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U.S. Multinationl's Intra-Firm Trades and Technology Transfers on LDCS' Growth

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The paper examines the effects of related-party export productions by U.S. multinationals on LDCs' economic growth for a sample of 23 semi-industrialized countries during the time period 1970-1981. The analytical framework employed is the extended version of a production function-type model. Finding of the econometric analysis employing this framework indicates that the related-party export productions of U.S. multinationals contributed directly and significantly to LDCs' economic growth. It also contributed to growth indirectly through the positive externalities which it generated for the other sector of the host economy. The impact of the technology transfer is less conclusive.

I. Introduction

For the last two decades, U.S. multinational firms have engaged in a fairly large scale overseas production of manufactured goods for export to the home market (Fröbel, et. al. 1980). According to Grunwald and Flamm (1985), approximately 15 percent of U.S. imports of manufctured goods was assembled abroad in 1981. Out of these munufactured goods assembled abroad, 22 percent was from less developed countries, and is growing. Assembly production abroad of U.S. firms grew from less than 4% of total U.S. imports in 1966 to approximately 10% in 1983. Asia and Latin American countries have been the primary locations for these operations in producing products ranging from textile and apparel to electrical machinery.[1]

The related-party trade[2] in which multinational corporations supply some production processes and components abroad with less developed countries (LDCs) primarily furnishing labor services is a relatively new form of division of labor in the international setting (Hellener 1973, pp.31). To cope with the pressures of international competition, many multinational corporations in developed countries seek redeployment in less developed countries the production stages to which they were no

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longer competitive in production due to higher wages in home countries.

Transferring assembly abroad as a system of production, multinationals retain their competitiveness by lowering production costs for products which are at the down side of their product cycle. After the technologies of production have become more widely spread, firms have to relocate or subcontract production facilities in lower wage countries in order to produce them economically, and to retain their competitiveness.[3]

A priori, the economic impacts of related-party export productions on LDCs have been less than clear. Many developing countries attempted in the last couple of decades to attract export-oriented foreign investment with the aims of creating jobs, transferring technology, securing foreign exchange and obtaining market outlets. However, the related-party export productions is not without its detractors. The growth of assembly production for export raises the possibility of perpetuating a low-grade labor force and unskilled production activities. Because most of assembly production for export is clustered in free exports processing zones of the host countries, doubts are also expressed concerning the weakness of linkages generated by the assembly activities and the rest of the host economy (Reuber 1973 ; Cohen 1973 ; Reidel 1975 ; Yoshihara 1978). The benefits of assembly production on LDCs are viewed as either minimal or non-existence in the long-run due to the activities' weak linkages to the rest of the economy.

To assess the conflicting effects of related-party export productions on a host LDC for its industrialization and economic growth is difficult if not impossible. The difficulties lie in the scarcity of theoretical and methodological antecedents and in lack of data collection. Cross sectional studies across countries of the effects are even more difficult because the detailed data are scarce, if available, and they are heterogenous

[1]Statistics indicate that the phenomenon of transferring production and assembly abroad is not restricted to large U.S. multinationals (Grunwald and Flamm 1985, p.6). Japanese firms also have their export-platforms nearby at Taiwan and Korea. However, their outputs are generally for local market or regional markets instead of being re-imported to home country. Some small U.S. firms also have their export-platforms closeby in Mexico and the Caribbean, while Western European firms have their export platform in Mediterranean and Eastern Europe.

"Export-platform investment" refers to foreign owned (mostly multinational corporations') plants whose main purpose is to produce and export their output. It also includes independent sub-contracting firms in LDCs whose output is mainly for export to world markets and significant portion of their equity interest is owned by foreign firms.

[2]"Related-party" trades cover trades between parties in which an ownership relation exists for 5 percent or more between exporter and importer. A related-party transaction is often equivalent to production flow. Occasionally, the transaction may also include sales between affiliates (Grunwald and Flamm 1985, Table 2. 4, p.22).

U.S.Bureau of the Census for certain years after 1975 provides statistics for "Related party" trade. Now, it no longer provides the statistics.

[3]The location of their choice for production is supposed to minimize the sum of the costs of marketing, supervision, technological transfer as well as production.

when available.

The drawbacks mentioned above not withstanding, this study estimates the effects of related–party export productions by U.S. multinationals on LDCs' economic growth in a production function–type framework (Michalopoulos and Jay 1973 ; Keesing 1967, 1979 ; Tyler 1981 ; Feder 1982 ; Balassa 1978) for a sample of 23 semi–industrialized countries.[4] In the production functiontype framework, economic growth of these countries are related to their respective changes in capital, labor, expansion of the related–party export productions and the externality and technology transfers induced by it through an underlying production function to explain intercountry differences in the rate of economic growth for the period 1970–1981. The main objectives are to test the hypotheses that the related–parry export productions contribute significantly to the rate of economic growth of the LDCs both directly and indirectly.

II. Related–Party Imports into the United States

Grunwald and Flamm (1985) estimated that in 1981 about 15 percent of U.S. imports of manufactured goods was assembled abroad, while 22 percent out of those assembled abroad was from less developed countries, and is growing. For selected product groups, the majority of imports assembled in LDCs are under the U.S. Tariff items 806.3 and 807, and are imported from foreign affiliates of U.S. firms.[5]

These U.S. Tariff items 806.3 and 807 allow import duty to be levied only on the value–added component of foreign manufactured goods. Custom duty was exempted for certain components which were reimported. This tariff provision thus encouraged multinationals and even small U.S. firms to set up facilities abroad to take advantage of much less expensive semi–skilled labor and extended related–party trade as a result. The growth of intra–firm trade (trade between foreign affiliates and U.S. parent companies) for electronic equipment, auto parts, textiles and apparel and metal fabrication, to certain extent, may be attributed to this tariff provision and thus the rapid growth of 806/807 items imported.[6]

A related party transaction is not necessarily equivalent to production flow for it also include sales between affiliates. In addition, not all outputs exported by U.S. foreign affiliates are re–imported to their parent companies in U.S. There are strong correlations between related party imports and 806/807 item imports, however.

Grunwald and Flamm (1985) compare 806/807 item imports to the related–party imports, and to the total U.S. imports in 1978 for selected product groups for fifteen countries. They found that "… somewhere between half and all of the imported television sets under 806/807 and between 90 and 100 percent of the semiconductors and motor vehicles are related party transaction." The statistics are even more striking when the data is disaggregated to each country. For example, more than 91% of imports of the selected commodities from Malaysia was related party imports, while it was 71% from Mexico. The result of their comparison and the high degree of correlation between 806/807 imports and related party imports are summarized in Table 1.

TABLE 1 The Related−Party Imports and U.S. 806/807 Imports As Percent of Total Imports, 1978

Country	806/807 Imports	Related−Party Imports
Mexico	65.3	71.3
Malaysia	85.5	91.4
Singapore	46.6	74.1
Taiwan	12.3	20.8
Hong Kong	10.1	17.2
Korea	10.2	24.3
Philippines	36.3	37.6
Brazil	19.0	43.0
Columbia	17.9	23.3
Fifteen Countries	16.2	56.7
All Countries	13.7	52.2

Source : Excerpted from Grunwald and Flamm 1985, pp.22−23.

[4]Following Chenery's strict as well as marginal definition of semi−industrialized LDCs (1980), the following countries are included in this study : Argentina, Brazil, Chile, Colombia, Ecuador, Egypt, Greece, Hong Kong, India, Israel, Malaysia, Mexico, Peru, Phillipine, Portugal, Singapore, S.Africa, S.Korea, Spain, Taiwan, Thailand, and Turkey. Indonesia is also added to our list for its growing export−processing productions in recent years. However, when Indonesia is excluded from our empirical estimation, the result is essentially the same as that presented in this paper.

[5]Item 806.3 applies to articles of metal (but not precious metals). Item 807 concerns articles assembled abroad with fabricated components made in the United States.

[6]U.S. import under 806/807 items has grown more rapidly than total import for the last couple of decades. It grew from less than 4% of total imports in 1966 to about 10% in 1983 (Grunwald and Flamm 1985, p.15). The U.S. imports of 806/807 items as percent of total manufactured goods imports from each LDCş varied considerably. In 1978, the percentage ranged from 0.9% from India to 100% from Guyana. Hong Kong had 9.4%, South Korea 10.3%, Taiwan 12.3%, Brizil 22.4%, Columbia 40.5%, Singapore 45.9%, and Mexico at 78.1%, for example (Moxon 1984, p.172−173).

The value of the products which were assembled abroad is much higher than that is represented by the items 806 and 807 imports to U.S. First, there are some U.S. components which are processed, assembled and sold in markets outside the U.S., which did not show up in 806/807 statistics. Second, 806/807 excludes certain products which were assembled abroad and sub−sequently imported to the U.S.

On the other hand, some 806/807 imports to U.S. were made by non−U.S. companies. And, some 806/807 imports were from non−U.S. subcontracting firms located in LDCs. Items 806/807 statistics does not indicate which imports are related party transaction.

III. Theoretical Framework

Consider a LDC (less developed countries) which is an open economy having two distinct production sectors : the related-party export production sector and the non-related party sector. The non-related party sector (or the other sector) produces Q_D unit of output with K_D units of capital, L_D units of labor and also is influenced by the volume of the output of the related-party export production Q_F. This latter specification follows the similar formulations made by Keesing (1967, 1979) and Feder (1982). In this specification, the related-party export production is hypothesized to have positive spill-over effects on the other sector through their introduction of more efficient and competitive management practices, better production techniques, better trained labor and imported resources.

The output of related-party export production Q_F is, in turn, produced using three factors : K_F units of capital, L_F units of labor and specific factor S_F. This specific factor embodies superior technology or management skills transferred to the related-party export production sector from abroad.

Symbolically, the production function for each of the two sectors is represented by :

$$Q_D = D(K_D, L_D, Q_F) \qquad (1)$$

$$Q_F = F(K_F, L_F, S_F) \qquad (2)$$

And by definition the gross domestic product (Y) is the sum of Q_D and Q_F :

$$Y = Q_D + Q_F \qquad (3)$$

Furthermore,

$$L = L_D + L_F \qquad (4)$$

$$K = K_D + K_F \text{ and thus}$$

$$I = I_D + I_F \qquad (5)$$

Where, by definition, investment I dk, I_D dk_D and I_F dk_F.

From equations (1) through (5), we can derive a growth equation to assess the separate impacts on economic growth of gross domestic investment, labor force growth, expansion of related-party export productions and its spillover effects, and transfer of technology. Feder (1982) derived such a growth equation under a different context and without explicitly incorporating the impact of technology trasfers. In the following, we restate Feder's (1982) growth equation in our framework and incorporate technology transfers explicitly. The growth equation can be written as

$$Y/Y = \alpha(I/Y) + \beta(L/L) + (D_F + \delta/1 + \delta)Q_F/Y + (1 - \delta/1 + \delta)F_S S_F/Y \quad (6)$$

where Y dY, L dL, S_F dS_F, D_F $Q_D/$ Q_F, and Q_F $dQ_F \cdot F_S$ is the marginal contribution of the special factor to the related-party export production (i. e. $Q_F/$ S_F).

The productivity differential parameter, δ, between the two sectors is a positive constant based on the assumption that the related-party export production sector is more productive than the other sector for the reasons alluded to earlier. The productivity differential between the two sectors can be written as

$$F_K/D_K = F_L/D_L = 1 + \delta \quad (7)$$

where F_K($Q_F/$ K_F) and F_L($Q_F/$ L_F). The F_K and F_L are the marginal productivity of captial and labor to the related-party export production respectively. The D_K($Q_D/$ K_D) and D_L are similarly defined for the other sector.

The other simplifying assumptions employed by Feder (1982) were:

$$D_K = \alpha \text{ and } D_L = \beta(Y/L) \quad (8)$$

That is the marginal productivity of the other sector production with respect to capital is a constant α, and with respect to labor is a constant function of per capita gross domestic product (Y/L).

In order to simplify the equation (6) further, we need certain additional assumptions. If Q_F is assumed to be weakly separable from K_D and L_D, and S_F is weakly separable from K_F and L_F due to imprecision in measurement of Q_F and S_F or because Q_F and S_F affect Q_D and Q_F respectively with constant elasticities, then the equations (1) and (2) can be rewritten as:

$$Q_D = D(K_D', L_D', Q_F) = Q_F^{\theta} \cdot g(K_D', L_D) \quad (9)$$

and

$$Q_F = F(K_F', L_F', S_F) = S_F^{\gamma} \cdot f(K_F', L_F) \quad (10)$$

Where θ and γ are the constant elasticities of Q_D and Q_F with respect to Q_F and S_F respectively.

The marginal contribution of related−party export production (Q_F) on domestic production (Q_D) is

$$\partial Q_D / \partial Q_F = DF = \theta Q_F^{\theta-1} \cdot g(K_D,\ L_D) = \theta / Q_F/Y - \theta \tag{11}$$

and the marginal contribution of specific factor S_F on related−party export production is

$$\partial Q_F / \partial S_F = F_S = \gamma S_F^{\gamma-1} \cdot f(K_F',\ L_F) = \gamma (Q_F/S_F) = \gamma (Q_F/Y / S_F/Y) \tag{12}$$

Substituting D_F and F_S of equations (11) and (12) into (6), it yields

$$\begin{aligned} \dot{Y}/Y &= \alpha (I/Y) + \beta (\dot{L}/L) + [(\theta / Q_F/Y - \theta + \delta/1 + \delta] (Q_F/Y) \\ &\quad + (1 - \delta/1 + \delta) \gamma (Q_F/Y / S_F/Y) (\dot{S}_F/Y) \\ &= \overset{(+)}{\alpha}(I/Y) + \overset{(+)}{\beta}(\dot{L}/L) + \overset{(+)}{\theta}(\dot{Q}_F/Q_F) + (\overset{(+)}{\delta}/1 + \delta - \theta)(\dot{Q}_F/Q_F)(Q_F/Y) \\ &\quad + (\overset{(+)}{\gamma}/1 + \delta)(Q_F/Y)(\dot{S}_F/S_F) \end{aligned} \tag{13}$$

Equation (13) is the basic model for our empirical analysis. The signs on top of each coefficient is our hypothesized signs. The equation (13) embodies the framework of conventional growth equation and the Feder's (1982) emtension of it, and our incorporation of technological transfers.

This basic model enables us to assess separately the impacts on economic growth of gross domestic investment and growth of labor force through an underlying production function, and to couple with the impacts of the real growth of related−party export production (Q_F/Q_F), gorwth of technology transfers (Q_F/Y) (S_F/S_F), and the spill−over effects of related−party export productions (Q_F/Q_F) (Q_F/Y). Theoretically one would expect a positive impact of each of the above listed variables on a country's economic growth measured by the real growth of gross domestic product (GDP).

Ⅳ. Empirical Analysis

Twenty−three semi−industrialized countries were selected for our study for the time period 1970 through 1981. We only cover 23 of Chenery's 31 semi−industrialized countries due to data limitation.[7]

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[7]See footnote 4.

Model Specifications

Three specifications, in terms of three regression equations, following the basic framework of the equation (13) are estimated (A list of the variables involved and their data sources can be found in the appendix) :

(a) when $\delta/1 + \delta = \theta$ and $\gamma = 0$

(i.e. productions for related-party exports do not generate externality, and technology transfers do not contribute to productivity of related-party export productions), then the equation (13) in natural log-linear form can be written as :

$$\ln(Y/Y) = \ln A + \alpha\ln(I/Y) + \beta(L/L) + \theta\ln(Q_F/Q_F),$$

(b) when $\delta/1 + \delta \neq \theta$ and $\gamma = 0$

(i.e. technology transfers do not contribute to productivity of related-party export productions), then the equation can be written as :

$$\ln(Y/Y) = \ln A + \alpha\ln(I/Y) + \beta\ln(L/L) + \theta\ln(Q_F/Q_F) + (\delta/1 + \delta - \theta)\ln(Q_F/Q_F)(Q_F/Y),$$

and (c) when $\delta/1 + \delta \neq \theta$ and $\gamma \neq 0$, then the equation is :

$$\ln(Y/Y) = \ln A + \alpha\ln(I/Y) + \beta\ln(L/L) + \theta\ln(Q_F/Q_F) + (\delta/1 + \delta - \theta)\ln(Q_F/Q_F)(Q_F/Y) + \gamma/1 + \delta\ln(Q_F/Y)(S_F/S_F).$$

The specifications (a) is essentially the formulation employed by Michalopoulos and Jay, Balassa and Tyler in their studies of the impacts of export expansion on economic growth (Michalopoulos and Jay 1973 ; Balassa 1978, 1985 ; Tyler 1981). And specification (b) is that of Keesing's (1967, 1979) and Feder's (1982) formulations in studying export expansion and its spillover effects on economic growth. Technology transfer is introduced explicitly in the specification (c) as an additional explanatory variable.

The natural log-linear regression equations are estimated with ordinal least-squares method. Structure of each regression is linear. And each variable of the regression is transformed by natural logarithm. Each of the estimated regression coefficients is then the growth elasticity with respect to each of the corresponding

Table 2. Regression Results and Sources of Growth of 23 Semi-Industrialized LDCs, 1970-1981

Variable	Name of Parameter	Model (a)	Model (b)	Model (c)$^{+}$	Contribution to Growth (%)	Sample Mean Before log Transformation (After log Transformation)
In $\frac{I}{Y}$	α	0.518410* (1.3535)	0.297247 (0.8283)	0.30058 (0.7980)	14.27	0.25673 (−1.38438)++
In $\frac{L}{L}$	β	0.286911* (1.2513)	0.20215 (0.9615)	0.20477 (0.9138)	27.44	0.02130 (−3.90732)
In $\frac{QF}{QF}$	ϕ	0.291757*** (2.4999)	0.24165*** (2.2462)	0.24133*** (2.1756)	19.54	0.11435 (−2.36056)
In $(\frac{QF}{QF})(\frac{QF}{QF})$	$(\frac{\sigma}{1+\sigma} - \phi)$		0.06336*** (2.3045)	0.06258** (1.8857)	24.42	0.00026 (−11.37554)
In TECH	$(\frac{\gamma}{1+\sigma})$			0.00366 (0.0499)	1.00	0.00070 (−7.95664)
Intercept		−0.38823 (−0.3818)	−0.42316 (−0.4608)	−0.38879 (−0.3196)	13.33	
$(\frac{Y}{Y})$						0.05974 (−2.91567)
R^2		0.4128	0.5466	0.5467		

t− values are in the parentheses
***− Significant at close to close to 1% level (one−tail test).
**− Significant at close to 5% level (one−tail test).
*− Significant at close to 10% level (one−tail test).

+− σ = 0.43660 and γ = 0.00526
++− values in the parentheses are the sample means after the matural log transformations.

explanatory variables. The results of the estimation are presented in Table 2, and the definition and data sources of each variable involved can be found in the appendix.

Cross-country aggregate analysis of economic growth using a single equation like ours may incur simultaneous equation bias. For example, the bias may arise due to possible simultaneous determination of dependent and independent variables (Chenery et al. 1970 ; Hagen and Hawrylyshn 1969). In addition, the estimated parameters in a cross-country analysis are interpreted as the average values for the countries under study, and not applicable to any specific country. It is assumed that these countries have identical production function and similar non-optimal allocation of resources, if any (Feder 1982).

Growth Elasticity of Related-Party Export Productions

For the model specification (a), the growth elasticity α for the variable ln(I/Y) (the share of gross domestic investment in GDP) is statistically significant at 10% level (one-tail test). The parameter reflects the marginal productivity of capital in the non-related party export productions sector. The parameter β which is associated with the growth of labor force ln(L/L) is statistically significant at 11% level (one-tail test). And the growth elasticity θ for the variable $\ln(Q_F/Q_F)$, the expansion of related-party export productions, is statistically highly significant at 1% level (one-tail test). It indicates that any 1% increase in the rate of expansion of related-party export productions without withdrawing resources from the other sector increases approximately 0.29% of the rate of growth of GDP of the average country. All of the independent variables, in the equation, together explain more than 41% of the variance of the rates of economic growth.

In the model specification (b), spillover effect of related-party export productions $\ln(Q_F/Q_F)(Q_F/Y)$ is introduced as an additional explanatory variable. The elasticity of growth with respect to this variable is statistically significant at 1.5% level (one-tail test). The positive and statistically significant elasticity for this variable is expected. Several case studies on related-party export productions (or more specifically the export-platform productions which ties closely to related-party exports) revealed that foreign firms in export processing zones do establish backward linkages overtime with firms located outside export processing zones in host country (Schive 1981 ; Schive and Majumdar 1981 ; Lim and Pang 1982 ; Spinanger 1983). Backward and forward linkages are only parts of positive effects which may be generated by firms located in export processing zones or engaged in related-party export production, through demonstration effects or technology transfers.

Likewise, the growth elasticity (θ) with respect to expansion of related-party export production is statistically significant at 1.5% level. The productivity differential parameter, δ, between related-party export production sector and the other sector can be computed, given the estimated θ value and the regression coefficients $(\delta/1 + \delta - \theta)$ which is associated with the variable $\ln(Q_F/Q_F)(Q_F/Y)$. The δ value from this computation is 0.44. And because the θ value and the $(\delta/1 + \delta - \theta)$ value are both statistically significant at 1.5% level (one-tail test), the positive δ value infers that the productivity differential between the related-party export productions sector and the other sector is statistically significant. In addition the former is more productive than the latter.

All of the explanatory variables in the model specification (b) together explains the growth variations in real GDP of these countries more than 54%. Compared to model specification(a), introduction of the $\ln(Q_F/Q_F)(Q_F/Y)$ as an additional explanatory variable here clearly increase the explanatory power of the growth equation substantially.

In the model specifications (c), one additional explanatory variable TECH is introduced in addition to those variables which are already included in the model specification (b). The growth elasticities for the explanatory variables $\ln(Q_F/Q_F)$ and $\ln(Q_F/Q_F)(Q_F/Y)$ are again found to be statistically significant at 2% and 4% levels respectively (one-tail test). The results indicate that the elasticity of economic growth with respect to expansion of the related-party export productions is 0.24. A 1% increases in the rate of growth of related-party export productions stimulates about 0.24% increases in the rate of growth of GDP. The estimation results also indicate that the productivities for the related-party export production sector and the other sector are different. The productivity of related-party export production sector is higher than the other sector due to the positive and significant δ value. The positive and statistically significant regression coefficient for the variable $\ln(Q_F/Q_F)(Q_F/Y)$ then indicates that the former sector generates positive spill-over effects for the latter due to linkages and demonstration effects or technology transfers.

The regression coefficient $(\delta/1 + \delta)$ for ln TECH variable is not statistically significant. It can be inferred from this observation that γ (i.e. the constant elasticity of Q_F with respect to S_F) is not statistically significant under the model specification (c), for δ is statistically significant. The result indicates that the specific factor S_F through related-party trade (e.g. the technological transfers, etc.) alone does not contribute significantly to host-LDC's economic growth.

One reason for ovbserving the insignificant coefficient for the ln TECH variable is that there is a relatively high multicollinearity $(r = 0.52)$ existing between the variables $\ln(Q_F/Q_F)(Q_F/Y)$ and ln Tech. Certain influences of ln Tech variable are captured by the varialbe $\ln(Q_F/Q_F)(Q_F/Y)$. To test this possibility, the $\ln(Q_F/Q)(Q_F/Y)$ variable is dropped from the model specification (c). The regression coefficient for ln TECH variable is then found to be positive (0.0840) and statistically significant at 13% level of significance (one-tail test) in the remaining regression.

Another reason for observing an insignificant coefficient for the ln TECH variable is that our proxy variable for specific factor did not include and measure all possible mechanisms of technology transfers. Our proxy is the net direct investment fees and royalties paid by the LDC affiliates to U.S. parent companies, per dollar of GDP (see definition of the variable in the appendix). This narrowly defined TECH variable missed certain aspects of technology transfers. Consequently the contribution of the specific factor S_F (e.g. technological transfers, etc.) on the related-party export productions and, in turn, on the economic growth connot be minimized, though the coefficients for TECH variable is statistically insignificant in the specification (c).

Sources of Growth

The estimated coefficients (or growth elasticities) for each explanatory variable in the model specification (c) are used, in addition to the respective sample means, to compute the sources of contribution to economic growth in percentage terms. The results are presented in column 6 of Table 2.

Expansion of labor forces contributed most to the economic growth (27.44%). More abundant labor force in most of these countries led to their relatively lower wage rates, which in turn made these countries more attractive and competitive for assembly productions. In turn, then, the labor force expansion contributed most to their economic growth. The positive spillover effects generated by the expansion of related-party export productions and the expansion of the related-party export productions itself also contributed very significantly to their economic growth. The percentages of these contributions are 24.42% and 19.54% respectively.

The Social Marginal Productivity of Investment for Related-Party Export Productions

To estimate the social marginal productivity of investment (SMPIF) in the related-party export production, we can restate Feder's estimation equation (1982) in our framework as:

$$\text{SMPIF} = (\ Y/\ Q_F)(\ Q_F/\ I_F) \tag{14}$$
$$= [1 + \theta(1 - Q_F/Y / Q_F/Y)](1 + \delta)D_K - D_K$$

where $D_K = \alpha$. SMPIF measures the productivity of investment in related–party export sector at the margin. It includes externality generated by the sector for the rest of the host economy.

Each country's SMPIF can be estimated by using respective country's share of related–party exports to GDP, Q_F/Y, and by utilizing the estimates for α, θ and δ from the model specification (c) presented in Table 2. Here instead of computing the SMPIF for each country under study, we take the average ratio of Q_F/Y for the 23 semi–industrialized LDCs (0.0045) and then compute the corresponding SMPIF as 23.1837. Should Q_F/Y be 0.06 for a country for example, then the computed SMPIF is 1.7629. The result indicates that the SMPIF could be quite large for most of the countries under study, and it is larger than the marginal productivity of investment for non–related–party export production sector (when the regression coefficients in the specification (c) is computed in terms of marginal productivities instead of growth elasticities). It also indicates that the higher the existing share of related–party export to GDP for an economy, the smaller the SMPIF.

It appears that from social viewpoint capital investment in related–party export production is quite desirable in view of the magnitude of externalities and linkages generated by it in short–run or intermediate run. However, the support of related–party export production should be subordinated to overall economic development strategy such as export promotion that will stimulate industrialization and trade–liberalization policy.

V. Conclusion

Related–party export productions of U.S. multinationals contributed directly and significantly to LDCs' economic growth via increases in foreign exchange and renumeration to factors of production. It also contributed to growth indirectly through positive externalities which it generated for the other sector through backward linkages, demonstration and learning effects and better resource allocations.

The impact on economic growth of the narrowly–defined technology transfer induced by the related–party export production is less clear. The growth elasticity of the narrowly–defined technology transfer variable, though positive, is statistically insignificant. Some of the possible impacts of technology transfer are captured in the positive and significant externalities variable due to a relatively high multicollinearity existing between the two variables. When the externality variable is dropped from the growth equation, the regression coefficient of the technology transfer variable is positive and statistically significant.

The support of related-party export production in LDCs should be subordinated to overall development strategy of the host LDCs, such as outward-oriented policy. Furthermore, its impact on LDCs' economic growth will be greater and longer lasting, the greater the integration of the related-party export production to the rest of the host economy. The integration would increase competition and force the rest of the economy to be more efficient. It would also encourage firms in the non-related-party export production sector to seek, and foreign firms to provide more training and technology transfer. The integration might increase local content of assembly production, increase subcontracting with independent firms in LDCs by foreign firms, and their joint-venture which, in turn, might facilitate transfer of technology to LDC firms through practical experience.

APPENDIX

List of Variables and Data Sources

(Y/Y) = Average annual growth rate of GDP (%) at constant factor cost, 1970-1981.
Sources : World Bank (1983). Taiwan's data is from Statistical Yearbook (1983).

(L/L) = Average annual growth rate (%) of population, 1970-1981, as a proxy for labor force's growth rate.
Sources : World Bank (1983) ; UNESCO (1981).

(I/Y) = Ratio of gross domestic investment to gross domestic product.
I = Gross domestic investment, current prices in national currency (million), 1970-1981.
Y = Gross domestic product, current prices in national currency (million), 1970-1981.
Sources : World Bank (1983) ; U.N. (1985) ; Taiwan (1983). Argentina's 1981 gross domestic investment is the arithemetic mean of its 1977 through 1979 figures.

(Q_F/Q_F) = (Real) Average rate of growth of related-party exports from LDC by MNCs' affiliates.
The average rate is computed as follows :

$$(Q_F/Q_F) = e^d - 1,$$

Where the d is estimated from equation Log $Q_F = C + d \cdot t$ and t = year in digit, 1970 =1, ··· 1981 = 12. The Q_F is computed with the following approximation : Q_F = shipped · M_X. Where M_X is real value of manufactured goods exported from each LDC to U.S. (in million U.S. $ deflated by GDP deflator) 1970−1981, and shipped is imports from affiliates of U.S. MNCs as a percentage (%) of total import to U.S. from the corresponding LDC in 1977.

Sources : U.N., Dept. of International Econ. and Soc. Affairs (1976, 1983, 1984) ; World Bank (1983) ; IMF (1984) ; U.S. Dept. of Commerce (1983).

$(Q_F/Q_F)(Q_F/Y)$ = The rate of growth of related−party exports multiplied by the shares of related−party exports in GDP.

Sources : same as (Q_F/Q_F) and Y.

TECH = Net direct investment fees and royalties paid by LDC affiliates to U.S. parent companies (all industries) per dollar of gross domestic product for each (and corresponding) LDC, 1977.

Sources : U.S. Dept. of Commerce (1981) ; World Bank (1983) ; U.N. (1985) ; Taiwan (1983).

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