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**Modelling Economic Development: The Lewis Model Updated
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***Modelling Economic Development:
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Abstract

This analysis updates the dual-economy model of economic development suggested by W. Arthur Lewis in 1954. The updated aggregate model incorporates advances since then in modern labor economics and the findings of empirical studies of LDC economies and it removes Lewis' implicit assumption that capital-formation is costless to the host LDC country. Specifying investment in human capital for both sectors refocuses attention on workers' well-being as the ultimate measure of development. Specifying the cost of capital formation permits the distinction between earnings that recover investment costs and the "surplus" available to workers for consumption. Policy implications include resolution of tradeoffs between "trickle-down" vs. "grass roots" development policies.

Keywords: Economic development, growth, human capital, dual-economy model

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I. Introduction

Economic Development as a field of economic theory was born some 65 years ago with the publication of a seminal paper by W. Arthur Lewis on what would become known as the “Lewis Model.” (Lewis, 1953) At that time economic theorists focused on neoclassical approaches to analyze resource allocation, income distribution, and imperfect markets, all of which are important for understanding how the economy functions. Lewis, inspired by the classical economics of an earlier era, was concerned with problems related to structural change and economic growth. He challenged us to build on that work to solve problems of major concern to the less-developed countries in the 20th century.

Lewis’ analysis of what came to be known as a “dual economy” provided the underpinning for decades of subsequent economic research in economic development.¹ An especially fruitful line of research involved empirical studies of what Lewis called the “traditional” or “non-modern” sector of the economy. With the limited data available to

¹ Not everyone was an instant follower of Lewis’s approach, and critiques began to appear soon after its publication (Schultz, 1962; Sen, 1966). Even its admirers eventually floundered: some because of empirical evidence that failed to support Lewis’ assumptions, some because of policy recommendations that were not successful, and some because the theory was not yielding new and useful insights. There followed decades in which the Lewis model was virtually ignored, effectively displaced by a neoclassical approach to the economic problems of developing countries.

him, Lewis had characterized that sector as one in which physical capital was negligible, labor was unskilled, productivity was extremely low, and social constraints limited the usefulness of conventional neoclassical economics. These assumptions were called into question as more data became available for microeconomic empirical analyses. They found – repeatedly for studies of many countries – that traditional firms and farms were profit-maximizing to the best of their ability, that their productivity could be enhanced by skills relevant to that sector, and that they invested in physical capital when profitable to do so. Unlike the case when Lewis wrote his seminal article, the consensus among today’s economists is that the traditional sector is characterized by the same economic motives and processes as any other economy.

Despite the potential usefulness of classical theories of economic growth – the original inspiration for Lewis’ paper – few modern economists have persisted with this approach. To some extent this had to wait for developments in Labor Economics that greatly improve our understanding of skill formation and utilization. The present paper makes use of this knowledge by specifying human capital as a distinct factor in an aggregate production function. It also assumes that investments in each type of capital are not costless.² Separating human- and non-human capital factors of production, allowing for traditional-sector investments in non-human capital, and incorporating the costs of capital formation are the only modifications made here to the original Lewis

² When Lewis introduced this subject during the Cold War era, less-developed Third World countries were viewed as so poor that capital formation would have to depend on assistance from the U.S, the USSR, or former colonial European powers. Although it has been some decades since this assumption was plausible, there are few if any aggregate models of economic development models that explicitly specify the investment costs of human or non-human capital accumulation.

model. Yet these simple changes yield some startling insights with important implications for economic development policies.

The present paper follows Lewis's fundamental insight that the classical economists were concerned with questions of economic development but refines his model with insights provided by empirical studies during the decades since Lewis wrote his seminal article. Part II explains the importance of treating human capital as a separate factor of production. Part III considers the investment market for human capital. Part IV uses this analysis to update the two-sector development model suggested by Arthur Lewis. Part V concludes with an overview of the updated model, the usefulness of this reformulated classical-style aggregate analysis, and insights for economic development policy,

II. Is Lewis' Model Really Capital-Driven?

Lewis, like most growth theorists before and after, preferred to treat skills as just another form of heterogeneous capital instead of treating them as an attribute of workers. He did recognize the importance of human capital, observing that "... [E]ven the unskilled worker is of more use to the capitalist sector after he has been there for some time than is the raw recruit from the country." (Lewis 1954, p. 150). Yet human capital theory was still relatively new when Lewis wrote, and few economists fully grasped its importance for economic development. He understood that skilled labor might well be a bottleneck in an expanding economy, but he believed that it was only

...a very temporary bottleneck, in the sense that if the capital is available for development, the capitalists or their government will soon provide the facilities for training more skilled people.

—Lewis 1954, p.145

Because of this he saw no reason to consider the matter explicitly, hence:

... [I]n this analysis the growth of productive capital and the growth of technical knowledge are treated as a single phenomenon (just as we earlier decided that we could treat the growth of the supply of skilled labour and the growth of capital as a single phenomenon in long run analysis).

—Lewis 1954, p.153.

Lewis' notion that capitalists and/or governments would quickly invest to relieve human capital bottlenecks seems to have been overly optimistic. An employer may invest in the employee's firm-specific skills, but has no incentive to invest in general skills that improve a worker's attractiveness to other employers. Governments may have an Education Ministry in charge of their school system, but this rarely coordinates with the branch of government dealing with economic development. The result is that resources for economic development go disproportionately to investments in non-human capital without explicit consideration of the relative merits of human capital investments.

Combining human and non-human capital into a single factor of production also obfuscates an important dimension of the development process itself. Although both kinds of capital are accumulated through investment, investment in human capital occurs in a market that is very different from the markets for non-human investment. Physical (and other non-human) capital can be accumulated in an impersonal market where investors and owners need never meet, and the resulting capital can be either owned by producers or rented by them in an impersonal factor market. In contrast, human capital accumulation is governed by the physical limits and social constraints that characterize the workers as people. Skills are formed by an educational process (whether formal, informal or non-formal) that is *ipso facto* personal, and skill is embodied in, inalienable from, and owned by the worker who then rents out its services in exchange for a wage.

Advocates of a “trickle-down” policy for economic development infer from the Lewis model that expanding modern-sector capital will ultimately absorb disguised unemployment, directly or indirectly, and thus lead to economic growth. Although Lewis himself clearly states that modern-sector “capital” can be either human or non-human, there is a tendency to forget this assumption, or to dismiss it as of little importance. As a result, “trickle-down” development policies typically allocate investment resources to non-human capital and view education and skill formation (if at all) as ancillary activities. Yet, as will be demonstrated below, the model’s transparency with respect to human capital is greatly increased simply by specifying human and non-human capital as two separate factors of production.

III. Investing in Human Capital

The original Lewis model assumed that all increases in labor inputs came on the extensive margin by hiring more workers. The modern sector could expand only by drawing workers out of the traditional sector or from the ranks of the unemployed, and the traditional sector could compensate for any loss of workers by drawing workers from a pool of subsistence labor (including women and children). But human capital can also be augmented on the intensive margin by investing in education or training, giving rise to markets for education (broadly defined to include training and other methods of learning) that have very different characteristics than those of an investment market for physical capital. It is to those markets that we now turn our attention.

The Intensive Margin: How much skill to acquire?

A worker’s demand for education depends on the extent to which it will lead to a higher wage relative to the cost of acquiring new skills. The marginal product of a

dollar's worth of education – the skills obtained by an additional investment on the intensive margin – may be high in some range of schooling levels, but at some point skill formation is subject to diminishing marginal product. Students, apprentices, interns, or anyone else investing in skill-formation face a conventional production function, and hence a cost curve, in the range relevant for decision-making.

Let h denote a worker's skill level (measured in appropriate efficiency units) and let $C(h)$ denote the total cost of acquiring skill level h where $C'(h) > 0$ and $C''(h) > 0$. The average cost curve $c(h) = C/h$ is a U-shaped function of h and $C'(h)$ is a positively-sloped marginal cost curve for education that crosses the U-shaped average cost curve from below at its minimum. Since the benefits of acquiring h continue from one time period to the next, the current-period portion of total, average, and marginal costs can be written as rC , rc , and rC' , respectively, where r is the interest cost of each investment dollar. A worker's supply curve for quality units is that portion of $rC'(h)$ at or above the minimum of the U-shaped average cost curve $rc(h)$. If v denotes the price of a unit of h in the labor market, workers will want to invest in additional skill units until h^* where $rC'(h^*) = v$ (These relationships are illustrated by the supply curves in Figure 1.)

The worker's wage, $w(h^*)$, is the rental value of his or her human capital, vh^* . Suppose prior human capital investments were financed by the worker, whether by borrowing at interest rate r or by accepting a lower wage from the employer. In either case, the current-period cost of prior investments is $rC(h^*)$ and the net wage available for current consumption is $w - rC$. But

$$(1) \quad (w - rC) = h^* (v - rc) = rh^* (C' - c) \geq 0.$$

These relationships hold regardless of whether the skills are formed in school, on the job, or in an informal setting – in each case, raising one’s skill level has an education production function with marginal costs and marginal benefits. They also hold regardless of how the skills are financed, whether by the worker before being hired or by the employer afterwards.³

Demand for Human Capital: How Much Skill to Hire?

Following the classical approach to a model of economic development, aggregate output Y is produced with a combination of non-human capital, K , and human capital, H .

$$(2) \quad Y = f(H, K) \quad \text{where} \quad f_i > 0, \quad f_{ii} < 0, \quad \text{and} \quad f_{ij} > 0 \quad \text{for} \quad i, j = H, K$$

Output is measured in monetary units, referred to in this paper as “dollars,” to abstract from the wide variety of physical items produced. Each type of capital is measured in its own “efficiency units.” An efficiency unit of non-human capital is valued at one dollar so its cost is the market rate of interest, r , and rK is the current-period cost (rental price) of non-human capital. Efficiency units of the human capital factor H are skill units whose market price is denoted v and whose total factor cost is vH . Let L be the number of identical full-time workers in whom the human capital is embodied, and let h be the level of skill that each worker has acquired. Then $H=hL$ is the total amount of human capital available for production, $vH=wL$ is the total factor cost, and each worker is paid a wage $w=vh$.

³ The efficiency-wage literature defines this same relationship in terms of productivity, positing that a worker’s productivity h is positively related to the wage v per efficiency unit and analyzing this relationship as a “productivity curve” (Stiglitz 1976). It is easy to show that this “productivity” curve is simply the inverse of a cost curve $C(h)$. An “efficiency wage” is defined as the price v at which the average product of an efficiency unit h is equal to its marginal product or, equivalently, where $C'=c$. The “efficiency wage” is thus the lowest price that can clear the market for h because it just covers the cost of skill-formation without any additional rent paid to the worker. (For a full development of this issue see Chiswick 1986.)

The marginal product of an additional unit of skill on the intensive margin is derived from equation (2) as $MPh = Lf_H(h)$. The downward-sloping curve f_H is the derived demand for skill levels per worker, and employing workers with higher skill levels is profitable only as long as $f_H \geq v$. The supply of skills is the upward-sloping curve rC' , the current-period portion of marginal cost. Equilibrium in the skill market occurs at price v^* and quantity h^* , where

$$(3) \quad f_H(h^*) = rC'(h^*) = v^*.$$

This market is illustrated by the graph in Figure 1. The wage earned by each worker, $w^* = v^*h^*$, is the shaded area determined by the intersection of supply curve rC' and demand curve f_H .

The shaded area in Figure 1 divides the wage into two components. The first, the lightly shaded area, is $rC(h^*) = rh^*c(h^*)$, the current-period portion of the total cost of attaining skill level h^* . This portion of the wage is required for repayment of debt, whether to others or to oneself, and is not available for current consumption. The darker shaded area is $w(h^*) - rC(h^*) = rh^*(C' - c)$, the net wage in equation (1) that is determined by the difference between marginal and average cost at h^* . This area is the benefit obtained by the worker from his or her investment in human capital, a measure of current consumption possibilities and thus an indicator of the worker's welfare.

The net wage described in equation (1) is an economic rent earned by the worker *per se* in addition to the return on his or her human capital. It arises because human capital can not exist without being embodied in a worker, because raising a worker's skill level is subject to diminishing marginal product, and because using human capital in a

production process requires hiring the worker in whom it is embodied.⁴ A worker is said to earn a subsistence wage if his or her earnings just meet the costs of working with nothing extra to augment consumption. In the present model, where current period earnings are w and the cost of the worker's human capital is rC , wages are at a subsistence level whenever $C' = c$ so that the net wage in equation (1) is zero. This can happen if there are so many workers that the demand for h crosses its supply curve at or below its reservation price.⁵ It also can happen if the supply of h is perfectly elastic and hence $C' = c$ regardless of the actual value of h . A subsistence-wage reservation price of labor can thus be attributed to an unlimited supply of human capital on the intensive margin (h), on the extensive margin (L), or both.

The Extensive Margin: What type of skill to acquire?

Consider an economy in which there are two distinct types of human capital that are created by very different investment characteristics. For example, one type might be embodied in production workers and the other in high-level professional employees, or they might be skills associated with the traditional and modern sectors respectively. Each type of human capital is measured in its own efficiency units, is created in a process with its own cost function, and seeks employment in its own labor market. Denoting these

⁴ The economic rent earned by workers, i.e. the wage net of investment costs, depends on their level of skill and is thus quite different from the wage of "raw" labor hypothesized in some models.

⁵ An "efficiency wage" literature defines subsistence as the case when the price of h is so low that its optimal level is at the bottom of its average cost curve where $C' = c$. This implies that even high-wage workers may be earning a subsistence income if their wage depends on skills that were expensive to acquire.

two types of human capital as H_1 and H_2 , respectively, the aggregate production function can be written as:

$$(4) \quad Y = f(H_1, H_2, K) \quad \text{where} \quad H_i = h_i L_i \quad \text{for} \quad i=1,2$$

Similarly, let $C_i = C_i(h_i)$ denote the cost of investing in additional units of skill of type i , let v_i denote the price of a unit of h_i in the labor market, and let $w_i = v_i h_i$ be the wage rate earned by a worker with skill level h_i .

Figure 2 illustrates an economy in which skill-creation (i.e., investment) processes are very different for the two skills. Type-1 human capital is relatively easy to acquire in a short amount of time, so diminishing marginal product sets in quickly making its cost function relatively inelastic. Type-2 human capital is more expensive to acquire and its cost curve is more elastic, reflecting an educational process whose marginal product diminishes later and more slowly. As in Figure 1, equilibrium wages are given by the shaded areas, each of which is divided into the current-period cost of acquiring skill h_i^* and the “surplus” available for current consumption. (Note, however, that these graphs do not reveal the relative income of the two groups of workers since h_1 and h_2 are measured in different efficiency units.)

Although workers consider wages when choosing an occupation, it is not the gross wage w^* but rather the net wage ($w^* - rC^*$) that provides the relevant incentive.⁶ In a competitive labor market where workers can change jobs and can invest in the skill of their choice, a long-run equilibrium is not reached until the net wage is the same for

⁶ For example, a person choosing between careers as a doctor or an EMT (emergency medical technician) knows that doctors are paid much more than EMTs, but the cost of medical school (direct cost plus opportunity cost) is much higher than the cost of EMT training.

every occupation.⁷ This result can be generalized to a production function with any number of human capital factors. Each skill type has its own education production function with associated cost curves, each induces investment on the intensive margin up to the point where the marginal cost of additional skill is equal to its marginal product, and workers choose which type to acquire by seeking occupations with the highest net benefit.

An important implication of this condition is that the long-run equilibrium value (labor rent) of a worker *per se* is the same in every occupation regardless of the observed wage distribution. That is, occupational differences in the gross wage ($w_2 - w_1$) in long-run equilibrium are entirely explained by differences in the cost of human capital investments and have no implications for differences in consumption power. In an economy where economic rent is high, consumers are well off and the population as a whole is prosperous. Similarly, if economic rent is low consumers have little discretionary spending and the economy is “poor.”

The net wage level (labor rents) is thus a proxy measure for the economy’s level of development, a more satisfactory indicator than per-capita income which is in turn a proxy for the average (gross) wage level. Growth rates can be stimulated by improvements in productivity, by industrialization, or by exploitation of natural resources. Whether this growth is enriching or immiserating – that is, whether it is associated with conventional notions of economic development – depends on its implications for the economic rent earned by its workers.

⁷ Mobility between occupations may involve retraining, but more often it occurs *ex ante* as new entrants to the labor force weigh their job options. In many cases such adjustments at the margin can be sufficient to bring about equilibrium in the labor market.

IV. Modelling Economic Development

In his original paper, Lewis envisioned an economy with L workers divided into three groups. A “traditional” sector employed L_1 people, the “modern” sector employed L_2 people, and the remaining L_0 people were “surplus” labor who were either unemployed or so underemployed that they could be considered dependents. All investment was directed toward capital formation in the modern sector, K_2 , on the assumption that the traditional-sector production function required only labor inputs. Production functions for the modern and traditional sectors, respectively, could be written as $Y_M = f(L_2, K_2)$ and $Y_T = g(L_1)$ where all human capital is subsumed in the modern-sector K_2 . The object of economic development was to shift people from the traditional (L_1) and/or the unemployed (L_0) into the modern-sector (L_2) until the modern sector employed all (or at least most) of the workers.

Three modifications of this model are proposed here. First, since non-human capital can augment the productivity of traditional-sector labor in various ways, the non-human investment budget should be allocated between the two sectors. Second, labor in each sector embodies its own form of human capital, assumed here (for the sake of simplicity) to be sector-specific and denoted $H_1 \equiv h_1 L_1$ for the traditional sector and $H_2 \equiv h_2 L_2$ for the modern sector. Third, the goal of economic development should focus on raising the level of consumption rather than production, the difference being the investment required to accumulate capital of all types.⁸

Using the notation developed above, an aggregate production function can be written as:

$$(5) \quad Y = Y_M + Y_T = f(H_2, K_2) + g(H_1, K_1) - I$$

⁸ Chiswick (1984) develops this same model in a different context.

where $K = K_2 + K_1$

$$H_2 \equiv h_2 L_2, \quad H_1 \equiv h_1 L_1$$

$$I = r [K + L_2 C_2(h_2) + L_1 C_1(h_1)]$$

and $L = L_2 + L_1 + L_0$

The original Lewis model can be thought of as the special case where $K_1 = 0$, $r = 0$, h_1 is a constant, and h_2 is incorporated in K_2 . In this case, growth in Y can occur only in the modern sector by investing in K_2 or by shifting workers from L_1 or L_0 into L_2 .

Zero Marginal Product of Labor?

Unfortunately, Lewis describes traditional sector production, $Y_T = g(L_1)$, as one where "...the marginal productivity of labour is negligible, zero, or even negative," a characterization that has led to much controversy and misunderstanding. As the following passage indicates, he clearly did *not* mean by this that $g'=0$. Speaking of traditional agriculture, he writes:

...if some members of the family obtained other employment the remaining members could cultivate the holding just as well (of course they would have to work harder: the argument includes the proposition that they would be willing to work harder in these circumstances).

– Lewis 1954, p.141

If the marginal product in agriculture was really zero, output would not go down when some family members left and there would be no incentive for the "remaining members" to work any harder. On the other hand, a downward sloping marginal product curve implies that any reduction in labor would cause a reduction in output and a consequent rise in the marginal product of labor, providing an incentive for the remaining workers to work harder.

Lewis' assumption of a perfectly elastic supply of "disguised unemployed" workers (L_0) implies that any labor leaving a traditional-sector farm (L_1) will be replaced to the point where the marginal product of labor, and hence total output, is the same as before. Thus, while the people in whom it is embodied may have changed, the total amount of labor in L_1 remains the same so there is no change in traditional-sector output $g(L_1)$. It is this sense, and this sense only, that he describes as traditional agriculture's "zero marginal product."

Unlimited Supply of Labor?

The Lewis model effectively treats L_0 (unemployment) as a third sector of the economy with a constant marginal product of labor. When the modern sector experiences a shift upward in its demand for L_2 , perhaps because of an investment in K_2 or perhaps because of an opening of new export markets, its higher marginal product is an incentive to recruit more labor. Its new workers may come to the modern sector from urban unemployment (Todaro 1976) or from traditional-sector farms (L_1) where they will then be replaced from rural disguised unemployment (L_0). The perfectly elastic supply of labor in L_0 is thus available to both sectors, either directly or indirectly, and establishes the reservation price of labor for the whole economy.

If workers are unlimited in supply, as Malthus suggested, they have no scarcity value and their economic rent falls to zero. The unlimited supply of labor in Lewis' paper consists of "disguised" unemployment in traditional agriculture, in petty retailing, and in a "whole range of casual jobs – the workers on the docks, the young men who rush forward asking to carry your bag as you appear, the jobbing gardener, and the like."

(Lewis 1954, p. 141). He later adds to these the wives (presumably available for work) and children (augmented by high fertility rates) of workers in the traditional sector.

Early critics of the Lewis model questioned the assumption that people in L_0 were unproductive. Schultz (1962) argued that “dependent” family members could be engaged in a variety of unpaid but useful activities, and Sen (1966) pointed out that even leisure has a utility-increasing value. A subsequent spate of empirical investigations found this to be the case, leading to the notion of an “informal” sector in the cities, important “non-farm production” activities in the countryside, and such family activities as child care, homemaking, or care for the sick and elderly to be productive.⁹ The modifications of the Lewis model in equation (5) incorporates these activities into the traditional sector, leaving L_0 to include only true dependents (young children, elderly, and disabled) as well as any family members who voluntarily elect not to be in the labor force.¹⁰

A Dual Economy?

Although Lewis is generally credited with its introduction into the literature, the term “dual economy” never actually appears in his original paper. It has come to mean an economy in which two technology systems coexist, one “modern” (which Lewis labels

⁹ During the decades since publication of Lewis’s seminal article, labor productivity in all these areas has been studied for many countries. Non-market provision of goods and services is understood to be competitive with market production, and judicious investments in both non-human and human capital can increase productivity in either or both venues.

¹⁰ This entire analysis assumes a country with relatively closed borders and hence a relatively fixed population size L . In the present era of large international migration flows, however, unlimited labor supplies have become easier to imagine, especially for small countries. Since an unlimited supply of immigrants generally characterizes the more-developed world – i.e. countries in which labor rents are relatively high – rather than LDCs concerned with fostering economic development, this scenario is beyond the scope of the present analysis.

“capitalist”) and the other “traditional.” All firms compete in both input and output markets, but profits and wages are presumed to be higher in the more productive modern firms than in the less efficient traditional firms.

Before applying this model to an economy with unlimited supplies of labor, it is useful to consider what we have learned so far. Physical capital in the traditional and modern sectors may be very different in appearance and function, but as long as K_1 and K_2 are both measured in currency they are commensurable between sectors and available in unlimited supply on the international market at a unit price r .¹¹ In contrast, skills and skill-formation markets are sector-specific and not commensurable. Modern-sector skills are generally costlier to produce than traditional-sector skills, and wages in the two sectors reflect this difference as well as differences in skill levels.

Human capital factors are relevant for an analysis of labor productivity, but the net earnings of workers (i.e., wages minus the costs of skill-formation) are relevant for assessing well-being. Wages are the sum of two components, a return on investment in human capital and an economic rent earned by the workers because human capital can't enter the production function without being embodied in an actual person. Workers allocate themselves between the two sectors so as to equalize net earnings. When the aggregate labor market is in equilibrium this rent is the same for all workers, regardless of their place of employment or their type of skill, and reflects the scarcity value of workers *per se*.

¹¹ This abstracts from differences in modern and traditional financial markets, about which there is a large literature. From the aggregate perspective, however, governments (and large firms) are price-takers on the world market and can borrow indefinitely as long as they pay back their loans so as to maintain their credit rating.

The model summarized in equation (5) is limited to two sectors to maintain compatibility with Lewis' formulation. It is easily generalized, however, to as many sectors necessary to deal with the relevant problem. For example, "surplus" labor L_0 might be viewed as working in a third sector (e.g., household chores) with little capital, few skills, and negligible economic rent. Zero rent can occur if skill levels h_0 are unlimited in supply, suggested by Lewis' assumption that when one person moves away the remaining family members "...would be willing to work harder in these circumstances" so that production does not decline (Lewis, p.141; cf. above, p. 14). Zero rent could also occur if there are so many workers that the demand curve $f(h_0)$ in Figure 1 crosses $rC_0'(h_0)$ at the minimum of the average cost curve $c_0(h_0)$.¹²

If rent is zero in one sector, however, the economy is not in equilibrium until labor rents are zero in every sector. A surplus-labor economy in which workers in any sector earn positive rents is characterized by a long-run, persistent disequilibrium. Empirically, despite a blurring of the boundaries between the modern and traditional sectors in "newly developed" economies, there remain large between-sector differences in standards of living for many LDCs. This is a clear indication of barriers to between-sector factor mobility: barriers in the financial market that distort incentives for investing in non-human and human capital, barriers in the labor market that distort the allocation of workers between sectors, and barriers in the education system that distort incentives to invest in various types of human capital.

¹² This zero-rent case is equivalent to the "efficiency wage" that would prevail if all employers financed the entire investment in human capital and if workers had no opportunity cost for subsistence employment.

V. Implications from the Classical Approach

The Lewis model drew its inspiration from the classical economists whose main interest was economic growth and who looked at that from an economy-wide perspective. Lewis expanded their vision by positing two sectors, but he maintained many of the classical assumptions. He focused on capital and labor (dropping land as a separate factor of production) but considered capital as a factor specific to the modern sector. He also viewed the “traditional” sector as *ipso facto* inferior to the “modern” sector and thus unworthy of new investment.

The Lewis model assumed that accumulating modern-sector physical capital was the bottleneck preventing rapid growth. It was widely cited to support a “trickle-down” theory of economic development, and seemed to justify concentrating investment resources into non-human factors of production in the so-called “capitalist” sector.¹³ Proponents of a “grass-roots” theory of economic development supported investments in the traditional sector which would have a direct effect on poverty reduction but an indirect effect (whether positive or negative) on modern-sector growth. Both approaches, however, viewed physical capital as the dominant resource bottleneck.

The model presented in this paper shifts the emphasis away from investments in physical capital to a consideration of a broader portfolio that includes both human and non-human capital as well as both modern and traditional sectors. This is achieved by simply including capital in the traditional-sector production function and by separating human from non-human capital in both sectors. This straightforward modification of the Lewis model results in an optimal pattern of resource allocation that equalizes rates of

¹³ When foreign aid programs provided large infusions of capital that did not have this effect, the failure was blamed on low “absorptive capacity” in the receiving countries.

return from all investments, without privileging modern over traditional sector or non-human over human capital.

Since the earnings of human capital accrue to the worker in whom it is embodied, specifying human and non-human capital as separate factors of production brings labor's role in the development process into sharper focus. It also permits consideration of tradeoffs between labor investments on the intensive and extensive margins. For simplicity, the model presented here follows Lewis by assuming that between-sector labor mobility is costless. Skill-formation, however, is subject to diminishing marginal productivity and is a profitable investment only until its marginal benefit is equal to marginal cost. In a well-functioning economy with free factor markets, this will happen when the rate of return on intensive-margin investments in skills is equal to the rate of return on other investments in human and non-human capital.

The third way in which this model differs from the original Lewis model is by considering the cost of investment in every factor. For non-human capital, profitability is conventionally measured as the "surplus" of earnings over investment costs (e.g., the current-period repayment of a loan). Similarly, a worker's consumption level can be measured as the "surplus" of his or her current wage over the cost of investing in skill-formation (e.g., the repayment of a student loan). Net wages must be positive in every sector of the economy, and occupational mobility (i.e., the absence of barriers to skill formation and employment) tends toward equality in the net wage distribution. Moreover, if the goal of economic development is to increase the well-being of its workers – and hence of its consumers – in the aggregate, the level of labor rents in an

economy is a better measure of progress toward this goal than its level (or growth rate) of production (GDP).

Development Economics owes much to Lewis (1954), the seminal article that first presented the “Lewis model” and stimulated a wide body of literature in the field. Lewis had some experience as an economic advisor and teacher in a few LDCs, but since he had no statistical data for traditional-sector economic activities and human capital theory was in its infancy, his assumptions followed the conventional wisdom of his time. By articulating assumptions about traditional economies, however, he provided hypotheses to be tested which in turn required statistics to be collected. As a result, we now know much more about traditional economies and can refine the assumptions in his model.

Lewis’ big innovation, however, was not so much in the assumptions as in his focus on the big picture – the overall process of economic development that could make some countries very rich while others remained very poor. With few exceptions, this question does not figure prominently in today’s economic development literature. The present paper looks at the big-picture questions as Lewis intended, making only parsimonious modifications. Six decades of research in Development Economics supports including investment in capital for the traditional sector, research in Labor Economics supports recognizing human capital as a characteristic of labor, and experience with transitional economies and international development aid programs both suggest the importance of ensuring that all investments are cost-effective. Updating the Lewis model with just these few modifications leads to important insights into the nature of economic development and the measurement of progress toward development goals.

VI. References

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Figure 1

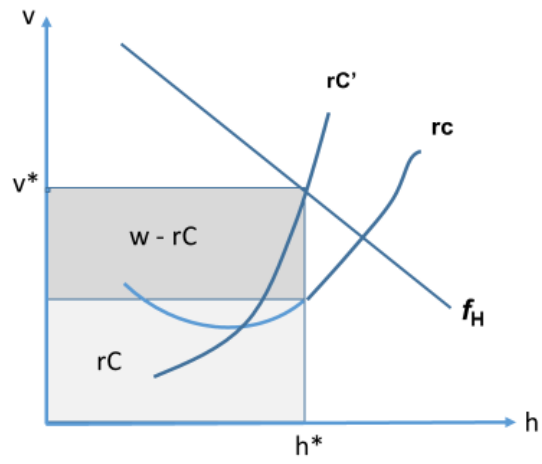


Figure 2

