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The Implications of New Growth Theory for Trade and Development: An Overview

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Department of Economics

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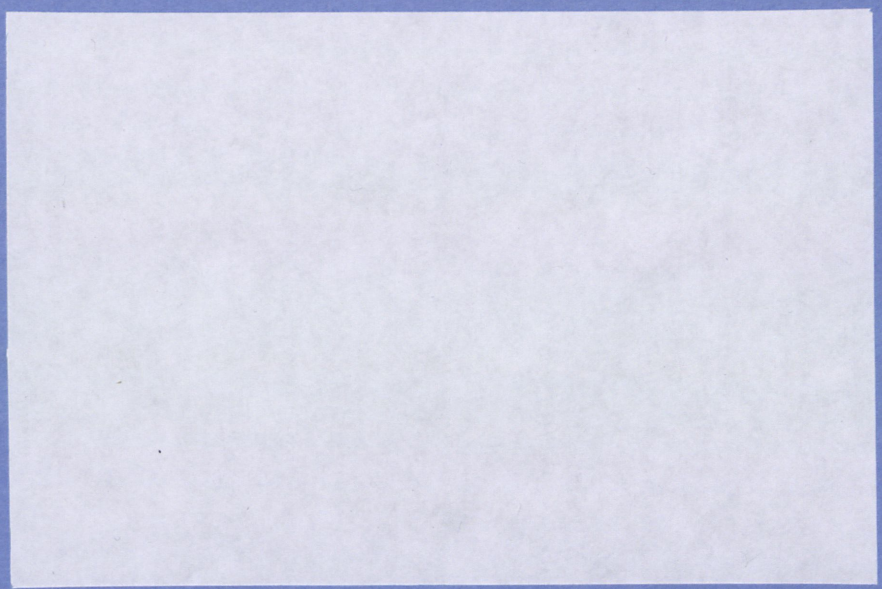

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Abstract

This paper attempts a brief critical assessment of the contributions of the so-called new growth theory to the literature of trade and development, particularly from the point of view of a poor country. It also suggests directions in which future research in this area will be productive.

This is a revised version of the Hewlett Lecture given at Boston University, October 1992.

I.

The theoretical literature on growth and trade flourished in the 1950's and the 1960's, starting with Hicks' famous Inaugural Lecture (1953). It first developed a framework for analyzing the comparative statics of the effects of capital accumulation and exogenous technical change on a country's terms of trade and balance of payments. Then in the second half of the 1960's the dynamic analysis of neoclassical growth models was extended to the case of the open economy. For a review and extensions of this literature, see Bardhan (1970) and Findlay (1973). In the 1970's and almost upto the end of the 1980's the theoretical literature on growth and trade was somewhat inactive, except for the development of several North-South models focusing on the impact on trade relationships of the various kinds of asymmetries between rich and poor countries (primarily in the structure of demand for importables and exportables, or in the labor markets). In the last few years there has again been a spurt in the literature flowing from the application of the so-called new growth theory following upon the leading contributions of Romer (1986, 1990) and Lucas (1988). The Grossman-Helpman book (1991) is the major example of this application to an open economy.

Let us start by pointing to two misperceptions about this new literature. First, it has often been claimed that the new growth theory has endogenized technical progress in contrast to the old growth theory, the central case of the latter being Solow (1956) growth model. This overlooks the tradition of endogenous growth in many of the growth models of the 1960's: apart from Arrow's (1962) learning-by-doing model where learning emanated from the dynamic externalities of cumulated gross investment, and Uzawa's (1965) model of investment in human capital generating technical change, there are the Kaldor-Mirrlees

model (1962) where investment is the vehicle of technical progress and Shell's (1967) model of inventive activity. Nor is the blurring of the distinction between capital accumulation and technical progress a new feature: it was the salient point of the Johansen-Solow type vintage capital models as well as the many growth models of Kaldor. The idea of aggregate dynamic economies of scale in the form of the development of new inputs, expanding the productivity in the final goods sector using those inputs, which Romer borrows from Ethier (1982) -- which actually goes back to Young (1928) -- has in some sense been already formalized in vintage-capital models where each new vintage of better machines expanded the range of higher-productivity inputs used in final goods production. I believe the major contributions of the new growth theory lie in combining all these with a tractable imperfect-competition framework which provides some (Schumpeterian) private motivation for investment in research and development.

The major contribution of the open-economy models in this literature is to give us new insights on the effects of trade on growth. The East Asian success stories have given credence[1] to the belief of many neoclassical economists in a positive relationship between "outward-orientation" and economic development (although a rigorous empirical demonstration of the causal relationship between some satisfactory measure of outward-orientation and the rate of growth is rather scarce). Standard neoclassical growth theory did not provide any such general theorem. It is the second misperceived claim about the new literature, that it provides an unambiguous theoretical demonstration of the positive effects

[1]It should, however, be noted that the export boom in manufactures for Korea and Taiwan in the 1960's came before any significant trade liberalization. As Rodrik (1992) suggests, a realistic exchange rate policy and a generous program of export subsidies, rather than trade liberalization per se, may be the key ingredients for successful export performance.

of trade expansion on the rate of development. We shall elaborate on the tenuousness of this claim later in section III.

II.

But for the time being we may instead point attention to four strands in the earlier theoretical literature which related trade policy to the rate of growth in a developing country. One is a simple extension of the Solow model with an essential imported intermediate input, the growth in supply of which depends on the rate of growth of exports -- see, for example, Khang (1968) and Bardhan (1970), Ch. 4. In these models the steady-state rate of growth of the economy is different from the rate of growth of population and labor-augmenting technical progress, depending on the rate of growth of the country's exports in the world market.

The second strand[2], following an older tradition, formalized dynamic economies of scale associated with learning by doing (captured by the inter-firm spillover effects of cumulated gross output) rationalizing an old argument for support of "infant" industry producing import-substitutes or new exports -- see the models of Bardhan (1970), Ch. 7, and Clemhout and Wan (1970). We shall later discuss some important extensions of this model in the recent literature.

Thirdly, in a small open dual-economy model with a tariff on capital-intensive capital goods and a fixed fraction of profits saved, Findlay (1982) demonstrated that protection can lower the steady-state rate of capital accumulation. In a more general three-good (including

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[2]The first and the second strands have, in a sense, been combined and extended in the recent work of Quah and Rauch (1990).

non-tradeables) three-factor model of a small open economy with savings determined by intertemporal utility maximization, Buffie (1991) has recently shown, however, that the effect of protection on the rate of capital accumulation need not be negative.

The fourth strand in the earlier literature involved the effects of trade policy on the modernization of the capital stock, based on vintage-capital growth models. The first models to link comparative advantage to endogenous differences in the economic life of capital between countries (lower wages in poorer countries allowing for the use of older, less productive, machines) were those of Bardhan (1966) and Bardhan (1970), Ch. 5; Smith (1976) developed a more general model to include trade in second-hand equipments between rich and poor countries. Bardhan and Kletzer (1984) showed in terms of a simple vintage-capital trade model with embodied technical progress how the question of a policy of protection accelerating or delaying modernization of capital stock (thus helping or dampening growth of labor productivity) depends, among other things, on the technological characteristics of the protected sector and does not have an unambiguous answer.

The new growth theory literature has not yet significantly followed up on this strand of the earlier literature. In fact borrowing as it does the Dixit-Stiglitz-Ethier "love of variety" models in terms of a production functional where endogenous growth takes the form of simply extending the range of new inputs, it overlooks the endogenous process of the economic obsolescence of some inputs: it is not necessarily the <u>width</u> of the range of inputs that enhances productivity. For example, in the new growth theory the production function for finished manufactured products is often something like:

$$Q = F\left(L, \left[\int_0^n x^{\beta}(j)\,dj\right]^{\frac{1}{\beta}}\right), \qquad 1 > \beta > 0 \tag{1}$$

where Q is output, L is labor, x(j) is the produced input of type j -- all symmetric but imperfect substitutes combined in a CES function -- and n is the measure of continually augmented inputs (as well as of the stock of cumulative knowledge capital). There is no scope here for the scrapping of obsolete inputs; an old abacus keeps on being symmetrically used as does a new computer. In the old vintage-capital models the production function may be written as:

$$Q(v,t) = F(L(v,t), I(v)) \tag{2}$$

where I(v) is the number of machines of vintage v, Q(v,t)dv and L(v,t)dv are the rates of output produced and labor employed respectively, at time t on machines of vintage v($v \leq t$). Total output is therefore:

$$Q(t) = \int_{t-T}^{t} Q(v,t)\,dv \tag{3}$$

where T is the vintage of the oldest machine in use. A machine is scrapped when the wage bill for operating it exhausts the value of its output:

$$W(t)\ L(t-T,t) = Q(t-T,t)\ , \tag{4}$$

where W(t) is the wage rate at time t.

Bardhan and Kletzer (1984) developed a vintage-capital model of endogenous growth with (linear) effects of learning by doing, where they trace the impact of trade policy on the time-path of productivity. Their fixed-coefficient production function is:

$$Q(v,t) = \min\{a(v)I(v),\ bq(v)L(v,t)\} \tag{5}$$

where a(v) is the capital productivity coefficient on machines of vintage v, b is a positive constant and cumulated output, which is the index of experience and learning, is given by:

$$q(v) = \int_0^v Q(t)\,dt \qquad (6)$$

This is an endogenous growth model which allows for economic obsolescence of producer goods. This model needs to be extended to the case of imperfect competition.

III.

A major result in the new literature is to show how economic integration in the world market, compared to isolation, helps long-run growth by avoiding unnecessary duplication of research in similar, developed, economies and thus increases aggregate productivity of resources employed in the R & D sector (characterized by economies of scale). World market competition gives incentives to entrepreneurs in each of these countries to invent products that are unique in the world economy -- see the models of Rivera-Batiz and Romer (1991) and Grossman and Helpman (1991), Ch. 9. One has, of course, to keep in mind the fact that sometimes these unique products are unique in the sense of product differentiation but not in the sense of any technological advance (it is well-known, for example, that in the pharmaceutical industry a majority of the so-called new products are really recombinations of existing ingredients with an eye to prolonging patent protection, and that they are new, not therapeutically, but from the marketability point of view). Besides, the presumption in these models of a common pool of knowledge capital created by international spillovers of technical information is not often relevant for a poor country. When knowledge accumulation is localized largely in the rich country and the poor country is also smaller in (economic) size, particularly in the size of its already accumulated knowledge capital (which

determines research effectiveness), the rich country captures a growing market share in the total number of differentiated varieties, and the entrepreneurs in the poor country foreseeing capital losses may innovate less rapidly in long-run equilibrium with international trade than it does under autarky, as shown by Feenstra (1990) and Grossman and Helpman (1991), Ch. 9. Trade reduces the profitability of R and D in the poor country as it places local entrepreneurs in competition with a rapidly expanding set of imported, differentiated products and may drive the country to specialize in production rather than research, and within production from high-tech products to traditional, possibly stagnant, industries which use its relatively plentiful supply of unskilled workers -- thus slowing innovation and growth. Of course, slower growth does not necessarily mean that the consumer loses from trade: apart from usual static gains from trade, consumers may have access to more varieties innovated abroad. But trade may sometimes cause a net welfare loss, since in the poorer country it accelerates a market failure (underinvestment in research in the initial situation) by allocating resources further away from research.

One should note that the relevant R and D for a poor country is, of course, more in technological adaptation of products and processes invented abroad and in imitation. But even this kind of a R and D sector is usually so small that major changes in aggregate productivity and growth on the basis of the trade-induced general-equilibrium type reallocation of fully employed resources into or away from the R and D sector, as emphasized by Grossman and Helpman, will seem a little overdrawn if applied in the context of poor countries.[3] In any case the ambiguity in the relationship between trade expansion

[3]It may also be noted that in the Grossman-Helpman (1991, Ch. 11) model of imitation, where the poor country grows faster with imitation and trade than without them, it is the process of imitation rather than the integration of product markets per se that contributes

and productivity growth in these general-equilibrium models only confirms similar conclusions in careful partial-equilibrium models, particularly when entry and exit from industries are not frictionless -- see, for example, Rodrik (1992).

In the Grossman-Helpman model of the innovating North and the imitating South with all firms in Bertrand competition with one another, labor costs form the only component of the cost of entry into the imitative-adaptive R and D activity in the South. So, armed with cheaper labor the Southern firms can relentlessly keep on targeting Northern products for imitation, unhampered by many of the formidable real-world non-labor constraints on entry (for example, those posed by the lack of a viable physical, social and educational infrastructure in a poor country). Also, the Grossman-Helpman models, by adopting the Dixit-Stiglitz-style consumer preferences, assume a uniform price elasticity and a unitary expenditure elasticity for each of the differentiated products which enter symmetrically in the utility function. This, of course, immediately rules out what has been a major preoccupation of the trade and development literature: to explore the implications of sectoral demand asymmetries for trade relationships between rich and poor countries.

The slow diffusion of technology from rich to poor countries is often interpreted in the literature as reflecting the frequent laxity in the enforcement of patents in poor countries and innovators in rich countries thus compelled to protect their ideas through secrecy. This brings us to the controversial issue of intellectual property rights (IPR), which has sometimes divided the rich and poor countries, as notably in the recent Uruguay Round discussions. Rich countries often claim that a tighter IPR regime encourages innovations (by expanding the duration of the innovator's monopoly) from which all countries benefit. Poor countries

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to a more rapid pace of innovation in the poor country.

often counter this by pointing to their losses following upon increased monopoly power of the larger companies of rich countries. Since the poor countries provide a very small market for many industrial products, the disincentive effects of lax patent protection in those countries may be marginal on the rate of innovation in rich countries, and as such attempts at free riding by the poor countries may make sense, as Chin and Grossman (1990) suggest. To this Diwan and Rodrik (1991) add the qualification that the disincentive effects may be very significant in the case of innovation in technologies or products that are particularly appropriate for poor countries (for example, drugs against tropical diseases). But both of these theoretical models use a static partial-equilibrium framework. Helpman (1992) recently constructed a dynamic general-equilibrium model of innovation and imitation to discuss the question of IPR. In the long-run equilibrium of his model, a tighter IPR (reducing the rate of imitation by the lower-wage poor country) increases the fraction of the total number of products produced unchallenged by the rich country, but lowers the long-run rate of innovation of new products (this works through the rise in the price-earning ratio of the R and D firm in the rich country, consequent upon the general-equilibrium labor reallocation effect of a larger range of manufactured products produced in the rich country).[4] Even apart from this effect on the rate of innovation, a tighter IPR, by shifting production from the lower-wage (and therefore lower-price) country to the higher-wage country makes consumers in both countries worse off.

The discussion advocating a tighter IPR regime also ignores the cases of restrictive

[4]In a different context Mookherjee and Ray (1991) have shown that when a dominant firm decides on the adoption of a sequence of potential cost-reducing innovations with Bertrand competition in the product market, a faster rate of diffusion of the latest technology to a competitive fringe may, over some range, increase the competitive pressure on the leader, quickening the latter's pace of innovations.

business practices of many multinational companies (like pre-emptive patenting and "sleeping" patents where new patents are taken out in poor countries simply to ward off competitors but seldom actually used in local production[5]). Furthermore, the flow of technology through direct investments by multinational enterprises to a poor country is often constrained not so much by restrictive government policy in the host country as by its lack of infrastructure (the development of which in turn is constrained by the difficulty of raising large loans in a severely imperfect international credit market).

In fact while the new models of trade and growth bring into sharp focus the features of monopolistic competition particularly in the sector producing intermediate products and, in some models, the Schumpeterian process of costly R and D races with the prospect of temporary monopoly power for the winner -- aspects which were missing in most of the earlier growth models -- there are other important aspects of imperfect competition (like the case of "sleeping" patents above or how international credit market imperfections shape the pattern of comparative advantage[6]) which need formalizing in the literature on trade and development.

In another respect the new literature marks a substantial advance over the old. This relates to what we have called in section II the second strand of the earlier literature on trade policy and growth, the one concerned with learning by doing. An important extension of the models of Bardhan (1970), Ch. 7 and Clemhout and Wan (1970) has been carried out

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[5]Some estimates by UNCTAD (1975) suggest that 90 to 95 percent of foreign-owned patents in developing countries are not used in those countries.

[6]Kletzer and Bardhan (1987) show how more costly credit under imperfect information may drive a poor country away from specializing in sophisticated manufactured products which require more selling and distribution costs than traditional primary products.

by Krugman (1987) and Boldrin and Scheinkman (1988), where the learning effects (emanating from production experience measured by cumulated industry output) enhance over time the existing sectoral patterns of comparative advantage; this may call for a deliberate trade policy that can orchestrate a breakout from such a historical "lock-in".[7]

But these models of learning share with the earlier ones the unrealistic feature of continued learning at a given rate on a fixed set of goods. As Lucas (1993) comments, evidence on learning on narrowly defined product lines often shows high initial learning rates, declining over time as production cumulates, and for on-the-job learning to occur in an economy on a sustained basis it is necessary that workers and managers continue to take on tasks that are new to them, to continue to move up the quality ladder in goods. The major formulations that try to capture this in the context of an open economy are those of Young (1991) and Stokey (1991). On the basis of learning by doing that spills over across industries, although bounded in each industry, Young's model endogenizes the movement of goods out of the learning sector into a mature sector in which learning no longer occurs and thus gives a plausible account of an evolving trade structure. Stokey has a model of North-South trade, based on vertical product differentiation and international differences in labor quality; the South produces a low-quality spectrum of goods and the North a high-quality spectrum. If human capital is acquired through learning by doing and so is stimulated by the production of high-quality goods, free trade (as opposed to autarky) will speed up human capital accumulation in the North and slow it down in the South. A similar result is obtained by Young. (It, of course, does not follow that the South would be better

[7]A similar model of hysteresis, based on self-reinforcing advantages not of learning but of headstarts in R and D, is developed in Grossman and Helpman (1991), Ch. 8.

off under autarky.) It also indicates why a policy of protecting infant export industries is sometimes more growth-promoting in the long run than that of protecting infant import-substitute industries, since in the former case the opportunities for learning spillover into newer and more sophisticated goods are wider than when one is restricted to the home market.

Finally, while the new literature has sharpened analytical tools and made our ways of thinking about the relationship between trade and growth more rigorous, it is high time that more attention is paid to the extremely difficult task of empirical verification of some of the propositions in the literature (I am leaving aside the largely vacuous cross-country regressions on the basis of very shaky, but easily available, international data that some of the new growth theorists have been playing with). While some beginnings have been made -- see, for example, the study by Feenstra, Markusen and Zeile (1992) on the basis of a sample of Korean industries -- to confirm the hypothesis of the new growth models that the creation of new inputs generates continuous growth in total factor productivity, the evidence on the link between trade and productivity growth is still scanty and rather mixed. On the basis of a sample of semi-industrial countries in the World Bank project on "Industrial Competition, Productivity and their Relation to Trade Regimes", Tybout (1992) observes: "the lack of stable correlations (between trade and productivity) in sectoral and industry-level data is matched by a surprising diversity in the processes of entry, exit and scale adjustment". The theoretical models, for all their recent enrichment, have a long way to go before they can catch up with the complexity of the empirical reality.

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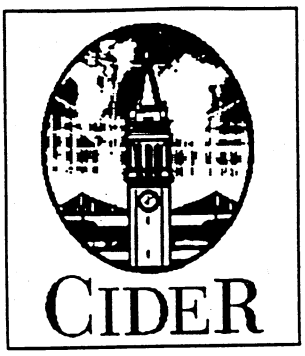

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