Engines of Growth and Africa's Economic Performance

Marcel Fafchamps

Department of Economics, University of Oxford, Manor Road,

Oxford OX1 3UQ (United Kingdom)

February 1998

Revised July 2000

Abstract

This paper takes a critical look at the literature and examines which theoretical contributions are most useful in understanding Africa's economic growth performance. After examining essentially all the explanations that have been proposed to account for differences in prosperity levels between countries and regions, we conclude that catching-up is a process distinct from growth. The key to catching-up is to copy and absorb technological improvements invented elsewhere and to emulate advanced economies. Due to agglomeration effects and pecuniary externalities, not all countries and regions can catch up at same time. Catching-up takes place mostly by convection: geographical proximity largely dictates who takes off next. In this respect, Africa is penalized by its isolation. Still, there is room for cautious hope concerning Africa.

It is customary for people living in developed economies to treat constant economic progress as natural and self-evident. Yet, if one looks at the human record since, say, the neolithic revolution, growth is the exception and economic stagnation is the rule. Indeed, for thousands of years prior to the industrial revolution, all regions of the earth experienced virtually no discernible change in the everyday life of their people. Empires came and went, and so did the prosperity of merchants and aristocrats in Venice, Vijayanagar, Beijing, and Timbuctu, but the livelihood of the mass of the population remained essentially the same (e.g., Braudel (1986), Pritchett (1997)).

From an historical perspective, what is absolutely remarkable is not stagnation but the rapid and dramatic improvement in the standards of living of millions of people over the last 200 years. This is certainly true in developed countries, which have achieved unprecedented prosperity. It is also true in newly industrialized countries, which have grown at unheard of speed (e.g., Maddison (1987), The World Bank (1993)). Compared with these outstanding performances, changes in other parts of the world -- and in Africa in particular -- appear modest. But even in Sub-Saharan Africa things have evolved dramatically over the last hundred years: life expectancy has all but doubled, child mortality has been cut in half, population has more than quadrupled without only a slight reduction in food availability, urbanization has gone from essentially nothing to one third of the population, and standards of living have, in all likelihood, doubled over the course of this century (e.g., Hopkins (1973)).

The growth performance of any region of the globe cannot be understood without an idea of what accounts for increased standards of living. Unless we know what fundamental economic forces can account for the diverse growth experiences of the various regions of the globe, we cannot hope to understand what happened in Africa over the last decades, what may happen in the future, and what policy makers can and should do about it.

There are many views at to what is responsible for economic growth, but little agreement as to which view best accounts for the facts. This paper takes a fresh look at the literature. Instead

of focusing on a single explanation, we examine essentially all the explanations that have been proposed to account for differences in prosperity levels between countries and regions and we discuss to what extent they explain Africa's growth performance. The originality of our approach is that we seek to understand the current state of the world by comparing the logical implications of different theories of growth. So doing, we can rule out certain explanations for the simple reason that they cannot account for the facts -- rapid growth in some places, stagnation in others. The outcome of the exercise is a better grasp on the determinants of economic prosperity and how they have shaped the performance of Africa. We also draw important lessons for policy.

Before embarking upon the body of the paper, we acknowledge that understanding what is responsible for growth is far from exhausting the larger question of economic development. For instance, it is often believed that growth exacerbates income inequalities and may even have perverse effects on certain vulnerable groups (e.g., Kuznets (1955), Kanbur (1997)). To attain economic development, it is argued, one must achieve 'not just growth' in aggregate output but also its equitable distribution among various segments of society. Yet, while it is true that the redistribution of the new prosperity generated by growth is far from automatic, there must be something to redistribute before we can talk of redistributing anything (e.g, Dollar and Kraay (2000)). Over the last two decades, slow growth has been Africa's main problem, not the unequal distribution of increases in prosperity, which have been small by most accounts.

The question of what drives growth is often debated together with the wider issue of what conditions and policies are required for growth to take place. While we do not dispute that an enabling environment is required for growth to occur, we believe it is important to distinguish between the engine itself and the environment that makes the engine work. Indeed, it is very unlikely that one may identify what the enabling environment should look like if one does not understand what needs to be enabled. For instance, if producing more cocoa is seen as the avenue to growth, then the enabling environment is one that facilitates cocoa production -- e.g., roads or

railtracks to cocoa producing areas, seed and fertilizer distribution programs, marketing infrastructure and institutions, and a harbor to export the product. In constrast, if exporting shirts is the chosen engine of growth, what needs to be facilitated is cheap urban labor, timely access to information about fashion, export finance, training on quality and packaging, etc. In both cases, whether the necessary services are likely to be supplied by private initiative or whether the intervention of the state is required depends on the usual economic arguments. Examples are the presence of externalities, hold-up problems, natural monopolies, coordination failure, credit constraints, and the like. Recent research has also emphasize the crucial role played by the institutional framework and political governance structure in which public goods are provided and private actors are allowed to operate. All these issues are important but, for obvious space limitations, they remain beyond the scope of this chapter as we focus exclusively on the engines themselves. For a more detailed discussion, the reader is referred, for instance, to Mkanawire and Soludo (1998), Elbadawi and Schmidt-Hebbel (1998), Oyejide (1998) and Collier and Gunning (1999).

This paper is organized as follows. We begin by discussing what we call elementary engines of growth, that is, engines of growth that do not require any reorganization of production. Next, we review engines of growth that are based on a static understanding of the world. In Section 3 we discuss engines of growth that emphasize the simple accumulation of productive resources. Increasing returns and poverty traps are discussed in Section 4. The role of technological change and innovation is examined in Section 5. Geographical determinants and agglomeration effects are introduced in Section 6 where the world is treated as a global economy. In each section, the relevance of each theory for Africa is discussed, together with the policy prescriptions implied by the theory.

Section 1. Elementary Engines of Growth

We begin by examining three elementary engines of growth: 'beggar your neighbor', commodity price fluctuations, and cartel formation. All three work essentially by redistributing wealth. Consequently, they cannot be regarded as ways to increase the prosperity of all and cannot account for the growth of developed economies since the mid 17th century. Yet, they have shaped events and policies for centuries in the past and continue to affect contemporary economies. We present them first so that the contrast will be more readily apparent with the engines of growth discussed in subsequent sections which are all capable, at least in theory, to improve everyone's standards of living.

One of the most effective ways of improving one's lot is simply to impoverish someone else. Much of pre-industrial history up to Saddam Hussein's invasion of Kuwait can be understood as variations on the eternal 'beggar your neighbor' principle (e.g., Maddison (1982)). Someone else's wealth can be taken away directly by looting and raiding, as hordes of 'barbarians' have done since times immemorial, or by taxing the defeated, the golden principle on which empires rest. Wealth can also be taken away indirectly by eliminating a competitor from a profitable business. Conflicts between kingdoms and cities for the control of the trans-Saharan trade are examples of this strategy. Current efforts by industrialized nations to wrest key international markets away from each other can be seen in a similar light.

Another powerful source of windfall gains and losses is the fluctuation of international commodity prices. These fluctuations are particularly important for countries and regions whose export structure is highly dependent on a small number of primary exports -- as is still the case in most of Africa. One major factor behind changes in commodity prices is the fluctuation of demand. If we focus on primary commodities -- the most relevant category for Africa -- we see that international demand follows two largely contradictory trends: increased demand for raw materials and the development of substitutes. Industrialization and rising consumption levels in

developed nations require increased use of raw materials. This trend favors a rise in commodity prices over time. For example, industrialization in Europe raised the demand for vegetable oils and benefitted African producers of peanuts and palm oil during the 19th century and the beginning of the 20th (e.g., Hopkins (1973)). At the same time, improvements in production technology permits the replacement of expensive raw materials by cheaper substitutes.[1] The rubber boom that followed the rapid development of the automobile at the beginning of the century is a case in point. It generated incredible wealth in Manaus, the world's capital of rubber at the time. But the invention of a synthetic substitute led to the collapse of the rubber price and Manaus went bust. As this well known example illustrates, the combination of the two effects makes the long term movement of primary commodity prices difficult to predict.

The role of that commodity prices play in the growth of individual developing countries has been the object of intense debate. Historically, the prices of primary commodities have not increased as fast as one would have expected based on projections of raw material use. Although opinions diverge on this issue, many even appear to have declined over the course of this century. As Deaton and Miller (1996) has recently shown, conventional commodity price prediction models often underestimate the role of invention and substitutes, and tend to overestimate future price movements.

Short of advocating cartel formation, there is considerable disagreement as to the policy implications to be learned from the role of commodity price fluctuations in growth. Some emphasize that betting on the right horse can work wonders and claim they can predict what commodity prices will be 10 years from now. They see nothing wrong in expanding the production of primary commodities as an engine of growth (e.g., The World Bank (1981)). Others, best represented in the Latin American dependency theory school of the 1960's and 1970's (e.g., Pre-

[1] See for instance the excellent description of how technological improvements in synthetic pesticides has affected the market for pyrethrum (a natural pesticide) in Winter-Nelson (1992).

bisch (1963)), insist that commodity prices show a secular decline. A development strategy, they argue, should not be based on increased production of primary commodities; industrialization is the only path that leads to sustainable prosperity. Others yet do not see the expansion of primary exports as inherently bad but point out that making the same recommendation to all developing countries leads to a fallacy of composition: while it may be good for Ghana, Nigeria and Ivory Coast to individually increase cocoa exports, if they all do it simultaneously, international prices may fall so much that they will all be worse off. This latter view, however, is but the cartel formation argument in disguise.

As is well known, international prices can be raised, even in the absence of demand shifts, through the formation of a producer cartel and other monopolistic practices. By forming a cartel and behaving like a monopolist, countries can thus increase their collective welfare by reducing quantities and forcing prices up. That such a strategy can generate substantial welfare gains for the countries involved is best illustrated by the OPEC cartel between the mid-1970's and the mid-1980's: when oil prices doubled in 1974 and subsequently quadrupled in 1979, oil producing countries indeed enjoyed unprecedented prosperity, reaching overnight standards of living close to those achieved in the West.

How relevant are these three elementary engines of growth in understanding the international distribution of prosperity? Clearly, robbing wealth from someone else can improves one's lot but it cannot increase prosperity in the world as a whole. If anything, military conflicts and trade wars to control resources and commercial routes can only subtract from aggregate welfare. The formation of cartels and other monopolistic practices partake from the same approach: they benefit producers at the expense of consumers. The world as a whole thus has interest in deterring such actions, and it does. United Nations peace keeping activities (e.g., the Desert Storm operation) and multilateral treaties for the promotion of free trade constitute international efforts to discourage and reduce wastage generated by 'beggar thy neighbor' policies and impediments

to free trade.

Fluctuations in commodity prices cannot be seen as engines of global prosperity either: gains for producers are losses for consumers, and *vice versa.* These fluctuations can nevertheless have a large influence on the growth performance of individual countries. What is clear from the available evidence is that building one's prosperity on a rise in commodity prices is extremely risky: prices are known to fall as quickly as they rose, leading to a dramatic economic collapse when this happens.

Do elementary engines of growth help understand the African experience? Undoutedly. The slave trade was, by excellence, a source of prosperity founded on the extreme impoverishment of others. Colonialism similarly contained elements of 'beggar thy neighbor' policy: Africans were deprived of the ownership of mineral resources and, in certain cases, of land as well. The most profitable economic activities were reserved for European settlers and Africans were not allowed to undertake particular activities or to move freely to certain areas. Farmers were taxed either directly through head taxes or indirectly by keeping farm-gate prices artificially low. Certain colonial powers, in particular in Belgian Congo, went as far as to restrict Africans' access to higher education. At the same time, however, colonial powers did much to increase production and 'develop' their colonies, especially toward the end of the colonial era, so that the colonial experience is more than a large scale application of the 'beggar thy neighbor' approach.

Some continue to blame external interference for Africa's failures since independence. It is nevertheless difficult to find strong evidence linking the poor economic performance of Africa to plundering and looting by foreign powers, either directly or through the modern descendants of chartered companies, the multinationals. There are indeed very few multinationals operating in Sub-Saharan Africa and the countries in which they operate, such as South Africa, tend to be wealthier. If anything, it is plundering and looting by African themselves -- assisted or not by foreign powers -- that have received much attention lately. Whatever the balance of internal and

external responsibility in the historical record in Africa, it remains that plundering and looting were certainly not the main engines of growth behind the extraordinary performance of nearly all newly industrialized countries in the last 50 years or so. While efforts to (mis)appropriate rents undoubtedly played a role in slowing growth in Africa, the point we want to emphasize here is that Africa as a whole cannot realistically grow by taking away from others.

Regarding price fluctuations, certain countries, like Nigeria and Gabon for instance, have been bestowed unheard of -- even if temporary -- wealth as the result of increase in oil prices. But as a whole, Africa's terms of trade have deteriorated since the mid-eighties (e.g., Humphreys and Jaeger (1989)). Furthermore, African countries have suffered great hardship as a result of commodity price fluctuations. The worst affected countries are those like Nigeria for which the price of their principal export increased a lot before collapsing suddenly. It is generally accepted commodity price fluctuations have largely contributed to Africa's problems and will continue to be a cause for concern until Africa diversifies its export base (e.g., Collier and Gunning (1999)).

Cartel formation and monopolistic practices have played a role in a few instances but their effect on Africa's growth has probably been minimal. For a while, African oil producers benefitted from the formation of OPEC, but other African countries were hurt in the process. De Beers has a dominant position in the world market for diamonds and is known for monopolistic practices that have benefitted South Africa and, possibly, other African diamond-rich countries . Producers of other primary commodities, like coffee and cocoa, attempted to form a cartel but failed to effectively control production. To summarize, elementary engines of growth have had a marked effect on the performance of African economies but they have failed to generate sustainable growth. In fact, more often than not, Africa has been penalized by the various forces that redistribute international prosperity without generating potential Pareto gains.

Section 2. Static Engines of Growth

We continue with models that see growth as springing from the removal of barriers to economic efficiency. We examine three basic concepts: putting idle resources to work; allocative efficiency; and comparative advantage. These concepts differ from the elementary engines of growth discussed in Section 1 in that a modification of the structure of production is required to generate an increase in prosperity. But they share the common feature that they are conceptually static. Most of these ideas were initially developed in the 19th century. Their current mathematical formulation still constitutes the workhorse of policy design and has been extremely influential, especially in the last decade or two. These arguments are also at the heart of all structural adjustment programs.

The simplest static engine of growth is putting idle resources to work. According to this approach, underdevelopment manifests itself by the existence of idle resources in the economy. Growth is achieved by putting unused resources to work, hence moving the economy closer to its production possibility frontier. Unused resources can be put to work in a variety of ways. Mineral resources can be exploited and unused land can be developed and colonized by clearing unproductive vegetation, draining excess water, etc. The introduction of new crops and techniques of production like irrigation can help employ labor resources more effectively. As a result, people are put to work who were previously underemployed because, for instance, of the seasonality of agriculture. People who earn a meager living from unproductive activities can be given a proper job. Equipment and machinery can similarly be used to their full capacity. Doing so typically require the transformation of the organization of production, the rehabilitation of certain machines, and the provision of spare parts, fuel, and raw materials. Standard policy recommendations aiming at putting idle resources to good use also include the reduction of transportation costs so that isolated resources can find an outlet for their output.

These ideas were particularly influential during the colonial period, and colonial authorities

liked to portray themselves as developing their colonies by putting idle land and labor to work. The construction of roads and railroads in Africa was seen as an outlet for idle labor, a 'vent-for-surplus' as Myint (1958) put it, and it is often seen as a major force behind the growth that took place during the early years of colonization (e.g., Hopkins (1973)). The same idea is behind programs to 'rehabilitate' African countries or enterprises, like, for instance, plans to revamp Ghana's gold mines and cocoa farms as part of structural adjustment.

While putting idle resources to work can undeniably increase prosperity and generate growth, it is evident that it cannot do so indefinitely: once all resources are fully employed, i.e. once the production possibility frontier has been reached, other sources of growth must be found. One such source is achieving allocative efficiency. It is widely acknowledged among economists that welfare can be increased by allocating resources to the production of what the population wishes to consume. The question is: how can an economy be producing the wrong kind of goods in the first place? After all, if consumers do not want something, there will be excess supply, and if they want something that is not available, there will be excess demand. Relative prices should adjust, signaling to producers that they should produce more of one good (since it is more profitable), and less of the other. Even if producers fail to respond to price signals, the economy should still adjust, albeit more slowly, as firms with low or negative profits shrink and close down, while firms with high profits expand. How then can allocative efficiency not eventually be achieved?

Governments are the usual suspect because they have the means and, often, the inclination to distort prices -- i.e., through differential taxes, rationing, or price controls. As a result, the policy recommendation that naturally comes from focusing on allocative efficiency is to eliminate all price distorsions and reduce the role of the government. One cannot but suspect that conservatives were drawn to the allocative efficiency argument not so much because they were seduced by its mathematical elegance but because they were sympathetic to its unexcapable policy con-

clusion: get prices right, roll back the state, and privatize. Yet, although it is clear that allocative efficiency can improve social welfare, it is hard to see it as an important long term engine of growth: once allocative efficiency has been achieved, growth stops. Moreover, country estimates of welfare gains from static allocative efficiency seldom exceed a one-off increase in GDP of a few percentage points -- nothing to get crazy about (e.g., Dervis, de Melo and Robinson (1982)).

A third static source of prosperity can be found in trading with others. The idea that trade can be mutually beneficial is one of the most powerful ideas in economics. It was most convincingly put forward first by Ricardo in the 19th century and has given birth to an entire body of economics -- trade theory. Ricardo's argument is extremely simple: countries should produce what they are good at producing, sell it abroad, and use the proceeds to import what they cannot easily produce themselves. By producing according to their comparative advantage, countries achieve a higher level of social welfare.

A question immediately arises: what could prevent an economy from taking advantage of gains from trade? Local producers, if faced with international relative prices, should realize that it is in their interest to produce more of what the world wants. As in the case of allocative efficiency, a country's failure to respect its comparative advantage is usually blamed on government's tampering with international trade, through tariffs, subsidies, foreign exchange controls, quotas, and other forms of distorsions. Lack of infrastructure is also occasionally identified as a reason why the comparative advantage of a country or region is not exploited. Considerations of comparative advantage thus dictate the removal of trade distorsions and the establishement of commercial infrastructures and institutions. There are strong similarities between the allocative efficiency and the comparative advantage ideas, both in the logic of their argument -- reliance on price signals, static view of the world -- and in their policy implications -- get prices right, less state. It is therefore not surprising that they are often used simultaneously and interchangeably.

There is no doubt that static engines of growth go a long way in explaining the African experience. The 'vent-for-surplus' idea rationalizes part of the success of colonial efforts to open up new areas to commercial agriculture and mining. Exploiting Africa's comparative advantage in the production of certain primary products and achieving gains from trade in the process was the primary engine of growth during the colonial era (e.g., Hopkins (1973)). African governments' inability or unwillingness to further expand primary commodity exports after independence and other allocative inefficiency generated by distortive government policies have been blamed for Africa's slow growth, leading some observers to call for for a resumption of the colonial emphasis on Africa's static comparative advantage, which is still in the production of minerals and tropical crops (e.g., The World Bank (1981)).

Still, it should be obvious that comparative advantage and allocative efficiency cannot be a long term engine of growth and cannot account for the long-term growth of developed economies. Opening a new continent to trade, as was achieved by the colonization of Africa, can generate significant prosperity (particularly for those who control new trade flows), and it may take some time, e.g. 20 to 30 years, before new opportunities for trade have been taken advantage of (e.g., Hopkins (1973)). But comparative advantage must eventually run out as an engine of growth: once all gold and copper is being mined, and all suitable land has been planted to cotton, coffee, and cocoa, comparative advantage can no longer raise social welfare.

None of the three static engines of growth discussed above -- putting idle resources to work, achieving allocative efficiency, and taking advantage of gains from trade -- can explain the continuous and dramatic improvement in standards of living that has taken place in the West over a long period of time. They would even be harder pressed to explain the rapid growth experiences of newly industrialized countries. Yet these ideas, in one form or another, have had an enormous impact on policy makers, to the point where they permeate nearly all policy documents produced by donors and international organizations and constitute the intellectual backbone of

all structural adjustment programs. What the above discussion makes clear is that structural adjustment cannot, by itself, be a long-term growth strategy.

Section 3. Accumulation of productive resources

We continue our search of an explanation for economic growth and turn to ideas and models that take a dynamic view of the world. The simplest ones insist that growth is the result of an accumulation process: output is increased, it is argued, because more productive resources are made available for production. In this section we focus on two types of accumulable productive resources: physical equipment and machinery; and human capital. Before doing so, we also say a few words about population.

Population growth is a somewhat tautological engine of growth: an economy that counts more workers nearly by definition produces more output. The problem, as originally emphasized by Malthus, is that some essential factors of production such as land are only available in fixed quantity. As a result, standards of living are bound to decrease as the productivity of additional workers falls. This principle thus predicts that increased population leads to negative growth per capita. The typical policy recommendation that follows from this line of argument is to reduce human fertility rates before population increase leads to a food crisis (e.g., Ehrlich (1968)).

The Malthusian view of the world has long had a strong influence on policy circles. It is nevertheless largely contradicted by the facts: rapid population growth in the world has not been concomitant with the kind of decrease in food availability that doomsday prophets have predicted (e.g., Bailey (1995)). It also fails to recognize that population growth triggers investment in infrastructure and technological innovation that may, in the long run, be beneficial (e.g., Boserup (1965)). Besides, developed countries did not become prosperous by reducing their population to raise returns to land per person. Population control is not a substitute for a development strategy.

Physical capital

A much more serious explanation for long-term growth is the accumulation of machinery and equipment -- often called physical capital. It has long been recognized that the accumulation of capital is a key feature of the industrialization process, and that it is necessary for growth to take place. As the number of pieces of machinery and equipment per worker increases, workers' productivity goes up so that output per worker -- and thus consumption per head -- increases. This simple, common sense observation forms the basis of what is called neo-classical growth theory.

Although more convincing that the short-term theories discussed so far, the simple accumulation of capital cannot account for long-lasting growth either. The reason is that too much equipment per worker saturates them. Think, for instance, of how many shovels a worker can use at a time. As Solow (1956) and other growth theorists have clearly demonstrated, an economy whose sole engine of growth is the accumulation of physical capital eventually stops growing: it reaches a point where the returns to an additional unit of capital fall so low that it is no longer profitable to add new equipment and machinery (e.g., Lucas (1988)). These ideas can easily be illustrated as follows. Let k be the stock of capital per head. Output per head y depends on the available stock of capital, i.e., $y = f(k)$. Suppose, for simplicity, that people save a constant proportion s of output and that the capital stock depreciates at a constant rate λ. The net addition to the capital stock is equal to savings minus depreciation, i.e., $\dot{k} = s\, f(k) - \lambda\, k$. Clearly, if savings is larger than depreciation, the stock of capital increases, and vice versa. Now, returns to additional units of capital per worker fall as the stock of capital gets large. Formally, this means that $\frac{\partial f(k)}{\partial k} < 0$: the function $f(k)$ is concave. Consequently, there must be a point k^* at which $s\, f(k)$ intersects the line $\lambda\, k$: at that point, savings exactly equals depreciation and growth is zero. For any capital stock above k^*, savings is insufficient to cover capital depreciation, so that the capital stock per worker decreases and growth is negative. For any capital stock below k^*, growth is positive. The

economy must thus converge to k^*, at which point growth stops.[2]

Another implication of this model is that the rate at which the economy growths is higher at low levels of capital stock: the reason is that returns to the first units of capital are high. In more elaborate capital accumulation models of growth in which the assumption of a constant savings rate is relaxed, poor countries are predicted to grow even faster because high returns to capital -- i.e., high interest rates -- trigger high rates of saving (e.g., King and Rebelo (1993)). The capital accumulation model of growth thus predicts that poor countries -- i.e., countries with little capital -- should grow faster than rich countries. This hardly seems to be the case (e.g., Pritchett (1997)). The theory also predicts that countries where people are unwilling to save, i.e., where s is small, will converge to a lower k^* and will forever remain poor (e.g., Lucas (1988), Jones (1997)). In this framework, if Togo is poor, it is because its people are unwilling to save enough to become rich.

Although by the own reckoning of neo-classical growth economists capital accumulation alone cannot account for continuing growth in developed countries, it has been used extensively in empirical and policy oriented work. The policy recommendations that come out of neo-classical growth theory are to encourage savings and investment at large. In principle, the theory is indifferent as to whether the accumulation of capital is done by private individuals or by the state. In practice, however, neo-classical theory has been widely used to justify policies that favor private accumulation, for instance by refraining from taxing returns to investment. Deviations from an exclusive focus on private investment are allowed only for large investments that have a public nature and the typical policy recommendation is to promote the public provision or subsidization of key infrastructures.[3] The establishment of industrial parks may also be favored

---

[2] To be technically correct, convergence to a constant steady state requires that, in the limit, returns to labor fall sufficiently close to zero. Jones and Manuelli (1990), for instance, construct a capital accumulation model of never ending growth in which marginal returns to labor are bounded from below.

[3] Policy intervention is justified by the public good nature of most large infrastructures. Whenever discriminatory pricing is not feasible or is costly to administer, the builder of public infrastructure may indeed be unable to capture all the economic rents generated by the investment. This results in underinvestment in infrastructure, even if all there are no other distorsions in the incentives to invest.

to reduce the cost of providing infrastructure to industries. All these recommendations naturally follow from the assumption that growth is simply due to capital accumulation, which is non-sensical since most neo-classical theorists themselve recognize that the accumulation of capital cannot by itself explain the growth of developed countries (e.g., Solow (1957)).

Human capital

Exclusive emphasis on the accumulation of physical capital has come under criticism. Some, like Schultz (1961), have pointed out that education and skills are complementary to physical capital: new skills and higher education are required for workers to make effective use of more powerful pieces of equipment and machinery. Recent empirical work has tended to confirm Schultz's claim that human capital plays an important role in growth (e.g., Barro (1991), Mankiw, Romer and Weil (1992)), so much so that human capital accumulation has become the latest fad in growth theory. Because people often find it difficult to borrow against future earnings, individuals may underinvest in education, thereby slowing aggregate growth. For this reason, the policy recommendations that come out of emphasizing the role of human capital accumulation in growth typically revert around promoting and subsidizing education. To the extent that firms cannot charge workers for on-the-job training, it may also be advisable to help unexperienced workers get their first job and acquire vocational skills.

Although, like physical capital, the accumulation of human capital is clearly a key ingredient of growth, it cannot any more than physical capital account for continuous and rapid improvement in standards of living. The reason is that people do not live forever, so that each generation must go back to school. Adding years of schooling subtracts from the time each worker spends in the labor force, so that there is a limit to the number of years of schooling that can profitably be accumulated in any given society.

Growth theories based on physical and human capital are implicitly based on the idea that growth is due to the accumulation of more of the same. Although neo-classical growth theory

recognizes the role of technological innovation in long term growth, it treats it as an exogenous force that bears no direct relationship with the accumulation of physical and human capital. Neo-classical models of growth, with or without human capital, all predict harmonious growth: given enough time, and except for differences in tastes and natural resource endowments, all countries are expected to naturally and rapidly converge to the same level of well-being. The models also predict high rates of growth in poor countries, since returns to initial units of physical and human capital should, according to the theory, be very high.

Since capital accumulation is speeded up when national income and savings are higher, accumulation can be maximized by putting idle resources to work, achieving allocative efficiency, and taking advantage of gains from trade. The policy prescriptions derived from the neo-classical theory of growth are thus often combined with recommendations based on the static arguments reviewed in the previous sub-section. The combination of these theories offers the intellectual advantage of being internally consistent, since they all rest on the same assumptions of constant returns to scale and perfect competition. The scope of policy intervention is limited to a few areas where market may not work perfectly: infrastructure, education, and vocational training. For the surplus, the neo-classical theory of growth provides no theoretical justification for industrial policy. Market incentives are assumed to direct investment in the most profitable activities, so that distorsions of relative prices by government intervention are strongly discouraged.

At a superficial level, events in Africa appear to confirm explanations of growth based on the accumulation of productive resources. Low levels of infrastructure, physical capital, and education are often presented as explanations for Africa's plight. But Africa's failure to conform with the more fundamental predictions of the model -- i.e., smooth and rapid convergence in standards of living -- is not interpreted as an indictment of the theory, but rather as an indictment of Africa itself. Since the theory says that poor countries should rapidly converge to OECD levels

of per capita GDP provided that they are thrifty enough to accumulate capital and go to school, Africa's failure to grow is attributed to the "African dummy" effect. Either Africans are happy the way they are: they do not wish to save, go to school and grow like, say, the Taiwanese did. Or their governments are too stupid, too corrupt, or both: the distorsions they have introduced in their economies is what prevents them from growing.

To those familiar with the African scene, such attempts to salvage the theory at the expense of an entire continent are totally unconvincing. It is true that some Africans are too poor to save and go to school. It is also true that some African governments have launched ruinous social experiments, and that many are corrupt. But not all the governments of the 50 or so African countries have been mistaken and corrupt all the time, and the great majority of Africans save and make incredible sacrifices to send their kids to school. Besides, prosperous countries of today seem to forget that, not so long ago, they were quite corrupt and yet growing rapidly anyway; simply think of the U.S. in the first half of this century. The truth is that Africa's failure is the failure of neo-classical growth theory.

Section 4. Increasing Returns and Poverty Traps

An alternative to neo-classical theory is to drop the assumption of constant returns to scale and to acknowledge the existence of increasing returns. Authors who have taken this approach have been able to show that, under certain circumstances, an economy may be 'stuck' in a poverty trap (e.g., Nurkse (1953), Murphy, Shleifer and Vishny (1989)). Because consumers are poor, the argument goes, market demand is small and the benefits from increasing returns cannot be achieved. Optimal size plants cannot function at full capacity and productivity remains low. In this section, we scrutinize these arguments more in detail.

Increasing returns to scale

Marshall, the father of neo-classical economic theory, was one of the first to formalize the

concept of increasing returns internal to the firm, what he called increasing returns to scale. Some things, he argued, are cheaper to produce in large numbers. Marshall recognized that the existence of increasing returns is incompatible with perfect competition because firms are likely to be large and to act strategically. For one thing, increasing returns to scale tend to advantage established firm. To see why, suppose a firm already produces something in large numbers. Its cost of production is low. Now consider a newcomer without established market who can initially produce and sell, say, a smaller quantity. Since its cost is higher than that of the established firm, the newcomer is at a disadvantage. If forced to sell at the same price as the established firm, its profit will be lower, possibly negative, and it may fail to expand or even survive.

In the presence of increasing returns to scale, small, new producers in underdeveloped countries are expected to face serious difficulties when they try to compete with established firm in the developed world. Partisans of this view would argue that a start-up car manufacturer in Africa, for instance, would find it extremely hard to go up against the General Motors and Toyota's of this world. Extrapolating this idea to the level of an entire economy, a country that has no established industries may hesitate to initiate industrialization if it is forced to compete with developed nations. If it tries anyway, chances are it will fail. Undeveloped countries, the argument goes, may thus be trapped in their undeverlopment. Only a massive investment program or 'Big Push' may prove sufficient to prop the economy above the minimum economic threshold below which it cannot compete with established economies (e.g., Rosenstein-Rodan (1943)).

The argument has been refined in many different ways. One school of thought, represented most vividly by the Economic Commission for Latin America in the 1960's and 1970's, advocated an import subsitution strategy to palliate what is perceived to be unfair competition from established firms in the West (e.g., Prebisch (1963)). The idea was that, by protecting their domestic market from international competition, developing countries help their infant industries

grow and prosper. Import substitution strategies were widely adopted in Africa in the 1960's and 1970's but they failed to deliver sustainable industrialization (e.g., Steel and Evans (1981)). Some argued that the failure of import substitution is due to the fact that countries are too small and people are too poor. While an import substitution strategy is perhaps feasible for large countries like India, Brazil and Nigeria, it could achieve little in most of Africa because African domestic markets are too narrow; consequently, local firms are unable to reduce their average cost sufficiently to be internationally competitive. For this reason, some see African economic integration as a way to establish protection for domestic industries at the regional level and thus to salvage the import substitution idea.

Start-up costs and learning by doing

A variant of the increasing returns idea insists that it is not so much returns to scale in everyday production that are problematic, but rather the existence of large sunk costs to initiate production. Think, for instance, about the enormous costs of developing a new computer chip or of setting up a network of car dealerships. Even if the production of the car or chip are characterized by constant returns to scale, the existence of large sunk costs is sufficient to discourage many potential entrants, particularly from poor countries. A related idea is that, over time, a firm and its workers get better at producing something and can produce it more cheaply, i.e., that there is learning by doing (e.g., Arrow (1962), Stokey (1988), Young (1991)). Learning-by-doing may also be present in marketing, product design, industrial organization, etc.

The typical policy implication that follows from the existence of start-up costs and learning by doing is to subsidize new investment, e.g., through tax holiday, or subsidized credit. It may also be useful to subsidize exports and to protect the domestic market for a while, that is, until infant industries can compensate their initial disadvantage. That these ideas are pervasive can be seen in the fact that virtually all developing (and developed) countries have some form of investment tax break in their investment code, and many have experimented with various forms of

trade protection and promotion.

These policy implications have nevertheless come under virulent attack from neo-classical economists, to the point that one may talk of a 'war of religion'. The truth is that neither side has genuinely tried to assess whether or not start-up costs and learning by doing are an impediment to investment in underdeveloped countries. Each side of this debate has tended to stack up hastily collected evidence in its favor and to dismiss as erroneous and biased any evidence collected by the other side. As a result, little scientific progress has been made.

A bit of common sense may, however, come to the rescue. It is true that setting up a business is difficult, every business person will tell you that. But if established firms had such a strong advantage over newcomers, we would observe very few newcomers even in developed economies where competition with established firms is the fiercest. Yet thousands of new firms pop up every day. On the other hand, if it was easy to successfully challenge established firms, we should observe very few old enterprises. Yet we do. The situation must therefore be an intermediate one in which established firms are at an advantage, but can be successfully challenged.

Drawing further from what we can observe in developed economies, we note that there are differences across industries: while there is little new entry in airplane manufacturing, there is a much larger turnover of enterprises in, say, small retail outlets and restaurants. One should therefore refrain from generalizing: the potential usefulness of infant industry protection is likely to vary drastically across sectors of economic activity. Finally, casual observation suggests that, at least in certain industries, innovation appears to be a prerequisite for successfully challenging an established firm. Challengers often come up with a new product, or a new way of selling it, so that they do not operate with the same average cost curve as existing firms, but with a lower one. Viewing firms' cost curve as static may thus be misleading as it ignores the role of innovation. We revisits this issue further below.

Gains from specialization and other spillovers

Other authors have indicated that it is not so much increasing returns and sunk costs at the level of individual firms that matter, but rather symbiotic relations between firms. Since Adam Smith's pin factory parable, economists have been aware of the existence of gains from specialization. As markets expand, tasks previously carried out jointly get separated and become undertaken by specialized firms or individuals. Specialization enables these firms and individuals to capture learning-by-doing effects: they become very good at what they do.

Firms that operate in an economy with lots of specialized providers of goods and services can subcontract these activities to outsiders and focus on their main business. Just picture all the industrial services that are available in a large U.S. city: subcontractors for technical parts and inputs; financial services and stock brokers; commodity brokers; wholesale and retail services; warehousing and transport; legal, technical and commercial advising; auditing; product design; repair and maintenance; safety and security; publishing and media; advertising and public relations; communications; and utilities, to name a few. Whenever these specialized goods and services are not available, firms must produce them themselves. Not only is this a source of distraction for the management, it also raises average production costs in the economy because gains from specialization are not captured.

Other sources of spillover come from the existence of an experienced and diversified labor force. In large developed economies, it is easier for individual firms to identify and hire workers who are already familiar with their own equipment and procedures. Workers acquire skills and experience that they take with them to subsequent jobs, thereby indirectly benefitting their new employer. In contrast, firms operating in undeveloped countries must make do with inexperienced workers who are unfamiliar with their equipment and mode of organization. They may even encounter problems with work ethics (e.g., absenteism, pilferage). The resources they spend training and supervising workers add to their production costs.

Gains from specialization and other spillovers are examples of pecuniary externalities, that is, of cost advantages firms enjoy from operating in a larger, more sophisticated economy. They are externalities because individual firms do not capture the full benefit of the cost advantages they generate for others. An employer who trains a machine operator does not, for instance, capture all the return to his investment: the worker can cash in his acquired job experience by joining another firm at higher pay. They are called pecuniary because they operate through market transactions, that is, the purchase of goods and services and the hiring of workers. The typical policy recommendations that follow from the existence of spillover effects among industrial and service firms are not very different from the Big Push argument: a critical mass must be achieved for gains from specialization and labor market externalities to materialize (e.g., Rostow (1956)). To achieve it, it may be necessary to subsidize industry.

Some economists, following the work of Hirschman (1958), argue that spillover effects are stronger within certain groups of industries. Using evidence on what firms buy from and sell to each other, which they call backward and forward linkages, they claim they can actually identify where spillover effects are strongest and what clusters of industries have the strongest spillovers. Based on evidence of backward and forward linkages, they recommend that policy support be targeted to those clusters of industries that are closely linked, instead of sprinkling support thinly over all industries. Once a viable industrial cluster has been established, these authors recommend to move on to another one: industrial policy is perceived as an essential part of development planning, and optimal sequencing is part of industrial policy.

Needless to say, not everybody agrees with these views, even among those who insist on the necessity to support infant industries. Targeting, sequencing and fine tuning in general -- usually known as 'industrial policy' -- are seen by many as too good to be true. Even strong believers in spillover effects like Jacobs (1969, 1984) point out that nobody has the information required to identify where spillovers are strongest, and that the linkages between industries that are apparent

in input-output matrices only scratch the surface and miss on many decisive yet imperceptible interactions. In spite of these critiques, many governments, including that of Japan over the last 50 years or so, have explicitly targeted specific groups of industries, and have claimed to sequence their targeting in such a manner as to move up the scale of industrial sophistication over time. Detractors argue that these efforts were essentially futile and, in the end, counterproductive (e.g., The World Bank (1993)). The debate continues unabated.

To summarize, the models and theories discussed in this Section present convincing arguments that it is difficult getting started on the path of industrialization and growth, much more difficult than neo-classical growth theory makes it sound. Yet, although these arguments have been among the most hotly debated in the development and growth literature, they are strictly speaking not about the engines of growth themselves. The focus of the debate is rather on the catching-up process. All authors in this controversy implicitly agree that capital accumulation is the key to increased prosperity.

How relevant is the debate to understand the African experience? The existence of spill-over effects has most probably played an important part in explaining why Africa has found it difficult to join the world economy as an equal partner. Evidence from structural adjustment experiments, for instance (e.g., Steel and Webster (1991)), suggests that opening Africa to garment imports exposes domestic industries to unbearable competition from low cost producers in East and South-East Asia. On the other hand, industrial protection in Africa does not appear to have helped infant industries 'grow up' and compete on international markets. The poverty trap is there alright, but the medicine the doctor ordered does not seem to be working. Could the ailment have been misdiagnosed? To this we now turn.

Section 5. Technological Change and Innovation

Technological change has long been recognized as an essential ingredient of growth. It is clear to almost everyone that standards of living in developed countries could not have increased

the way they have over the last 200 years if it had not been for technological change. There is little doubt that it is the scientific revolution, that is, the application of science to technology not only in industry, but also in agriculture, medecine, and services, that is responsible for the remarkable achievements of the last 200 years.

If technological change is the most important engine of growth, economic development then can be seen as a modernization process, that is, as an historical transformation by which an undeveloped economy joins the scientific era. Technology transfer becomes the main requirement for this transformation to take place. The role of policy is then to speed up the transfer. The rapidity with which a country develops is attributed to the speed with which an economy absorbs modern technology and ideas. Failure to grow is interpreted as an unability to remove obstacles to progress and an unwillingness to join the rest of the world in celebrating the triumph of technology. Places that do not grow are perceived as being 'marginalized', as being left out on the wayside of global modernization.

Although most economists acknowledge the role of technology in growth, they diverge in what they see as the critical mechanism behind the invention process. They also give different interpretations to the relationship between economic forces and technological change. These differences shape the role they recognize for government in facilitating technology transfer and modernization.

Embodied technological change

Perhaps the most commonly held view of technological change is to associate it with particular pieces of equipment or machinery, e.g., the steam engine, the textile mill. Technological change is then said to be embodied in physical capital. In this case, new technologies can only be accessed by accumulating capital. This implies that the accumulation of physical capital is the royal path to growth, not so much because more of the same equipment makes workers more productive, as neo-classical models implicitly assume, but because the new equipment is more

productive than the old. Technological change also makes it possible for workers to use larger and more powerful pieces of equipment. Piling up shovels on a single worker, for instance, does not increase labor productivity; but switching from shovels to a bulldozer does. Without the invention of bulldozers, the accumulation of capital does not go very far: little growth can be achieved by accumulating shovels alone.

Not only does technological change increase the productivity of labor, it can also increase the productivity of capital. To see why, consider the evolution in personal computers: one can buy today a piece of office equipment that is many times more performant that what the same amount of money would have bought five, ten or fifteen years ago. As a result, university professors, say, can increase their output $f(k)$ without changing their computer budget k: progress in computer technology shifts $f(k)$ upward.

One does not have to be an economist to see that there is a lot of truth in the idea that many technological innovations are embedded in physical capital. From the point of view of a developing country, the issue of technology transfer then becomes one of importing up-to-date equipment and machinery. An immediate logical implication is that governments which want to speed up growth should facilitate technology transfer by subsidizing imports of machinery and equipment.[4] Furthermore, the adoption of modern methods of production usually requires a new organization of the production process -- e.g., larger firms, different shop floor arrangements.

[4] This view does not entirely go unchallenged, however. Some economists have argued that modern pieces of equipment and machinery designed in developed economies are not appropriate for developing countries because they are not adapted to their relative scarcities of capital and labor. Switching from the shovel to the bulldozer is too much of a jump, they argue. More appropriate technologies are needed that recognize the relative cheapness of labor in poor countries and allow for intermediate amounts of capital per worker k. They recommend that governments and donors should subsidize the search for technologies that are appropriate for undeveloped countries.

Although the idea sounds appealing, the payoffs to this type of research are uncertain. For one thing, many intermediate technologies have already been developed ... one hundred years ago, when the capital labor ratio in the West was lower -- e.g., the ox plow, the horse carriage, or the water mill. It is unnecessary to invent them again; all one has to do is to dig for old blueprints. Second, much intermediate technology is already available for sale. Many African manufacturers, for instance, use second or third hand equipment purchased from the West or from other Third World countries that are a little bit more advanced than themselves. Although antiquated pieces of equipment tend to break down often and are difficult to service, they are nevertheless sufficiently productive to discourage the production of new outdated equipment. This makes the development and manufacturing of intermediate technology quite problematic.

Reorganization may have to be repeated to take advantage of ever changing technologies. This idea has been used to argue that growth can only be achieved by private firms because they are more flexible and thus more efficient at constantly reorganizing themselves.

Using modern equipment and machinery often requires better trained workers. Human capital accumulation is thus a complement to physical capital and a necessary condition to access new technologies. Although primary and secondary education seldom provide vocational skills that are immediately applicable on the factory floor, they foster a modern outlook and make workers more adaptable. It is therefore not surprising that numerous studies have shown there exists a positive relationship between economic performance and education (e.g., Mankiw, Romer and Weil (1992), Barro (1991)). Indeed, a country could not grow for long if it ran short of educated manpower. Although this evidence has led many to conclude that primary and secondary education should be the primary focus of government policy, it should be clear that an educated workforce is essentially useless if it is not combined with modern equipment and machinery.

New consumer products

Not all technological change takes the form of new capital equipment, however. Some innovations translate into new consumer products, like the automobile or the television. These new products are occasionally used as production inputs and thus constitute cases of embodied technological change as well, but new consumer items make a separately identifiable contribution to improved standards of living. Try to imagine life without automobiles or telephones!

An immediate policy implication is that undeveloped countries can improve the welfare of their population by acquiring new products invented elsewhere. They can import them already made, or copy them through reverse engineering and produce them themselves (e.g., Grossman and Helpman (1991)). Copying raises delicate copyright issues that we shall not go into. What is obvious, however, is that the vested interests of developed countries where most of the inventing

is done differ from those of industrializing countries where the copying is done. Most of Africa, however, has not yet reached the point where the copying by local manufacturers of products developed elsewhere has become a bone of contention with Western countries.

It is now increasingly recognized that a significant share of the welfare gains from new and improved products is not counted in GDP statistics. Think of home computing, for instance. Home computers are much more powerful today than 15 years ago, and the enjoyment one gets from them has undeniably increased. Because home computer prices have essentially remained unchanged, however, this increased welfare is not adequately reflected in GDP growth. Similarly, when African consumers buy imported electronics, their enjoyment is not counted as development, yet it is their way of partaking in the global increase in standards of living. The same thing can be said of drugs and medical services: their constant improvement is not counted in standard indicators of growth. Yet they make a very significant contribution to human welfare, as evidenced by increased life expectancy and the like. There is, thus, an important dimension of African modernization that does not appear in the disappointing GDP growth performance of the continent.

Knowledge

Not all technological change is embedded in new capital equipment or new consumer products. Some also take the form of public or private knowledge. Private knowledge like know-how or patents typically belongs to firms in developed countries and is is not directly accessible by firms elsewhere (e.g., Romer (1990)). Knowledge can also be public and non-excludable. Scientific knowledge is perhaps the best of example of publicly accessible knowledge. Even at the height of the cold war, Russian and American scientists continued to publish results from their medical, biological and physics research in professional journals. Any African scholar provided access to a good library can read about the latest scientific discoveries.

The problem is that few Africans have a level of technical expertise sufficient to make use of information published in academic journals to generate technological innovations. Only laboratories and research institutes outfitted with modern equipment can turn publicly available scientific knowledge into tangible products or processes. Other forms of publicly available information similarly require equipment to access it. One cannot, for instance, access one of the most exciting technological innovation of the last few years, the internet, without computer and communication equipment.

To the extent that the accumulation of knowledge is an essential factor behind the ever increasing prosperity of advanced economies, it is unlikely that poor countries can attain commensurate levels of prosperity without tapping into the same stock of knowledge. However, unlike advanced economies that cannot grow without generating new knowledge, poor countries can grow simply by applying existing knowledge to their own economy. In other words, they can grow by catching-up with more advanced countries. As is clear, catching-up does not necessitate the generation of new knowledge; it simply requires the adoption of existing knowledge and its adaptation to local conditions. Typical policy recommendations for filling the knowledge gap emphasize subsidizing local research; sending students and scientists abroad for study; focusing on the local adaptation of fundamental research performed elsewhere to save on research costs; and favoring joint research with developed countries.[5] Grants of information related equipment are also frequent. If the private knowledge of firms located in advanced economies is essential for catching-up, developing countries also have to attract investment by such firms, either directly or through joint-venture agreements.

---

[5] High levels of training need not, by themselves, do the trick. Unless properly funded research institutions are created locally, scientists sent abroad to upgrade their skills often find it both more profitable and more fulfilling to seek employment in the research establishment of developed countries.

Innovation and Schumpeterian competition

So far, we have treated technological change as manna from heaven and discussed it as if the only question was how to transfer new technologies to developing countries as quickly as possible. Some economists, however, take a less benign view of technology. It is not so much that they have a different conception of what constitutes technological change, but they insist that what matters is the process by which new scientific knowledge is transformed into new products and techniques of production.

The most prominent thinker in this school of thought is Schumpeter (1961). According to his view of the world, firms compete with each other not so much through costs and prices, as portrayed in neo-classical theory, but through product and process innovation. In a Schumpeterian world, private invention is the driving force behind technological change. Process innovation (reducing production costs) provides a cost advantage to the inventor; product innovation (inventing a new product) procures a monopoly. Schumpeterian economists propose a dynamic vision of the economy in which individual innovation initially generates rents for innovators. These rents progressively erode over time as innovations are copied by other firms. Firms find themselves on a treadmill: in order to stay ahead of the competition, they must constantly innovate (e.g., Nelson and Winter (1982), Grossman and Helpman (1991), Romer (1990), Aghion and Howitt (1992), Aghion and Howitt (1998)). It is this process of constructive destruction that Schumpeter presents as the driving force behind growth and development and what he identifies as the mark of our time.

The Schumpeterian view of the world differs widely from the harmonious vision of neo-classical economics. In a dynamic world where products and processes change constantly, what is crucial is not to be at the point where marginal cost equals marginal revenue, but rather to keep innovating and stay ahead. Moreover, competition through innovation is virulent and potentially wasteful. Indeed, firms may overdevelop new brands and designs in order to differentiate their

products and lure consumers -- e.g., too many different brands of cars, breakfast cereals, and pharmaceutical products. Yet, according to a Schumpeterian view of the world, tampering with this process is a bad idea: reducing innovation rents can only discourage research and development and thus slow down growth. Unbridled capitalism, they argue, is the only economic system that can deliver maximum innovation, and thus the system a country must choose if it wishes to stay ahead of other nations. The typical policy recommentation that comes out of this vision of the world is to encourage and protect innovation through patent laws and the promotion of free enterprise.

Schumpeterian economics also recognizes a role for entrepreneurs; the future of the Third World is seen to depend on the quality and imagination of its business class. Entrepreneurs are conceived of as modern day heroes to be grown, like rice plants, in ’nurseries’ before being transpanted in the real world. African government are advised to nurture local business talents irrespective of their ethnic origin. Policies to weaken European or Asian business interests in Africa are seen as extremely damaging because they subtract from the local entrepreneurship capital. At the same time, racial and ethnic discrimination are seen as counterproductive because they reduce the pool of potential talents from which tomorrow’s entrepreneurs are drawn (e.g., Fafchamps (2000)).

Although Schumpeter was strongly opposed to any kind of government intervention, his thinking has convinced many that competition through innovation can be wasteful, that it generates excessive rents and that its most detrimental effects should be mitigated. Efforts by the World Health Orbanization to draw a list of essential pharmaceutical products, for instance, can be seen as an attempt to mimimize costs associated with excessive product diversification. Actions by countries like India and the former U.S.S.R. to limit the number of car types allowed on their soil can similarly be seen as an effort to countervail what was perceived as superfluous diversity.

Assessment

There is wide agreement among economists that technological change is essential for development and growth. To the extent that technological innovations are embodied in equipment and machinery, the accumulation of physical capital is a prerequisite for growth. Because sophisticated equipment can only be operated by skilled and educated manpower, modern capital can only be put to good use if the labor force is well trained. Neo-classical economists are thus right to emphasize physical and human capital accumulation in the growth process, but they are right for the wrong reason: what matters the most is not the quantity of capital *per se* but the technology that is embodied in it. Similarly, primary and secondary education *per se* generate nothing if they are not combined with sophisticated equipment and machinery. Furthermore, neo-classical theory misses out on certain crucial dimensions of technology, like product innovation and disembodied knowledge, and it ignores what motivates firms to innovate.

Taking a closer look at what technology is made of helps one realize not only that governments can help the transfer of technology but also that the transfer process is fraught with difficulties. One the one hand, the temptation exists to disseminate knowledge and know-how as widely as possible to speed up the catching-up process. On the other, Schumpeter argues, the absence of protection for innovators can only deter innovation. Some believe that a 'fine tuning' approach to development is feasible. Copying should be encouraged early on, when little true innovation is done locally. Patent laws can be enforced more vigorously later on once indigenous firms themselves have begun to innovate. This approach appears to be the one Taiwan and other NIC's have taken.

How do these concepts apply to Africa? First, it is obvious to even the most casual observer that, except for a few isolated cases, Africa is not making use of the most advanced methods of production available in the world. This is true not only in manufacturing, but also in agriculture, trade, banking, transportion, education, and government services. The scientific revolution is tak-

ing hold on the African continent, as progress in infant mortality and life expectancy demonstrate, but the rate at which productive activities are modernized remains slow. Africa's inability to apply much of existing scientific knowledge to production is certainly a tragedy for the millions of Africans who must continue living in poverty. But it also represents great promise for the future: should Africa finally tap into the opportunities opened by science, growth could be rapid and improvements in standards of living could be realized virtually overnight. What then hinders the modernization of Africa?

The reasons why Africa is not keeping up with modern methods of production are numerous, but they appear to have little to do with the absence of protection for domestic innovation and the lack of Schumpeterian entrepreneurs. Several factors are at work, most of which have been correctly identified by the theories that we discussed earlier. Because a major portion of technological change is embodied in equipment and machinery, Africa's inability to accumulate infrastructures and physical capital fast enough means that its access to technological progress is *de facto* restricted. This is why, some argue, Africa must to first export more primary products to generate the foreign exchange required for purchasing modern equipment abroad. Because vocational skills are required to take advantage of new machinery and methods of production, Africa is hurt by its lack of trained manpower, particularly in technical fields where few jobs are currently offered in which workers can accumulate technical expertise. The small size of African markets means that few specialized industrial services are provided, making Africa an unattractive place to operate in spite of low wages. This discourages foreign direct investment that could, in theory compensate for governments' inability to finance or subsidize local capital accumulation.

To summarize, many of the observations made by various strands of literature are correct in their prescriptions. But they often give the wrong reason why they should be followed. This can be very misleading. Realizing the importance of technological change and private entrepreneur-

ship in growth can help avoid serious mistakes. For instance, the accumulation of capital and infrastructure is, *per se*, ineffective if local technological capabilities are not upgraded. Modernization strategies cannot succeed unless enough foreign exchange is generated, initially through primary commodity exports, to finance imports of modern equipment and raw materials. The provision of education to large segments of the population remains a costly luxury if it is not accompanied by vocational training and an emphasis on scientific and technical skills. Enlarging markets and providing a supportive environment for business cannot bring rapid sustainable growth if it fails to attract foreign investment and technology.

Section 6. Agglomeration effects

So far we have regarded growth and development as a process that takes place essentially within each country separately. However, certain economists like Myrdal (1957), Jacobs (1984), or Perroux (1962) have long viewed growth as a global process. They insist that the performance of individual parts of the world, whether countries, states, or cities, cannot be understood in isolation from what happens elsewhere. They point out that within developed countries themselves economic activity is not spread evenly. Most industries and supporting services are concentrated in a few cities clustered in industrial basins (e.g., Krugman (1991)). The immense majority of counties in the U.S. and other developed countries have a trade structure similar to that of developing countries: they export primary products -- e.g., agricultural output, livestock, minerals, and fish -- and import manufactures and services. A few counties, mostly suburban neighborhoods, export labor. Others, like military bases, live from transfers from the rest of the nation. A tiny fraction of all counties export manufactures and services to the rest of the country.

The geographical division of labor that exists within industrialized nations is not too different from what prevails in the world as a whole: a few developed countries are responsible for the bulk of manufacturing and service exports, while the rest specializes in primary exports. This analogy has inspired several authors to suggest that certain economic activities have a

tendency to cluster geographically and that this tendency is reflected in the international patterns of trade (e.g., Krugman (1991), Young (1991)). Spatial clustering is attributed to a variety of agglomeration effects due to proximity. Positive feedbacks between firms may take the form of information contagion (e.g., Arthur (1990)). They may also result from pecuniary externalities discussed in section 3: the local provision of specialized industrial services and the local availability of a pool of qualified workers (e.g., Rodriguez-Clare (1996), Ciccone and Matsuyama (1996)).

If location externalities are important, the poverty trap arguments discussed in section 3 must be revisited in a new light. Once a city or region of the world has built a sufficiently large and efficient industrial base, pecuniary externalities among industries and supporting services put newcomers at a disadvantage. Fortunately for newcomers, industrial cluster sooner or later become overcrowded: higher land prices and wages drive costs up and eventually erode the gains from pecuniary externalities (e.g., Fafchamps (1997)). When this happens, there is a window of opportunity for newcomers.

The logic of the positive feedback argument nevertheless suggests that relocated industries are likely to cluster again elsewhere. At each window of opportunity, only a small number of newcomers can successfully industrialize. The gradual spread of modern economic activity across the world is thus not smooth. Instead, it proceeds from cluster to cluster, a bit like industries spread from Japan to Taiwan, Korea, Singapore and Hong-Kong, and then from there to Thailand, Malaysia and Indonesia, and then from there to mainland China and Vietnam -- before they reach other shores in the future. A similar process has been at work within Europe: England industrialized first, followed by Belgium, then Germany, then, in succession, France, Holland, Scandinavia, Russia, northern Italy, Israel, and northern Spain. The process is now spreading to Greece, Turkey, Central and Eastern Europe, and North Africa (Morocco, Tunisia, Egypt) (e.g., Morris and Adelman (1988)).

Geographical economy arguments naturally lead to their own set of policy recommendations. If countries and regions develop one at a time, developing countries can be compared to pretty maids all in a row: only the prettiest will marry the millionaire. To lure foreign investment and capture agglomeration effects, governments must put together support infrastructures and commit themselves to a pro-business attitude. This can be achieved by setting up export processing zones and other industrial parks, unveiling tempting investment codes, and promising the best tax holiday on the block. Positive advertising is part of the game, as infomercials in the *Financial Times* and the *Economist* regularly remind us. Announcing one's intention loudly and lavishly is also a way of attracting attention. Even if the time has not yet come for the next cluster of industrial activity to focus in one's country, it is possible to prepare oneself for the next window of opportunity by making sure that the local workforce is well trained, by setting up the basic infrastructure, and by building up international links with the research and business establishment.

Economic geography arguments add to our understanding of Africa's performance. Historically Africa has been penalized by its geographical isolation and paucity of navigable rivers (e.g., Braudel (1986), Hopkins (1973)). Advances in global communication and information technology and the reduced importance of sea transport in favor of air transport are likely to change the situation. Still, the absence of African NIC means that the geographical emulation process that has characterized other parts of the world has not yet started in Africa. The fact that the most prosperous economy south of the Sahara, South Africa, was until recently isolated from its neighbors by its abhorrent political system certainly did not help. On the bright side, patterns of geographical expansion elsewhere are likely to be replicated on the African continent. If economic growth indeed spreads by geographical convection, as the works of Ciccone (1996) and Hummels (1995) seem to suggest, all we really need to get things started is for a couple African NICs to take off and sustain double digit growth for a decade or so. Half a dozen countries are good candidates to foot that bill and in fact the process may already be underway (e.g., Biggs et al.

(1994)). The situation is still extremely fragile, however, and temporary setbacks are not only possible but likely. This makes 'picking winners' essentially impossible.

Conclusion

There are many views as to what is at the foundation of economic development and growth. Each of these views has some intuitive appeal and provides useful insights. Each also comes with a different set of policy recommendations. Can we ever figure out which of all these different arguments is true and which is not? Probably not: each of them contains an element of truth. It unlikely that these different views could be integrated in a single model of the world. Such a model would indeed be too complicated to be useful. In fact it would be nearly as messy as the real world itself! All we can realistically hope to accomplish is to combine these views at an intuitive level and use the insights they provide to guide policy.

A few key ideas nevertheless emerge from the literature. My own assessment of these ideas is as follows. Economic development is a process of modernization by which scientific principles are applied to the production of goods and services. It began with the industrial revolution in England and progressively spread from there. As more and more countries, a few at a time, achieve OECD levels of development, more and more resources are spent in the world turning science into progress. Since the frontiers of knowledge and technology are being pushed back by an ever increasing number of countries sharing the results of their research, growth in advanced countries speeds up; it is indeed faster now, over the long run, than it has ever been in the last 200 years (e.g., Romer (1986)).

The way by which poor countries can achieve standards of living comparable to those of rich countries is through catching-up. Catching-up is a process distinct from growth in developed countries. The key to catching-up is to copy and absorb technological improvements invented elsewhere and to emulate advanced economies (e.g., Gerschenkron (1962)). Due to agglomeration effects and pecuniary externalities, not all countries and regions can catch up at the same

time. In addition, catching-up seems to take place mostly by convection: geographical and ethnic proximity largely dictates who takes off next. In this respect, Africa is penalized by its isolation.

Given that economic activity is getting ever more mobile, competition among candidates for industrialization means that investors are attracted towards locations that provide the best environment. As a result, a rapid inflation seems to have taken place in the requirements that make a location attractive. While 50 years ago Japan might have lured American investors with cheap and docile labor, today's investors expect much more. The quality of the service proposed to potential investors now includes 'good governance' and 'market institutions' in addition to infrastructures and tax holidays. Like in soccer, the nature of the game evolves over the years. Growth strategies that would have been successful in the 1960's now fail to score.

Rapid growth is typically based on industrialization.[6] This is because industries and the services that support them are the forms of economic activities that benefit the most from agglomeration effects and modernization.[7] Returns to agglomeration in manufacturing are thus responsible for cross-country differences in trade patterns but also in growth performance. Because the potential for technological improvement is limited in primary exports but strong in industry and services, geographical locations that specialize in the former stagnate while the latter prosper (e.g., Young (1991)).

A geographical approach to international patterns of industrialization thus suggests that undeveloped countries or regions can attract internationally mobile capital and skills only to the extent that congestion drives production costs up in advanced regions (Fafchamps (1997)). Given that industrialization is characterized by increasing returns and gains from specialization,

---

[6] In the context of this chapter, industrialization should be understood to include modern services.

[7] Although the process of development is often described as one of industrialization, the distinction between industry, agriculture and services is misleading: what matters is the adoption of modern techniques of production. The prospects for increasing output through modernization differ across sectors, however. Although the productivity of agriculture and other primary sectors can be improved through investment and innovation, manufacturing and certain types of services are where the use of modern techniques of production yields the highest payoff, if only because there are no immobile factors of production.

not all undeveloped regions can industrialize at the same time: if a newly industrialized country has begun penetrating export markets, it gains a first mover advantage compared to other undeveloped countries. If the above interpretation is correct, absence of industrialization is the normal outcome, catching-up is the exception. Although more empirical work is required to ensure this interpretation is valid, it is worth pointing out that, historically, lack of industrialization and modernization has indeed been the norm for the overwhelming majority of the world's population, Africa included.

Poor countries unable to attract foreign capital to finance rapid industrialization can nevertheless harness some of the engines of growth listed in this chapter, such as allocative efficiency and the production and export of primary commodities and the import of manufactures. Becoming an efficient primary producer can generate growth for a while, but it is bound to run out of steam. Moreover, the well-being of primary producers remains sensitive to variations in commodity prices and the accumulation of external debt that invariably follows external terms of trade shocks. Primary producers nevertheless benefit from product innovation -- e.g, new vaccines -- in ways that are not adequately captured in standard measures of growth and welfare.

There is hope, however, because, as the gap between developed and stagnating countries keeps growing, there is more to catch-up on and catching-up, when it happens, takes place at an increasingly rapid pace (e.g., Fafchamps (1997)). Furthermore, the recent experience of Asian NICs indicates that things can change unexpectedly and rapidly. Based on this understanding of the processes at work in the world today, there is room for cautious hope concerning Africa.

In terms of policy advice, there is a violent contradiction between the neo-classical view of the world which priviledges a laissez-faire approach to government, and arguments based on increasing returns and pecuniary externalities, which recognize a role for industrial policy. This conflict has dominated the debate about Africa, the reasons for its lackluster performance, its economic future, and the role of structural adjustment. The contradictory policy recommenda-

tions that are peddled by each side of the debate are not dictated by scientific observation but rather are derived from different theoretical assumptions and opposing philosophical views of the world. For that reason, the debate is essentially a sterile and confusing one. I suspect that Africa will take off before the debate is resolved, and when it happens, each side will claim Africa's performance was best predicted by their model, as has been the case for East Asian NICs.

References

Aghion, P. and Howitt, P., ‘‘A Model of Growth Through Creative Destruction,’’ *Econometrica*, 60(2): 323-351, March 1992.

Aghion, P. and Howitt, P., *Endogenous Growth Theory*, MIT Press, Cambridge, Mass., 1998.

Arrow, K. J., ‘‘The Economic Implications of Learning by Doing,’’ *Review of Economic Studies*, 29: 155-173, June 1962.

Arthur, W. B., ‘‘‘Silicon Valley’ Locational Clusters: When Do Increasing Returns Imply Monopoly?,’’ *Mathematical Social Sciences*, 19: 235-251, 1990.

Bailey, R., *The True State of the Planet*, The Free Press, New York, 1995.

Barro, R. J., ‘‘Economic Growth in a Cross-Section of Countries,’’ *Quarterly J. Econ.*, 106, May 1991.

Biggs, T., Moody, G., Leewen, J. v., and White, E., *Africa Can Compete! Export Opportunities and Challenges in Garments and Home Products in the U.S. Market*, The World Bank, Washington, D.C., March 1994. RPED Discussion Paper.

Boserup, E., *The Conditions of Agricultural Growth*, Aldine Publishing Company, Chicago, 1965.

Braudel, F., *Civilization and Capitalism*, Harper and Row, New York, 1986.

Ciccone, A. and Matsuyama, K., ‘‘Start-Up Costs and Pecuniary Externalities as Barriers to Economic Development,’’ *J. Devel. Econ.*, 49(1): 33-59, April 1996.

Ciccone, A., *Externalities and Interdependent Growth: Theory and Evidence*, Department of Economics, University of California, Berkeley, October 1996. (mimeograph).

Collier, P. and Gunning, J. W., ‘‘Explaining African Economic Performance,’’ *Journal of Economic Literature*, 37(1): 64-111, March 1999.

Deaton, A. and Miller, R., ‘‘International Commodity Prices, Macroeconomic Performance, and Politics in Sub-Saharan Africa,’’ *Journal of African Economies*, 5(3): 99-191, October 1996. Supplement Part I.

Dervis, K., de Melo, J., and Robinson, S., *General Equilibrium Models for Development Policy*, World Bank, 1982.

Dollar, D. and Kraay, A., *Growth Is Good for the Poor*, Development Research Group, The World Bank, Washington, D.C., March 2000. (mimeograph).

Ehrlich, P. R., *The Population Bomb*, Ballantine Books, New York, 1968.

Elbadawi, I. and Schmidt-Hebbel, K., ‘‘Instability and Growth in the World,’’ *Journal of African Economies*, 7, Supplement 2: 116-168, 1998.

Fafchamps, M., ‘‘Ethnicity and Credit in African Manufacturing,’’ *Journal of Development Economics*, 61: 205-235, 2000.

Fafchamps, M., ‘‘Mobile Capital, Location Externalities, and Industrialization,’’ *J. Comparative Econ.*, December 1997. (forthcoming).

Gerschenkron, A., *Economic Backwardness in Historical Perspective*, Belknap Press of Harvard UP, Cambridge, Mass., 1962.

Grossman, G. M. and Helpman, E., ‘‘Quality Ladders and Product Cycles,’’ *Quarterly J. Econ.*, 106: 557-586, 1991.

Hirschman, A. O., *The Strategy of Economic Development*, Yale University Press, New Haven, 1958.

Hopkins, A. G., *An Economic History of West Africa*, Longman Group Ltd, London, 1973.

Hummels, D., *Global Income Clustering and Trade in Intermediate Goods*, University of Michigan, Ann Arbor, January 1995. (mimeograph).

Humphreys, C. and Jaeger, W., *Africa’s Adjustment and Growth in the 1980’s*, The World Bank and the UNDP, Washington, 1989.

Jacobs, J., *The Economy of Cities*, Random House, New York, 1969.

Jacobs, J., *Cities and the Wealth of Nations*, Random House, New York, 1984.

Jones, C. I., ‘‘On the Evolution of the World Income Distribution,’’ *J. Econ. Perspectives*, 11(3): 19-36, Summer 1997.

Jones, L. E. and Manuelli, R., ‘‘A Convex Model of Equilibrium Growth: Theory and Policy Implications,’’ *J. Polit. Econ.*, 98(5): 1008-38, October 1990.

Kanbur, R., *Income Distribution and Development*, The World Bank, Washington, D.C., January 1997. (mimeograph).

King, R. G. and Rebelo, S. T., ‘‘Transitional Dynamics and Economic Growth in the Neoclassical Model,’’ *Amer. Econ. Rev.*, 83(4): 908-931, September 1993.

Krugman, P. R., *Geography and Trade*, Leuven U.P. and MIT Press, Leuven and Cambridge, Mass., 1991.

Krugman, P. R., ‘‘Increasing Returns and Economic Geography,’’ *J. Polit. Econ.*, 99(3): 483-99, 1991.

Kuznets, S., ‘‘Economic Growth and Income Inequality,’’ *Amer. Econ. Rev.*, XLV(1): 1-28, March 1955.

Lucas, R. E., ‘‘One the Mechanics of Economic Development,’’ *J. Monetary Econ.*, 22: 3-42, 1988.

Maddison, A., ‘‘Growth and Slowdown in Advanced Capitalist Economies: Techniques of Quantitative Assessment,’’ *J. Econ. Lit.*, XXV(2): 649-698, 1987.

Maddison, A., *Phases of Capitalist Development*, Oxford University Press, Oxford, 1982.

Mankiw, N. G., Romer, D., and Weil, D. N., ‘‘A Contribution to the Empirics of Economic Growth,’’ *Quarterly J. Econ.*, CVII: 407-437, 1992.

Mkanawire, T. and Soludo, C., *African Perspectives on Structural Adjustment: Our Continent Our Future*, African World Press, Nairobi, Kenya, 1998. An IDRC-CODESIRA Publication.

Morris, C. T. and Adelman, I., *Comparative Patterns of Economic Development, 1850-1914*, John Hopkins University Press, Baltimore, 1988.

Murphy, K. M., Shleifer, A., and Vishny, R. W., ‘‘Industrialization and the Big Push,’’ *J. Polit. Econ.*, 97(5), 1989.

Myint, H., ‘‘The ’Classical Theory’ of International Trade and the Underdeveloped Countries,’’ *Economic Journal*, 68: 317-337, 1958.

Myrdal, G., *Economic Theory and Under-Developed Regions*, Gerald Duckworth and Co. Ltd., London, 1957.

Nelson, R. and Winter, S., *An Evolutionalry Theory of Economic Change*, Harvard UP, Cambridge MA, 1982.

Nurkse, R., *Problems of Capital Formation in Underdeveloped Countries*, Oxford University Press, New York, 1953.

Oyejide, A., ‘‘Trade Policy and Regional Integration in the Development Context: Emerging Patterns, Issues, and Lessons for Sub-Saharan Africa,’’ *Journal of African Economies*, 7, Supplement 1: 108-145, 1998.

Perroux, F., *L’Economie des Jeunes Nations*, Presses Universitaires de France, Paris, 1962.

Prebisch, R., *Towards a Dynamic Development Policy for Latin America*, United Nations, New York, 1963.

Pritchett, L., ‘‘Divergence, Big Time,’’ *J. Econ. Perspectives*, 11(3): 3-17, Summer 1997.

Rodriguez-Clare, A., ‘‘The Division of Labor and Economic Development,’’ *J. Devel. Econ.*, 49: 3-32, 1996.

Romer, P. M., ‘‘Increasing Returns and Long-Run Growth,’’ *Journal of Political Economy*, 94 (5): 1002-1037, October 1986.

Romer, P. M., ‘‘Endogenous Technological Change,’’ *Journal of Political Economy*, 98 (5) pt.2, 1990.

Rosenstein-Rodan, P., ‘‘Problems of Industrialization in Eastern and South-Eastern Europe,’’ *Economic Journal*, June 1943.

Rostow, W. W., ‘‘The Take-Off into Self-Sustained Growth,’’ *Econ. J.*, 261(LXVI): 25-48, March 1956.

Schultz, T. W., ‘‘Investment in Human Capital,’’ *Amer. Econ. Rev.*, LI(1): 1-17, March 1961.

Schumpeter, J. A., *The Theory of Economic Development*, Harvard University Press, Cambridge, Mass., 1961.

Solow, R. M., ‘‘A Contribution to the Theory of Economic Growth,’’ *QJE*, 70: 65-94, 1956.

Solow, R. M., ‘‘Technical Change and the Aggregate Production Function,’’ *Review of Economics and Statistics*, 39: 312-320, 1957.

Steel, W. F. and Webster, L. M., *Small Enterprises under Adjustment in Ghana*, The World Bank, Washington, D.C., June 1991. Tech. Paper No. 138, Industry and Finance Series.

Steel, W. F. and Evans, J. W., *Industrialization in sub-Saharan Africa*, The World Bank, Washington D.C., 1981.

Stokey, N. L., ‘‘Learning by Doing and the Introduction of New Goods,’’ *J. Polit. Econ.*, 96(4): 701-17, 1988.

The World Bank, *Accelerated Development in sub-Saharan Africa: An Agenda for Action*, Washington, D.C., 1981. (also known as the Berg report).

The World Bank, *The East Asian Miracle: Economic Growth and Public Policy*, Oxford University Press, New York, 1993.

Winter-Nelson, A. E., *Marketing Boards and Market Power: The Case of Kenyan Pyrethrum*, Food Research Institute, Stanford University, Stanford, 1992. Unpublished Ph.D. thesis.

Young, A., ‘‘Learning by Doing and the Dynamic Effects of International Trade,’’ *Quat. J. Econ.*, p. 369-405, May 1991.