backward societies are sacrificed. The mechanism of this sacrifice is the international economy. Malnutrition spreads in Brazil and Colombia, in the face of rising coffee exports, all in the name of "gains from trade" and comparative advantage. The backward countries can only watch passively as the economic powers of alien and vastly more productive agricultural and industrial capital bring about mass unemployment on their land and in their cities. A similar process seems about to begin working within their domestic economy as well as within the international economy.

The competitive plight of backward countries today is thus much

more serious than was that of the United States a century ago. Their quandary lies in the fact that modern industrial and agricultural technology requires the application of technical skills and work attitudes that can be built up only over a period of time. However, educational facilities currently available in the backward countries are far insufficient to educate their stream of new working-age population. Furthermore, in order to initiate a modern human capital-formation function new teachers must be withdrawn from the ranks of the potentially productive skilled labor force. In this lies the major source of pessimism as to economic prospects in the backward countries. The major limitation on their economic development does not lie in diminishing returns in agriculture, or in the dearth of natural resources—the bogies of old Malthusianism—but in the manpower constraints of their educational infrastructures.

Still, upgrading of their human capital resources and agricultural modernization are the two most essential paths of overcoming their international backwardness. Their indicated path today is similar to that followed by the United States following the Republican victory in the 1860 elections, when protectionists moved to supplement American labor with energy-intensive capital, so that the American workingman would be freed for higher, more sophisticated tasks. “The American System,” wrote Peshine Smith, the economic spokesman for Secretary of State William Seward and later the third-ranking employee of the State Department, “rests upon the belief, that in order to make labor cheap, the laborer must be well fed, well clothed, well lodged, well instructed, not only in the details of his handicraft, but in all general knowledge that can in any way be made subsidiary to it. All these cost money to the employer and repay it with interest.”²² Agricultural extension services must be developed today as they were in the United States to modernize agriculture, something which is conditional upon a radical transformation of land tenure systems in the food-deficit countries.

These educational expenditures will obviously add further to the already strained budgets of the less developed countries. Unfortunately, the monetary impact of the resulting budget deficits will hardly aid them in fostering full employment. In fact, the very concept of full employment is sharply narrowed by the Obsolescence Function. The seemingly homogeneous group of laborers depicted in neo-classical economics is seen to be actually divided into two noncompeting groups. Skilled, increasingly capitalized and sophisticated labor competes against unskilled and increasingly obsolete manual labor. To acknowledge this duality is to

foresake any simplistic theory of full employment. We find a tendency towards full employment of skilled labor, but declining employment opportunities for unskilled labor. Today, what Marx termed the army of the unemployed has turned out to be an army only of welfare recipients.

This means that there is no simple monetary or income-policy cure for the domestic ghetto or for urban ghettos in the backward countries. Labor retraining, including in many cases cultural retraining programs as well, is a precondition for the modernization of obsolescent labor which would otherwise remain a social overhead, unable by itself to inaugurate the rise in educational levels required by modern technology. Just as capitalists must either reinvest some portion of their income in cost-reducing technology or see their businesses go under, so too must labor. In the advanced nations, whose labor has succeeded in keeping pace with the march of technology this labor has moved on to the more imaginative skills which are increasingly requisite for contemporary production. This elevation of labor in the advanced nations seems to have doomed to a status of unemployed obsolescence the uneducated classes in urban ghettos wherever they remain in the world economy.

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¹ Charles P. Kindleberger, *International Economics*, 4th ed. (Homewood: 1968), pp. 29-30.

² Paul A. Samuelson, *Economics: An Introductory Analysis*, 7th ed. (New York: 1967), p. 675.

³ Calvin Colton, *Public Economy for the United States* (New York: 1848), pp. 429-30. See also pp. 65, 178-79. For a modern restatement of this theory, see Samuelson, *op. cit.*, p. 667 and Kindleberger, *op. cit.*, p. 33.

⁴ Francis Amassa Walker, *The Wages Question* (New York: 1876), p. 41.

⁵ Jacob Schoenhof, *Wages and Trade in Manufacturing Industries in America and in Europe* (New York: 1884), p. 19. See also Schoenhof's definitive work on *The Economy of High Wages* (New York: 1892), p. 385.

⁶ *The Economy of High Wages*, p. 39. The American protectionist E. Peshine Smith had already asserted, in his *Manual of Political Economy* (New York: 1853), p. 104, that "high proportional wages are the index of cheap production."

⁷ Alexander Hamilton, *Report on the Subject of Manufactures* (1790), reprinted in Frank Taussig, ed., *State Papers and Speeches on the Tariff* (Cambridge: 1893), p. 17. Hamilton's document remained the germinal theoretical defense of protectionism for more than two generations.

⁸ *Ibid.*, p. 35. For a more detailed analysis of the implications of this theory, see my dissertation on *E. Peshine Smith: A Study in Protectionist Growth Theory and American Sectionalism* (New York University: October, 1968).

⁹ Calvin Colton, *Life and Times of Henry Clay* (New York: 1846), Vol. II, pp. 159-60.

¹⁰ See for instance E. Peshine Smith's *Manual of Political Economy*, p. 53, Francis Amassa Walker, *The Wages Question*, pp. 58, 84, and Jacob Schoenhof, *The Industrial Situation* (New York: 18—), pp. 14-15. The analogy seems to have

come intermediately from Justus Liebig, *Complete Works on Chemistry*, trans. Lyon Playfair (Philadelphia, n.d.), pp. 76-77, and originally from Belidor's *Architecture Hydraulique* (1739).

¹¹ E. Peshine Smith, *op. cit.*, p. 72. This calculation is attributed to Mayhew's *London Labour and the London Poor* (London: 1851), p. 439.

¹² Seymour Melman, *Dynamic Factors in Industrial Productivity* (New York: 1956), pp. 40-44.

¹³ *Ibid.*, p. 1.

¹⁴ W. E. G. Salter, *Productivity and Technical Change* (Cambridge: 1960), pp. 23, 65-73.

¹⁵ Peshine Smith, *op. cit.*, p. 107.

¹⁶ *The Economy of High Wages*, p. 27.

¹⁷ For a controversion of the Ricardian concept of soil, see Liebig, *op. cit.*, Peshine Smith, *op. cit.*, and Daniel Lee's articles in the *Report of the U.S. Commissioner of Patents, Vol. II: Agriculture*, for the years 1849, 1851, and 1852.

¹⁸ Ronald Jones, "The Role of Technology in the Theory of International Trade," in Raymond Vernon, ed., *The Technology Factor in International Trade* (New York: 1970. Universities-National Bureau Conference Series #22), p. 76.

¹⁹ *Ibid.*, p. 84.

²⁰ James Phillips Kay, *The Moral and Physical Condition of the Working Classes, Employed in the Cotton Manufacture in Manchester* (London: 1832), p. 52.

²¹ Quoted *ibid.*, pp. 53-54.

²² Peshine Smith, "The Law of Progress in the Relations of Capital and Labor," *Hunt's Merchants' Magazine*, Vol. XXVI (January 1852), p. 42.