

INDUSTRIALIZATION MEETS GLOBALIZATION: UNCERTAIN REFLECTIONS ON EAST ASIAN EXPERIENCE *

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* This paper derives from extensive notes used for a lecture and related seminar given April 18, 2000 at Macalester College, St. Paul, Minnesota under the auspices of its Economics Department's Cargill Distinguished Visitor Program; thanks are due to Macalester's economics faculty for their invitation leading to the paper. Some of the work discussed herein was supported by the United Nations University, Institute for New Technologies, Maastricht, the Netherlands, and by the Joel Dean Foundation's funding of summer research by Swarthmore students in the social sciences; Esther Parker '97 provided exceptionally able research assistance in the doing of the work.

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ABSTRACT

The efficacy of export-led industrialization in the hyper-successful East Asian economies depended in no small measure on the forces that drove globalization. These forces fueled transfers of technology in unprecedented volumes and by innovative means in a variety of industries, including those at the frontiers of global technological change. The successful exploitation of these transfers would not have been possible without purposeful, aggressive actions of the part of the recipient firms in order to realize the increased technological capabilities that they enabled. Firms were incited to undertake these activities by conducive, neoclassical policies which were crucially augmented with selective interventions that fostered rapid technological development. Owing to significant uncertainties about the future course of the global economy, comprehension of the ingredients of past success does not suffice to state the recipe for future success, but it is sufficient to identify the key areas of concern for future policy making.

BIOGRAPHICAL NOTE

Larry Westphal has long been a student of industrialization, particularly the East Asian variety. Between 1967 and 1974, he spent a total of more than 27 months working in the Republic of Korea as a senior advisor to the Economic Planning Board and, for a short period, to the Korea Development Institute. Subsequently, during 11 years spent directing the World Bank's research on industrial development, he gained experience in both Chinas and in the Philippines. Since arriving at Swarthmore in 1985 has worked in Taiwan and in Thailand. He was UNU/INTECH's Principal Research Fellow from July 1992 to August 1993. His publications deal with economic development in South Korea, industrialization strategy and policy (theory as well as practice, the latter with respect to East Asia's "miracle" economies), investment analysis under increasing returns, and empirical analyses of technological development in the industrial sector. He is the co-author, with Robert E. Evenson, of "Technological change and technology strategy" in the *Handbook of Development Economics* (Elsevier Science B.V., 1995).

INTRODUCTION

Stripped of the hype that surrounds the term in many contemporary discussions, “globalization” means simply the increasing integration of markets across countries through flows of goods, services, and factors. This paper focuses on one aspect of globalization, namely increased flows of manufactured goods between countries. It additionally focuses on “East Asia,” by which I mean seven countries: the “early achievers” -- Hong Kong, Korea, Singapore, and Taiwan; and the “late comers” -- Indonesia, Malaysia, and Thailand. I will not discuss the East Asian Crisis, which began in 1997 and from which the region, apart from Indonesia, has now clearly emerged. Rather, I will discuss East Asia’s participation in the expansion of global trade in the 35 years before the crisis -- the factors that enabled it and its relationship to industrial development in these countries.

Over the thirty five years from 1960, considering only goods (not also services), the volume of world trade relative to the value of global production rose 2.2 fold, and East Asia’s share of global exports increased by nearly 11 times, rising to 16.5 percent in 1995.¹ These dramatic changes in the global economy are far from being unrelated; they are, in fact, intimately related, in that the global (as distinct from country-specific) forces driving each were the same. Indeed, industrialization met the current wave of globalization at its very onset, in East Asia, in the late 1950s ~ early 1960s.² That is when two of the early achievers, Taiwan (late `50s) and Korea (early `60s), embarked on their stellar trajectories of export-led industrialization; Hong Kong got a somewhat earlier start; Singapore, a somewhat later start. The late comers were precisely that, having gotten their start considerably later. East Asia’s remarkable development riding the globalization wave is well encapsulated in the fact that per capita GNP in these economies grew on average by more than 5.5 percent annually from 1965 to 1990; this rate is well more than twice the average rate for other developing countries and for the OECD countries, each group separately considered [World Bank (1993, p. 2)].

Baldwin and Martin (1999), in their enlightening discussion comparing the current and previous waves of globalization, review the forces driving both. (The previous wave lasted over the period around 1820 to 1914.) They observe that the so-called Third World fared remarkably differently in these two waves: the first wave led to its deindustrialization, and this not simply as a consequence of colonialism; but in the second wave there has been a significant shift in the global distribution of industrial production to some parts of the Third World, most notably to East Asia. The driving forces of globalization were “radical reductions in technical and policy barriers to international transactions” [Baldwin and Martin, (1999, p. 1)]. However, in the first wave, it was trade in goods that was facilitated and flourished; in the second, comparatively, trade in ideas.

¹ Statements are based on data provided in Dicken (1998, pp. 25 & 36), which is an outstanding source book on all aspects of the globalization of production.

² Dating of the start of contemporary globalization is from Baldwin and Martin (1999).

Baldwin and Martin, in common with other analysts³, emphasize a singular consequence of the greatly enhanced trade in ideas: the globalization of production, which has been reflected in the extraordinary growth of world trade relative to production, and realized -- in large measure -- through ever expanding flows of intermediate products among producers involved in increasingly differentiated, disaggregated stages in the production of a wide range of manufactured goods. Indeed, the globalization of production simply can not be understood without reference to the increasing vertical disintegration of production into distinct value-adding stages along supply (or commodity, production, value) chains running from raw materials extraction through variously finished components and sub-assemblies to final sale of the end products.

The development of most of East Asia's highly successful manufacturing export sectors has been inextricably bound with the forces that have driven the globalization of production. But the story -- of the rupturing of supply chains bound within single localities or nations to forge supply chains of international scope -- is not only about flows of intermediate and final goods, it is also very importantly about the transmission of technology to, and the acquisition of technological capabilities by, East Asian firms. It is the latter aspect that this paper examines in some detail. But first it is necessary to sketch the policy foundations of East Asia's successful development, and this for two reasons. East Asian success is by no means due only to policies directly concerned with export promotion. And, one must understand something of the true nature of East Asian policy to comprehend the possible lessons for policy makers elsewhere.

SOURCES OF EAST ASIAN SUCCESS

Many analysts have sought to comprehend the fundamental sources of East Asia's stellar development performance, in order to draw lessons for development policy [see, for example, World Bank (1993)]. Among them there is strong agreement that several factors, apart from historically determined conditions, were critical.

- ✧ Macroeconomic stability, important in part because it has enabled rapid and effective responses to disruptive shocks, and reflected in:
 - ✧ relatively low inflation rates and positive real interest rates;
 - ✧ fiscal balance (between government revenues and expenditures); and,
 - ✧ real (purchasing power parity) exchange rates that were not greatly, if at all, overvalued.
- ✧ Rapid accumulation of physical and human capital; that is, rapid growth of factor inputs.
- ✧ Successful agricultural development from the outset.
- ✧ Competent bureaucracies, effectively able to orchestrate the development process.

But there is fundamental disagreement on several issues. One concerns the efficacy of selective interventions by which the government sought to promote the development of targeted infant industries.

- ✧ Some analysts, such as myself, consider these interventions to have played a vitally important role in the past development of, in particular, Korea, Taiwan, and Singapore.

³ See, for example, Dicken (1998) and, in connection with the particular focus of this paper, Hobday (1995a,b) and Geriffi (1999).

- ❖ Others dispute this contention, believing that these countries succeeded *in spite of* misguided and costly interventions. In other words, their development performance would have been even better had their governments not intervened selectively.

Another area of disagreement concerns the relative contributions of factor accumulation, on the one hand, and increases in the productivity with which factors were being employed, on the other.⁴

- ❖ The majority, conventional view holds that productivity growth made a relatively small contribution; not negligible, but neither particularly remarkable when considered in light of other countries' growth experience.
- ❖ The minority view, held by evolutionary (or Schumpeterian) economists, of which I am one, argues that technological change played a vitally important part in East Asia's rapid industrialization [see, most notably, Nelson and Pack (1999)].

Among the observations made by these analysts is the following: According to the consensus, mainstream estimates, productivity growth in Korea and Taiwan, for example, is distinctly above the average in comparison to both developing and developed countries.⁵ In this respect, they argue that above average productivity growth should in fact be seen as extraordinary because it was achieved in the context of exceptionally rapid rates of capital accumulation.⁶

The third contentious issue -- the one I will be concentrating on -- relates to the role of exports in the industrialization of these economies.

- ❖ There is no disagreement about the basic fact that the East Asian economies experienced atypically rapid export growth; faster -- in some cases *much* faster -- than the growth of GNP.
- ❖ Nor is there disagreement in very general terms about the lesson to be learned from East Asia's openness to foreign trade *and* to foreign ideas, as reflected in the rapid growth of exports and imports as well as a truly impressive record of technological development.

The general lesson is that openness is a critically important part of effective development policy. Openness certainly includes the maintenance of a properly valued exchange rate, one that is -- if at all -- not very much overvalued, this to assure adequate export incentives for producers and also to confront importers with the true opportunity cost of the foreign exchange they require.

Where there is controversy is whether openness also includes something akin to free trade, namely low and uniform tariffs on imports. Consider some facts:

- ❖ Two, but only two, of the East Asian economies -- Hong Kong and Singapore -- have followed free trade policies, imposing no tariffs or non-tariff barriers to trade.
- ❖ The other five economies also assured that *exporters* had unrestricted access to tariff-free imported intermediate inputs and capital goods for use in export production.
- ❖ But these economies also imposed variable -- that is, non-uniform -- tariffs on imports and, in some cases, went yet further, imposing quantitative restrictions on trade, even sometimes to the

⁴ Here, and throughout, "productivity" refers to total factor productivity.

⁵ Collins and Bosworth (1996) provide one set of estimates frequently cited by mainstream analysts.

⁶ This point has been stressed by Howard Pack in private exchanges.

point of precluding imports of some kinds of goods that could be produced domestically (that is, imposing a so-called “law of similars”).

What, then, should one conclude about openness with respect to imports? I conclude that it is not openness *per se* that counts, instead it is openness in *effective* terms (rather than, say, “*in toto*”) that matters.⁷ Consider the contrast between the India of the 1980’s and the Korea of the 1960’s through 1970’s: while neither was very open to imports, and both used precisely the same instruments of protection in ostensibly the same way, there can be no question that Korea was *effectively* far more open to imports -- to the imports that mattered for its efficacious development. Accordingly, and also on more general grounds as well, I would argue that openness in effective terms does not preclude a significant degree of import protection; that is, so long as there are means to assure that protectionist measures do not unduly constrain a country’s pursuit of its dynamic comparative advantage, through the achievement of internationally competitive production by newly established, infant industries within a reasonably short period of time and its continued maintenance thereafter.⁸

A parallel controversy concerns whether openness also includes unrestricted access to foreign technology acquired through various means of technology transfer. Imports of capital goods, which embody key elements of production technology, are of course one such means of technology transfer, but there are many others, including -- for example -- direct foreign investment (further examples are given in due course). Everything just said comparing India and Korea applies as well in the realm of technology imports. Again, it is openness in effective terms (as defined implicitly above) that matters.

THE ROLE OF EXPORTS

There is thus disagreement about what it means to be “open” to international trade in goods, services, and technology. There is also disagreement about the role of exports. The big question, seemingly answered to the satisfaction of very few analysts, is “Why do exports matter?” -- as it seems empirically that they surely do in some fashion.

- ❖ Conventional trade theory gives one answer, an answer that is most assuredly not unimportant: by exploiting its comparative advantage through exporting and importing, an economy can achieve higher levels of well-being for its people. In particular, in the HOS version of the theory, exports enable a country to make the most effective use of its relatively abundant factor. As a consequence, increased demand for the factor leads to its being paid a higher price, which in turn results in higher incomes for its owners.⁹

The importance, in the development context, of exploiting an economy’s comparative advantage in primary production or in labor-intensive manufacturing can hardly be understated.

⁷ Rodrik (1999) persuasively reaches the same conclusion in a lengthier argument.

⁸ It bears emphatic notice in this respect that levels of protection have generally fallen over time as the effectively protectionist East Asian economies have progressed in their industrial development.

⁹ This of course assumes that trade affects the relative prices on the domestic market of traded commodities, raising those of the economy’s export products relative to what they would otherwise be.

The impact in terms of poverty alleviation through raising the incomes of the poorest segments of the population can be very pronounced. Indeed, many observers of Korean and Taiwanese development, in particular, have stressed the significance of labor-intensive exports as an important source of their atypically employment-intensive industrialization, and have thus emphasized the role these exports have played in maintaining the atypically equitable income distributions found in these two countries.

- ✧ A second answer -- to why exports matter -- relates to the existence of static economies of scale, which are assumed not to exist in simple models of international trade. But in some industries average production cost is still falling at the scale of a single plant's output that would satisfy all of domestic demand in many developing economies. Trade in such cases enables domestic demand to be met at lower cost by:
 - importing from countries that produce in plants of minimum efficient scale; or,
 - producing the product in a plant of minimum efficient scale and exporting what is not sold on the domestic market.

One can, in fact, point to particular cases in East Asia where exporting has played precisely this role. Korean exports of cement in the 1960's and 1970's give but one example.

The foregoing answers are not sufficient to establish that trade, let alone exports, plays an important part in economic development. This is because they imply that trade matters because it affects the *level* of GNP, not because it affects the *growth* of GNP. But growth effects are, of course, what matters for development. Moreover, as is well known, empirical work to quantify the implied level effect shows it to be relatively small in typical cases -- hardly ever greater than ten percent of GNP, and often smaller than four or five percent. Why, then, does trade matter for development?

- ✧ Structuralist development economics gives an answer that includes an important growth effect. Exports matter, quite simply, because they enable imports. This may seem an obvious and uninteresting point, but it is not. Not in the context of development policies that bias resource allocation away from exporting. Such policies have -- in the past, in many countries -- led to severe "balance of payments" constraints affecting the ability to import intermediate inputs, required to utilize existing capacity, and capital goods, required for the growth of capacity.

Growth obviously entails increased stocks of capital goods, but why "must" they be imported -- why can't they be produced domestically? In fact, not all capital goods "need" be imported; all developing economies possess a comparative advantage, vis-a-vis supplying the domestic market, in at least some kinds of capital goods (building construction, for instance). But other kinds of capital goods "must" be imported; in particular, those embodying modern technology that has not been fully and effectively assimilated by domestic producers of capital goods. Two polar cases may be distinguished. In the first, producers in the country have effective mastery of the technology's use, but the country does not possess a comparative advantage in the technology's embodiment in physical capital. Here imports play an efficiency role, enabling a higher growth rate than would be achieved by violating comparative advantage. In the second case, technology has not yet been effectively transferred to the economy.

Imports here play a quite distinct role; they are a means of technology transfer, enabling the economy to acquire modern technology.

Structuralist development economics paid scant attention to issues concerning technology transfer, which was in effect considered something that simply happened -- fully and automatically -- with the importation of capital goods. Thus adequate attention to technology transfer issues awaited the advent of endogenous growth theory and the flowering of evolutionary economics, both of which call attention to the importance of endogenous technological change as a source of growth.

- ❖ Endogenous growth theorists have explored various ways in which participation in international trade can (but not necessarily must or will) significantly augment growth in the productivity of an economy's resource use.¹⁰ As a consequence of their theorizing and confirming econometric studies, it is now generally accepted that imports of capital and intermediate goods alike can significantly affect productivity growth. Succinctly stated: a good deal of technological change appears to be associated with the proliferation of increasingly differentiated intermediate inputs. Going no further than this, one might conclude that exports matter only because they enable imports. Indeed, Dani Rodrik -- reflecting a widespread view -- has arrived at precisely this conclusion (Rodrik, 1999, p. 32). Notably, this answer, though not the reasoning leading to it, is no different from that given by the structuralist development economists.
- ❖ Other economists, working in the tradition of evolutionary economics and basing their empirical work on case studies, have argued that exports *per se* -- that is, export activity as distinct from the imports it enables -- do matter, certainly with respect to a country's technological development; i.e., for the acquisition and effective assimilation of technological capabilities (or, in more common parlance, for efficacious technology transfer). In particular:
 - Export activity facilitates important technology transfers; it is not infrequently the means for significant, incremental technological development.
 - In addition, export activity serves as the stimulus for various efforts leading to technological development; it fosters and enforces the acquisition of enhanced technological capabilities.

THE POLICY CONNECTION¹¹

That exports may serve as a peculiarly powerful engine of technological development is, of course, not a sufficient grounds in and of itself to justify the kinds of selective interventions that were used by Korea and Taiwan, in particular. The justification lies elsewhere, in the fact that the elements of technology are far from being perfectly tradeable in the sense that purchase is not sufficient for effective possession. Technology is not simply embodied in capital and intermediate goods along with complementary codified

¹⁰ See, among other possibilities, Grossman and Helpman (1991).

¹¹ This section draws heavily on Westphal (1990, pp. 55 & 56). For further discussion, including a survey of the empirical basis for the assertions made, see Pack and Westphal (1986). In turn, for an exceptionally lucid and thorough exposition of technological capabilities and their importance in the context of export-led industrialization, see Ernst, Mytelka, and Ganiatsos (1998).

knowledge and documented practices; important aspects of any technology are tacit and can be acquired only through experience-based learning. Thus there are severe difficulties in communicating technology over long spatial distances and across even small social differences, difficulties that can be overcome only at some cost. Accordingly, and to state the essence of the matter, the price paid to import a given element of technology from some location exceeds the price that would be obtained for exporting it to the same location. Furthermore, tacitness of the knowledge of the circumstances in which technology is to be used makes some elements inherently non-tradeable. Peculiarities of local resources, institutions, and technological practices embedded in the routines of firm behavior cannot be comprehended without being experienced in some way.

Efforts to acquire technological capability -- the ability to make effective use of technology -- and to tailor technology to particular circumstances or to undertake incremental technological changes often coincide. This is because purposefully monitored experience plays a substantial part in all kinds of technological effort. The resulting technological changes can typically be characterized as minor in view of their effects on technical efficiency or the alterations made in processes and products. But, in firms that have rapidly achieved international competitiveness, changes often occur in cumulative sequences that increase productivity by twice or more within a decade. The returns to investments in technological development are thus potentially very high, though it also appears that the costs can be far from negligible.

Because of the imperfect tradability of technology, externalities related to technological development can be extensive. There are marked economies of scope in the application of many capabilities acquired in the course of industrialization, as transactions involving elements of technology among domestic agents increase in relative frequency, and as specialization with respect to technological efforts increases among various agents. Additional externalities are found in the demonstration effects of initial entrants' investments to master new technology, effects which can greatly reduce costs for subsequent, nearby entrants. Moreover, the returns to a particular technological effort may be largely inappropriate as a significant share of them derives from the application of the newly acquired element in a cascade of subsequent technological changes.

In sum, owing to the externalities entailed, there is a clear theoretical rationale for selective intervention to promote infant industries in less developed countries. Appropriately used, selective intervention can greatly enhance an economy's ability to capture dynamic economies associated with introducing and exploiting modern technologies. Of course, it does not necessarily follow that selective intervention as practiced in East Asia constitutes the first-best policy approach. But it can not be denied that such intervention is a possible approach, nor that it may be the only practical approach available to policy makers in developing countries. Thus a strong case, combining both theoretical argument and empirical observation, exists for the use of unorthodox means of intervention to foster industrialization in an environment where functioning markets and capable agents are being created rather than simply being acted upon. But export promotion using such measures is warranted only if it can be shown that exports can in fact be an engine of technological development. What does the available evidence say in this respect?

ECONOMETRIC EVIDENCE

Exports *per se* are thought not to matter for growth because there is scant econometric evidence that they do matter in the way that it is thought they should. There is ample evidence showing that firms which export have significantly higher productivity levels than do firms -- in the same industry, more or less narrowly defined -- which are not engaged in exporting. But the mere association of higher productivity with exporting does not necessarily mean that export activity is the cause of higher productivity; it may rather be the case that higher productivity is the cause of exporting. Carefully conducted econometric studies based on panel data have sought to disentangle cause and effect by testing for significant differences in the rate of productivity change between exporting and non-exporting firms in the same industries.

In one such study -- focused on manufacturing exporters in Colombia, Mexico, and Morocco -- firms were not found to experience significant productivity gains after they began to export.¹² Of course, the absence of confirming evidence in these three countries is not sufficient to prove that exports don't matter in other developing countries. Moreover, there are ample grounds for expecting that confirming evidence would not be found in at least two of the three countries. Neither Colombia nor Morocco is noted for having a particularly effective industrialization strategy or an adequate set of export incentive policies.

Far more compelling, in light of the preceding caveat, is a study of firms in Korea and Taiwan recently undertaken by Aw, Chung, and Roberts (2000). The industries examined are textiles, apparel, plastics, electrical machinery / electronics, and transportation equipment; panel years are 1983, 1988, & 1993 for Korea and 1981, 1986, & 1991 for Taiwan. The study distinguishes between "continuous exporters," firms that exported in all panel years, and "export entrants," firms that began exporting between panel years. To quote from the authors' findings regarding statistically significant differences:

- ❖ In Taiwan, "Plants that diversify into the export market have higher productivity prior to entry than plants that choose not to enter.... [But] there is no evidence that the productivity advantage of continuous exporters over plants that never export increases over time. [However] the evidence for several industries [textiles, plastics, and electrical machinery / electronics] indicates that productivity differences between [export entrants] and nonexporters widen as export experience accumulates.... This... could reflect direct benefits from exporting, such as knowledge spillovers from buyers..." (pp. 82 & 83).
- ❖ In Korea, "there is less evidence of productivity-based transitions.... Following entry, there is no widening of the productivity differential.... there is no evidence that the productivity advantage of the group of continuous exporters widens over time relative to producers that never export" (p. 83).

To summarize the authors' quantitative findings, I here give simple averages across industries, including only significant differences: The productivity edge of continuous exporters over continuous nonexporters

¹² The study, done by Clerides, Lach, and Tybout, is summarized in Roberts and Tybout (1997).

is 20.3 percent (in 5 industries) in Taiwan, and 12.7 percent (5 industries) in Korea. In turn, the productivity advantage, prior to export entry, of firms that become exporters over those that do not enter export markets is 8.6 percent (5 industries) in Taiwan; 11.6 percent (3 industries) in Korea. Following export entry, entrants in Taiwan experience a greater than doubling of their advantage (3 industries); export entrants in Korea experience no significant increase in their advantage following entry.

Apart from the last cited findings for Taiwan, there is seemingly little evidence in the econometric studies done to date that is consistent with the notion that exports *per se* matter for development. Why “seemingly?” Because there are various grounds on which to question the relevance of these studies; it can be argued that they may offer neither necessary nor sufficient confirming evidence.¹³ For example, the underlying model may be mis-specified: The case-study literature, which these studies in part seek to confirm,¹⁴ has found -- as will be discussed further on -- that significant technology transfers typically occur, when they do occur, in the context of a firm’s introduction of a new export product (one not previously produced by it; including differentiated varieties of existing export products) rather than in the context of continuing exports of an unchanged product. Econometric studies to date do not directly test the consequences of this finding; the data used does not permit distinguishing between the production of new versus continuing products. Moreover, there is the ever-present problem of determining the relevant counter-factual. Consider, for example, an alternative (to that implicitly assumed) under which continuing export activity is required -- as an input, as it were -- simply to maintain an exporting firm’s productivity edge. This could well be the case insofar as export success is associated with the constantly on-going introduction of new products / product varieties, as appears to be true in some key industries -- the high-tech industries for example.¹⁵

In turn, would strongly confirming evidence (showing that exporters experience greater productivity growth) from econometric studies be sufficient to demonstrate that exports *per se* do matter? It depends on what is meant by “matters.” The assertion at issue here is that exports *per se* matter for an economy’s technological development; that significant transfers of technology occur most effectively and efficiently -- sometimes: if at all, only -- in the context of export activity. A plausible alternative hypothesis is that exports *per se* matter only in another quite different, and surely not unimportant, way. Exports expose firms to a far more vigorously competitive environment (than may be found on the domestic market, where there is always some degree of “natural” protection); it is this competition, not directly related to technology transfers, which leads to greater productivity growth.

Moreover, even were exports *per se* unarguably found to matter as a means of technology transfer, a fundamental issue would yet remain open.¹⁶ Do they matter in the small, or in the large? In the small:

¹³ The argument that follows is but a sketch of the more complete case that could be made here.

¹⁴ That is, to be explicit, by finding that exporters experience greater productivity growth than do non-exporters.

¹⁵ It is instructive here to note that Aw, Chung, and Roberts (2000, Table 6 on p. 80) find that, in both Korea and Taiwan, firms that cease exporting experience a loss in productivity growth relative to continuous exporters (4 industries in each country; statistically significant in only 3, all in Taiwan).

¹⁶ To be explicit: it is being assumed throughout that exporting enables technology transfers that would otherwise either not occur or be more costly to accomplish with equal effect. In turn, there is another issue not addressed here: the supply of export-related technology transfers may not be competitively determined, such that ameliorating

Individual exporters are able to appropriate fully the returns associated with any and all export-related transfers of technology that they receive. In this case there is no reason to promote export activity through selective interventions in order to assure that the socially optimal level of such transfers takes place. In the large: Individual exporters are not able fully to appropriate the associated returns; there are externalities, or spillovers, that benefit other firms producing either for export or for domestic sale. Here there is reason to intervene selectively in favor of export activity in order to assure the socially optimal level of technology transfers; more generally, to realize the optimal path of technological development.

When all is said and done, one is left with two contradictory views about whether exports *per se* matter: either they can; or, they can not.¹⁷ The debate here is very much like the debate over the importance of technological change to East Asia's successful development. Like that debate, this one pits those who focus on productivity growth, and find it unremarkable, against those who emphasize technological development, and find it extraordinary. Moreover, it features the same disparity between the preponderance of econometric evidence on one side, and the findings of case-study research -- and, one might say, broadly conceived common sense -- on the other.¹⁸

SURVEY CUM CASE-STUDY EVIDENCE

If one is looking for indications that export activity uniquely enables effective technology transfers, there is no better evidence than the unearthing of technology transfers from the buyers of exports. (In what follows, these should be understood to span a diverse range of economic agents, with market-savvy buyers representing retail firms at one end and technically-knowledgeable engineers from producing firms at the other.) The discussion of such discoveries here is by no means meant to provide a full survey of the relevant literature. It is rather a highly selective overview meant to show in general terms how exports can matter for technological development and thus for an economy's industrialization.

Korean Exporters in the 1970s

To my knowledge, the first systematic evidence showing that such transfers exist was found in a survey of Korean exporters conducted by Rhee and Pursell in 1976 [see Westphal, Rhee, and Pursell (1979) and, for complete details, Rhee, Ross-Larson, and Pursell (1984)]. They found that exporters across a wide variety of traditional and non-traditional industries considered export buyers to be either "very important" or "important" (here together referred to simply as "important") sources of technology.

- ❖ For process technologies, where 88 firms responded in regard to 241 technologies:
 - The industries in which buyers were considered an important source of technology transfer included textiles; clothing; shoes; leather products; toys, handicrafts, & sporting

policies are warranted. See, for example, Moran's (1999) discussion of export performance and local content requirements imposed on multinational subsidiaries.

¹⁷ "Can" rather than "do" because there is absolutely no necessity that export activity must generate technological development; whether it does or not depends on circumstantial conditions.

¹⁸ A parallel disparity bedevils the questions of why and how direct foreign investment matters for development. But with regard to these issues, many -- seemingly most -- analysts are peculiarly willing to dismiss the econometric evidence as being simply wrong about what can be achieved through direct foreign investment.

goods; fishing; processed food; metal products; machinery; shipbuilding; tableware; electronics; synthetic fiber & resin; overseas construction. Buyers were not considered an important source by exporters in the remaining industries, producing wigs; tires; cement; plywood; and refined sugar.

- Among the specified sources of technology transfer in the survey, export buyers were cited as important in nine percent of the responses overall; in several of the industries, they were so cited in more than 30 percent of the responses. Overall, only two other distinct foreign sources of technology were more frequently cited as being important: returning ex-patriot workers, in thirteen percent of the responses; foreign suppliers of capital or intermediate inputs, eleven percent. Other foreign sources included licenses & technical agreements and technical assistance (for the latter, from affiliated and unaffiliated firms separately).
- For product technologies, where foreign sources generally were cited in 68 percent of the responses:
 - Export buyers were cited as sources of technology in 26 percent of the responses overall (sectoral breakdown is not available).
 - As a distinct matter, 74 percent of 92 responding firms modified product characteristics to meet buyers requests or produced directly to the buyers' specifications.
- The forms of export-related technology transfers were various:
 - Technical assistance in relation to process technology, given through periodic factory visits, quality assurance inspections during production (sometimes by permanently stationed buyer staff) or before shipment, and by other means. Often, but not always, provided by engineers or technically competent persons; infrequently, obtained through visits of exporter's technical personnel to foreign buyer's operations.
 - Product technology in the form of basic technical specifications and lesser aspects thereof; blueprints, models and patterns for specific products; information about product design and styling as well as packaging. Sometimes given in the form of feedback on design, quality, or technical performance of products.
- Consequences included improved production techniques; product designs and styling better adapted to market requirements; development of new products or product varieties; improved quality control methods; improved methods of cost control and accounting.
- Indications of possible spillovers from export-related technology transfers: Out of 69 responding firms, 48 percent claimed to be the first to introduce some technology to Korea, involving a total of 51 new technologies. But this evidence is of limited relevance in two respects: the extent to which these technologies were obtained through export-related transfers is not known; and it is unknown to what degree the firms involved were able fully to appropriate the returns from their innovations.

In sum, the survey of Korean exporters clearly shows that many of them benefited from export-related technology transfers. It also shows that all of them realized technology transfers from a variety of other foreign sources, to the degree that foreign sources were considered important in more than half of the responses. Put crudely, foreign sources were responsible for more than half of the technology that was being used by the surveyed exporters. But this considers only technology obtained directly from them. It needs to be recognized that most of the technology counted as coming from domestic sources initially came from abroad; its identification as domestic simply reflects its effective assimilation by domestic suppliers, typically other producing firms, and subsequent diffusion domestically.¹⁹

The survey's findings obviously do not speak to the comparative importance, for technology transfers into the country, of firms that export versus those that do not export.²⁰ But they do demonstrate that exporting firms had a vital part in the transfer of technology in Korea.

Taiwanese Exporters of Electronic Products in the 1980s and 1990s

The evidence just discussed is particularly salient because it pertains to a relatively early stage in Korea's industrialization; one might expect export-related technology transfers to be most important early in an industry's development. Evidence from Taiwan shows that this is not always true, but suggests that it may generally be so. The evidence reported below is from firm interviews conducted in 1994 by Fang-Yi Wang working under the supervision of Howard Pack and myself.²¹ A total of 55 firms was interviewed; 28 electronics producers, 12 producers of textiles and/or apparel, and 15 suppliers of capital goods. Here I report only on findings from the firms producing electronics.

Historical data on Taiwan's exports of specific electronic products reveal an amazing agility in firms' abilities to respond to market trends, as the following table demonstrates. Omitted from the table are exports of personal computers as well as separately exported PC keyboards and terminals, all of which exhibit similar spurts of dramatic growth, but not decline (through 1990), over short periods of time. Shown in the table are the number of units of product exported in the year(s) of peak exports and -- subject to data availability -- at three-year intervals before and after the peak years.²² In some cases the acceleration of export growth was far more dramatic than may be obvious from the data below; for example: after growing steadily for roughly a decade, telephone exports suddenly jumped from 3.4 million units in 1982 to their peak of 26.0 million in a single year; electronic calculator exports more than doubled from 11.0 million in 1980 to the 22.2 million shown in 1981.

¹⁹ The extent of such diffusion of technologies that were initially acquired through export-related transfers is unknown; to this degree, the importance of export-related transfers can not be fully gauged.

²⁰ The comparative importance of export-related transfers is known to depend on the industry being considered, as is briefly discussed in the section on other, related research further below.

²¹ The work in Taiwan was funded by the United Nations University, Institute for New Technologies. Additional support for processing of the interview results came from a Swarthmore College, Joel Dean Foundation award to Esther Parker '97. Findings from this work have not yet been formally published.

²² Howard Pack was the one who discovered these data and recognized their significance.

Product	Year & Number of units exported							
Radios	1965 1.2M	1967 3.2M	1970 6.2M	1973* 14.5M	1982# 6.1M	1987^ 11.6M	1990 5.9M	1992 4.6M
Televisions	1970 1.3M	1973^ 4.5M	1975# 3.0M	1978* 7.1M	1985# 4.3M	1987^ 6.4M	1990 3.7M	1992 2.6M
Telephones	1974 332T	1977 456T	1980 1.8M	1983* 26.0M	1985# 11.5M	1986^ 22.3M	1989 16.5M	1992 9.8M
Sound recorders	1975 2.5M	1978 7.8M	1981 10.4M	1984* 18.8M	1985# 15.4M	1987^ 17.0M	1990 8.1M	1992 6.3M
Electronic calculators	1972 36T	1975 2.8M	1978 6.1M	1981 22.2M	1984^ 53.9M	1986# 44.9M	1989* 68.7M	1992 16.1M
Computer monitors			1980 39T	1983 1.8M	1987 6.1M	1990 7.3M		

Notes: T, thousand; M, million; *, primary peak; if a pronounced secondary peak exists: ^, secondary peak; #, trough between peaks. Data are lacking for years before 1965 or after 1992; for computer monitors, I have data only for years spanning 1980 through 1990.

Agile hopping from one product to another and upgrading within product categories, both achieved through entry of new firms as well as product-mix changes within existing firms, was enabled by very rapid acquisition and assimilation of technology on the part of many small and medium size firms. Consider just two of the firms -- both wholly, locally owned -- investigated in our survey. I would not argue that these two firms, to which I will make several references, are typical in all salient respects. But I can affirm that the basic conclusions drawn from their discussion here -- that export buyers have been a critically important source of technology -- is generally true across all of the electronics exporters that were interviewed.

Epitomizing the agility seen in the aggregate data, the principal export products of the two firms changed rapidly and dramatically (considering the implied assimilation of technologies new to the firm) over time. Each firm's principal exports, from the early 1970s to the early 1990s, are listed here in the temporal order of their introduction.

- ✧ Firm one: transformers and coils for radios; transceivers; mobile citizen-band transceivers; audio stereo products; cordless telephones; power supplies; desktop computers; portable computers; a variety of telecommunications equipment, including depth sounders, mobile telephones, fax machines; GPS (global positioning system) location finders.
- ✧ Firm two: calculators; telephones; multi-function telephones; answering machines; cordless telephones; digital answering machines; palm top computers; color LCD video games; virtual reality games.

How were these, and many other firms, able to obtain the new capabilities required in each case that a new product was introduced? The story appears not atypically to be something like the following: Based on its technological capabilities already accumulated and honed in previous production, and perhaps augmented by hiring specialized human capital (notably, generally not trained abroad; but not infrequently formerly employed by leading multinational subsidiaries), the firm copies -- that is, reverse engineers -- a basic version of the new product. On the basis of its thusly acquired, rather rudimentary

(with respect to the new product) production capability,²³ the firm receives an export order that it typically can not fulfill without some form of non-trivial technology transfer from the export buyer. Over time, utilizing incremental additions of technology acquired from a succession of export orders, the firm diversifies and upgrades the product varieties that it is able to supply. This often means that it adds non-trivial features to the product; for example, in the case of telephones, a redial capability or a facility to store frequently called numbers.

Before going further, several additional elements of the story bear emphasis. Firms engaged in such continuous technology upgrading have sizeable R&D (research and development) staffs. In the case of the two firms cited above, five and ten percent, respectively, of their employees were engaged in R&D. Additionally, such firms variously benefit from substantial public support given to technological development; for example, that available from Taiwan's Industrial Technology and Research Institute, which does R&D related to the transfer of "generic" technologies into Taiwan. However, in general, the firms we surveyed considered public sources of support to their technological development to be, at best, modestly important, and that only in relation to some technologies. In turn, a number of the firms noted the importance of R&D results acquired from, or jointly achieved with, research faculty in local universities.

The point remains, however, that the importance of technology transfers from export buyers in the foregoing story can hardly be minimized. This is strikingly apparent in firm one's considered statement that export buyers were responsible for around sixty percent of its technology enhancements. Firm two gave no such judgement, but it was clear from the interview that export-related technology transfers were critical for the development of some of its product lines newly introduced over time, and that they were also quite important for a number of incremental technological changes.

In what forms do export buyers provide technology? In many forms, as the full set of interviews demonstrated. Depending on the capabilities of the firm and the nature of the export order:

- ◊ product design information, in forms ranging from:
 - complete blueprints, sufficient to enable realization of the fully articulated design, to
 - only the essential specifications, from which the firm develops the product design;
- ◊ information about manufacturing processes and related quality control methods, given by various means:
 - suggestions provided in the course of inspecting production and quality control methods, during on-site plant visits. Such inspections, with accompanying technical advice, may come at any time, before an export order is placed through the period of production to accomplish the order;
 - consultations with the buyer's engineering and technical staff, for problem solving and trouble shooting;
 - incremental technology transfers, sometimes from third-parties such as overseas R&D labs, arranged by the buyer;

²³ Various distinct forms of technological capability are defined and discussed in relation to technological development in Evenson and Westphal (1995); see especially the discussion in section 4.

- ✧ training courses for key technical and production staff members.

A number of distinct case types can be distinguished which differ by the nature of the technological development they enable on the part of firms that are highly attentive to assimilating all that is transferred -- whether explicitly or implicitly -- to them. Here I discuss only three broad types.

- ✧ Least interesting, because they (in and of themselves) directly enable little, if any, subsequent technological development, is the case in which the buyer provides virtually everything -- in particular, full product information, sometimes supplemented with idiosyncratic elements of production capability -- except the very basic production capability, which is possessed by the firm.
- ✧ More important are the various sub-cases in which the buyer provides elements spanning the range from advice reflecting superior product design or process know-how, to incremental elements of technology wholly new to the firm. Technology transfers in these cases are what enable the firms successively to upgrade their capabilities -- reducing production costs, improving quality, moving to higher product varieties, and even to new product lines.
- ✧ Most interesting are the sub-cases in which the firm collaborates actively with the foreign buyer to translate the concept for some product design into what is needed to realize and produce it. Firm two, for example, has collaborated on the introduction of new telephone varieties with a number of prominent multinationals: AT&T, Philips, and Panasonic, to mention but a few. So too have a number of other firms in our sample collaborated in similar undertakings. One sub-case of fundamental consequence here -- and one that is pertinent to a number of the firms -- is that in which the firm's engagement in collaborative innovation serves as an important means of its acquiring innovative capabilities.

The last of these broad cases reflects what could -- in the small, relative to the market niche being served -- be considered as the end of the line in a firm's technological development. The firm has achieved sufficient innovation capability to make it a sought for partner in joint innovation projects with firms at the leading edge of technological change within the industry. However, the "end of the line" characterization is apt only in rather narrowly defined product lines -- such as, say, electronic calculators -- where the technology is relatively stagnant. It is not at all appropriate in the case of highly dynamic industries that experience continual technological change. Thus the leading firms in Taiwan's computer and related peripherals industries have for some time maintained their high degree of global competitiveness in part through their engagement in consortia among world technological leaders to implement new platforms and standards. Examples in the case of one surveyed firm (neither firm one nor two) include participation in consortia to implement computers systems based on the RISC (reduced instruction set) and Power PC processor chips; the firm's specific contributions related to the fine tuning required to achieve a stable computer system through engineering changes in various components.

Some might think it misleading to consider collaborative innovation and consortium participation as means of (export-related) technology transfer. But they would be wrong in thinking so. Consider the

latter: it is, quite simply, the means whereby firms in Taiwan have been able to incorporate features invented abroad into their own products. Moreover, regardless of how they are styled, involvements in such joint undertakings demonstrate a central fact: firms wishing to engage in activities fueled by changes at the frontiers of high-tech industries must find means to remain linked to the forefront of global innovation, regardless of how humble their part in these industries might be. (Taiwanese firms have long since moved beyond playing a truly humble part in most of its high-tech export industries.) This means that they must ultimately possess two capabilities that are critical in the current wave of globalization: the capability to innovate; and, the capability to interact effectively with other firms in more or less tightly connected networks of shared production and innovation.

To conclude this part of the discussion: Among the numerous countries not classified (in conventional parlance) as being “advanced,” Taiwan’s share of manufactured exports in 1996 was thirteen percent. Fully 41 percent of its manufactured exports in that year were “high-tech” -- largely electronics -- products, up from 21 percent just eleven years earlier when its manufactured exports were only a quarter as large.²⁴ Clearly, Taiwan’s electronics industry has experienced extraordinary technology transfer and diffusion. It would be foolhardy indeed to argue that Taiwan would have achieved its high-tech prowess in the absence of a rich assortment of technology transfers from the buyers of its exports.

Other, Related Research

So far as is known, export-related transfers of technology have been vitally important for technological development only in some industries; in others they appear to have played no role at all, as will be further discussed briefly below. Hobday (1995a,b) provides the most extensive evidence of the role of such transfers in East Asia’s industrialization and export success. Based in large part on interviews conducted with firms in Hong Kong, Korea, Singapore, and Taiwan, Hobday’s research shows that export-related technology transfers have played a vital part in a number of prominent export industries, including -- among others, and as well as electronics products -- bicycles, footwear, and sewing machines. Gereffi (1999, among others) has also done important work in the area; the cited article demonstrates the importance of these transfers in the apparel industry.

Both authors make explicit several important aspects of globalization in relation to export-related technology transfers that I have not touched on to this point.

- ❖ Such transfers are important principally in industries that are characterized by clearly articulated supply chains among different producers, each tending to be located in the country having the greatest comparative advantage in the associated value-adding stage; and, in which the linked chains are dominated cum driven by export buyers -- often those selling under their own brand names, but increasingly those engaged as intermediaries (e.g., firms located in the early achievers) -- rather than by export suppliers. It appears that at least one third of total world trade takes place in the context of such production networks [World Bank (2000, p. 65)].

²⁴ The source for these statements is Lall (1998), which very informatively examines, at a more general level, the issues dealt with in this paper.

- ❖ Transfers have been appreciably facilitated by important institutional innovations in international trade. New transactional forms -- most notably, original equipment manufacture (OEM), own-design manufacture (ODM), and own-brand manufacture (OBM) -- have been developed in the context of East Asian export activity.²⁵ As Hobday rightly emphasizes, by shifting their exports from OEM through ODM to OBM, many East Asian exporters have upgraded their international marketing abilities and presence in tandem with their technological development.
- ❖ Just as they were a crucially important vehicle for the relocation of production from the advanced countries to the early achievers in the 1960s and 1970s, so too have they proven to be equally important in the migration of production from them to the late comers. They have thus been an important means whereby countries have been enabled to ascend the cascading stages of comparative advantage, starting with unskilled-labor-intensive activities and progressing to increasingly more skilled-labor- and technology-intensive activities. However, where the early achievers -- Singapore excepted -- ascension of the cascade was primarily powered by wholly locally owned firms interacting with export buyers, the late comers climb has been importantly propelled by multinational subsidiaries, including -- very importantly -- the subsidiaries of firms in the early achievers, driven to relocate elements of their export production by their loss of comparative advantage in lower stage activities.²⁶

Of course, by no means are all transfers of technology to exporters export-related in the senses discussed above. This is no less true for the firms featured in the case studies than for firms in various industries that appear not to experience significant transfers from buyers of their exports.²⁷ From what is known from the literature on firm-level technological development in less developed countries, it seems reasonably certain that exporters in industries producing standardized products -- largely intermediate products, including metals and chemicals; also including such “commodity items” as DRAM computer chips -- have not benefited much, if at all, from export-related transfers. The same probably holds as well for some industries producing highly differentiated goods; for example, I know of nothing to suggest that the Korean shipbuilding industry received comparatively notable benefits from export-related transfers.

It is, however, known from extensive research, largely in advanced countries, that so called “user-producer” interchanges of information and technology -- between supplying firms and their respective customers -- can play a critical role in the achievement of incremental technological change. So far as I am aware, it remains to be determined whether exporters in these other industries have gained significant technological advances from such interchanges.²⁸ Nonetheless, in all of these industries, certainly in the

²⁵ See Hobday (1995a,b) for extensive discussion of these forms.

²⁶ For a useful overview of the evolving nature of direct foreign investment in relation to various forms export-related technology transfer, see UNCTAD (1999), especially ch.s 7 and 8 in part 2.

²⁷ For a sampling of the literature on which the discussion here is based, see Enos and Park (1987), Amsden (1989), and Kim (1997).

²⁸ User-producer interchanges may be of primary importance close to the global frontier of technological change, where East Asian exporters have probably not yet been greatly active. An exception: the engagement of Taiwanese

cases of Korea and Taiwan, technologies were acquired and technological development occurred in part -- in some, in very large part indeed -- in order to export, sooner rather than later. In this sense it appears quite legitimate to conclude that their technological development can meaningfully be characterized export-led.

CONCLUSION

It is a fact that export activity can deliver, and in many instances in East Asia has delivered, real benefits in the form of new, enhanced technological capabilities to firms engaged in the activity. But, as discussed previously, this fact alone is not sufficient to establish that exports matter for technological, and thus industrial, development in some way that may justify government intervention to promote export activity. Such intervention is warranted only if it overcomes a market failure that is somehow connected to export-related transfers of technology. There would be no market failure if exporters were able fully to appropriate the returns to their efforts to acquire and assimilate these transfers.²⁹ Thus the argument for intervention turns ultimately on whether there are any externalities, in the form of unrequited spillovers of technology, associated with export-related transfers of technology.

Compellingly concrete evidence demonstrating that important externalities are associated with export activity is highly elusive; all the more so is similar evidence for export-related technology transfers. But I find it hard to believe that anyone having a basic understanding of the dynamics of industrial development in one or several of East Asia's hyper-successful export industries, of the kind that have benefited from export-related technology transfers, could reasonably conclude that technological externalities were of minimal importance, either in extent or in consequences. There is some discursive literature propounding the importance of spillovers in the process of export-led industrialization, but the notable examples that come most readily to mind happen to concern spillovers from direct foreign investment. Schive's (1990) forceful account of the Singer (sewing machine) Company's experience in Taiwan shows what can be achieved through government intervention aimed directly at promoting maximum spillover benefits. In turn, Moran (1999) provides a useful survey of several studies documenting highly believable spillovers related to multinational investments in electronics and automotive production in late-comer East Asia and in Latin America.³⁰

It remains only to make explicit the uncertain reflections promised in the paper's title. First, however, a certainty: I have no doubt that exports *per se* can matter tremendously for technological and hence industrial development, or that they have so mattered in East Asia and are correspondingly a major contributor to its stellar development performance prior to the economic crisis that overwhelmed much of

electronics exporters in collaborative innovation and consortium participation is (in some instances) a prime example of user-producer interchanges.

²⁹ This assumes that there is no financial market failure such that exporters are unable to finance warranted expenditures to achieve gains from export-related transfers.

³⁰ As briefly mentioned in a preceding footnote, Moran (1999) argues that there is market failure vis-a-vis technology transfers channeled through direct foreign investment. In his argument, the failure is not owing to the nature of technology *per se*, but rather to strategic trade considerations and to the multinationals' defense of their core competencies. In the cases analyzed, he concludes that export-performance requirements have been successfully used to avert the market failure.

the region in the late 1990s. But, in connection with the emphasis given to "can" in the foregoing statement, it must not be neglected that the degree to which exports *per se* actually do matter depends on government strategy and policy. In particular:

- ✧ Policies to capture and capitalize on export-related technology transfers. These importantly include policies to assure macro economic stability as well as to achieve the other ingredients of success cited at the outset of this paper.
- ✧ Policies to achieve appropriate levels of education cum human capital formation, including technical and vocational education.
- ✧ Policies to establish and advance the creation of supporting infrastructure for technological change, including: promotional legislation and mechanisms; institutions that facilitate access to globally available technical information; technological (and complementary managerial) extension services; training at various levels in technical subjects; organizations that enable and conduct relevant R&D.

Now to the uncertainties, which relate to drawing implications from these arguments for contemporary thinking about strategy and policy. Will the next generation of "highly performing" developing economies in part owe their success to selectively interventionist policies to promote export-led industrialization, as have all of the early-achiever and late-comer East Asian economies except Hong Kong?³¹ One may correctly doubt that they (or, perhaps only it) will³², for such policies -- whether rightly or wrongly³³ -- have come under increasing attack. As a consequence of agreements reached during the Uruguay Round and its aftermath, restrictions on less developed countries' policies have either been imposed, are in process toward being imposed, or are under active consideration in the following areas.³⁴

- ✧ Prohibition of tariffs and quotas overtly inhibiting trade; correspondingly, it will no longer be possible to develop export industries behind trade barriers, using sales in protected domestic markets to cross-subsidize sales in export markets.
- ✧ Severe restrictions on, if not the proscription of, export subsidies, including rebates of tariffs on imported inputs -- a key element of East Asian export promotion; it will accordingly be difficult, if not impossible, to offset any anti-export bias that arises from import protection.
- ✧ Banning of export performance requirements and domestic content mandates; thus, for example, what Taiwan was able to achieve through its licensing of Singer's investment will be no longer be possible.³⁵

³¹ The "highly performing" appellation comes from the World Bank's (1993) miracle study.

³² One may thus also doubt that they, or it, will experience equally rapid growth and real (i.e. inclusive of technological capability building) structural transformation; the conclusion follows from the argument in Pack and Westphal (1986, pp. 114 crossing to 115).

³³ For a further discussion of which -- rightly or wrongly -- see Westphal (1998).

³⁴ It is important to observe that the least developed countries do have somewhat greater latitude in pursuing some selectively interventionist policies, but subject to limitations that could well preclude their usefulness.

³⁵ Singer was required to meet both export targets and domestic content minima; the latter were instrumental in upgrading the capabilities of existing producers by forcing Singer to transfer technology to the producers of parts and components who were also supplying domestic sewing machine producers [see Schive (1990, ch. 5)].

- ❖ Enforcement of certain obligations related to the protection of intellectual property rights; this means it will be far more difficult, for example, to engage in copying (or reverse engineering) to achieve rudimentary levels of technological capability in production.

These restrictions are not only of consequence to industrializing nations. They are, or should be, of concern also to consumers worldwide, who are likely pay higher prices as purchasers of many industrial products. East Asia's interventionist, export-led industrialization over the past four decades has, beyond any doubt, significantly enhanced the welfare of consumers of its export products. Similar gains to consumers from the next generation of high performing developing economies may to a large extent be precluded by the new restrictions. Some might counter that comparable, perhaps even greater, welfare improvements will come through the transfer of technology mediated by direct foreign investment, the presently much touted vehicle for industrialization. For reasons not here to be enumerated, I find this counter argument hard to accept.³⁶

There is no less, and possibly far more, uncertainty associated with on-going changes at the global frontiers of technology: how will these changes affect the potential for realizing significant technological development through export-related transfers of technology? I barely know how even to begin answering this question, but it is by no means clear to me that the co-evolution of technology and market institutions will have benign consequences.

- ❖ Consider, for instance, the emergence of “business-to-business” (B2B) networks on the World Wide Web. Because they greatly facilitate communication among firms at different stages in the supply chain, they have considerable potential for enabling the sourcing of goods from new suppliers having the requisite capabilities. Thus, for example, India's already quite capable producers of automotive parts may far more readily be enabled to enter the global market and to realize rapid export growth. Easier communications within B2B networks may also enable greater flows of export-related technology transfers than in the past, which could mean faster technological development. However, there is a downside: it is likely to no longer be sufficient simply to possess the requisite production capability, it will also be necessary to have access to and comprehension of B2B communications on the Web. In the 1960s, firms East Asia could be the passive beneficiaries of peripatetic foreign buyers aggressively travelling the world searching for capable, low cost suppliers. In the twenty first century, firms that are passively offline are likely to be passed by, however capable they may be given their level of technology.
- ❖ In turn, consider the emergence of “factories for hire” that engage in contract manufacturing in the electronics sector.³⁷ Their share of the market for electronics hardware, which has recently been growing more than 20 percent a year, is currently 11 percent. Such factories are able to produce multiple product lines simultaneously; they can add or drop product lines with comparative ease. Moreover, they are highly mobile, able to shift quickly from one locale to

³⁶ Recent papers by Lall (2000) and Hobday (2000), which appear in a valuable collection of articles focused on East Asia's technological development, provide complementary evidence of the sort that I would use were I to develop my arguments here.

³⁷ This example is drawn from an article in *The Economist*, February 12, 2000 issue, pp. 61 & 62.

another to maintain cost competitiveness. They epitomize what appears to be an on-going trend toward de-linking production from the accumulation of technological capabilities in late comer (present and future) economies, a trend which could in various ways significantly reduce opportunities for indigenous firms to experience technological development through export-related technology transfers.

- ❖ Perhaps the biggest puzzle of all is the degree to which the locus of export-led development may shift from industry to services. India's emerging export success is highly instructive in this respect, for it is to a large extent based on exports of software, principally from Bangalore's high-tech growth pole.³⁸ It also appears likely that India could become a major exporter of entertainment via the latest modes of mass communication.

There are, in conclusion, powerful reasons for thinking that exports may no longer have the potential they have had as a driver of technological development in the industrial sector. Manufactured exports *per se* may no longer matter in the future to the extent that they have in East Asia's recent past. But even were the potential not to be lost, it would remain true that exports *per se* would matter only for those lesser or least developed countries that were able to "put their policy house in order." Thus we come to the final uncertainty -- how will political and social evolution in each of these countries affect its ability to realize the gains of export-led development? Should it be that this is not *the* question for policy makers in these countries, then *the* question would relate instead to the ability to realize the gains from globalization in more general terms.

³⁸ See various issues of the *Far Eastern Economic Review* over the past six months for news of developments in the Indian economy.

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