

Determinants Of Foreign Direct Investment: Taiwan, 1965 - 1993

Yingshing Lin, The National Institute of Technology, Kaoshiung, Taiwan

Michael Szenberg, Lubin School of Business, Pace University

Thomas J. Webster, Lubin School of Business, Pace University

Abstract

This study empirically investigates the relationship between changes in macroeconomic and microeconomic (firm-specific) determinants and changes in foreign direct investment made by Taiwanese firms. The empirical analysis presented in this paper confirms that at the macroeconomic level of generality increases in Taiwanese foreign direct investment the period 1965-1993 resulted from rapid capital accumulation, which encouraged the development of capital-intensive industries, the accumulation of manufacturing intangible assets, and labor shortages. At the level of the individual firm, the empirical analysis presented in this paper verifies that an appreciating foreign-exchange rate, higher export profits, wider differential economic growth and international interest rates were important determinants in the decisions of firm management to invest overseas. The analysis indicates that while changes in foreign-exchange rates and capital controls were important in affecting the volume of foreign direct investment changes in the underlying structure of the Taiwanese economy played a more significant role. Specifically, Taiwanese manufacturing growth in previous decades developed specific industrial strengths, which enabled Taiwanese enterprises to exploit comparative advantages in production and management methods to compete effectively in international markets.

I. Introduction

During the 1980s and 1990s, Taiwan's successful industrialization contributed to the growth of its foreign direct investment (FDI) abroad. Between 1965 and 1993, overseas investments totaled more than US \$23 billion, which ranked Taiwan as the seventh largest source of direct investment capital in the world. Most of this overseas investment occurred during the late-

1980s and early-1990s. In 1989 alone Taiwanese foreign direct investment totaled about US \$7 billion. Between 1988 and 1990, foreign direct investment increased to around US \$16 billion. Since the early 1990s, Taiwan's foreign direct investment remained steady at about US \$2 billion annually, or about ten times the amount registered during the 1980s.

The upward trend in foreign direct investment suggests that Taiwan could achieve most developed country (MDC) status by the early

Readers with comments or questions are encouraged to contact the authors via email.

twenty-first century. The purpose of this paper is to empirically examine the relationship between selected macroeconomic fundamentals that affect overseas direct investment decisions, and microeconomic determinants that influenced the selection of investment targets during the period between 1965 and 1993. The period of the analysis begins in 1965 when the United States government suspended capital assistance to the Republic of Taiwan. Prior to 1965, outward-bound direct foreign investment was comparatively insignificant. In succeeding years, Taiwan's overseas investment activities, which were primarily financed by internally generated savings, increased dramatically.

II. Hypotheses

It may be argued that overseas direct foreign investment is functionally related to a vector of macroeconomic aggregates, such as net national savings rates (the savings-investment gap), factor resource endowments, real national economic growth rates, international interest rates, etc. On the other hand, while macroeconomic factors define the overall business environment, specific overseas direct investment decisions typically are formulated at the level of the individual firm. If the decision-making process is rational, these decisions are based on the risk-return trade-offs associated with alternative overseas investment opportunities (see, for example, Yoshida 1987).

The purpose of this paper is two-fold. First, this paper will examine the relationship between Taiwan's foreign direct investment and a vector of macroeconomic variables that characterize the overall business environment. This will be followed by an examination of overseas direct investment activity from the perspective of a profit-maximizing firm. In this subsequent formulation, overseas investment decisions are functionally related to microeconomic (firm-specific) decision variables that are of particular interest to management. To test for theoretical robustness, these models are empirically estimated using ordinary-least-squares using three

specifications: linear, semi-log (mixed), and log linear (multiplicative).

Macroeconomic Specifications

Federal Budget and External Account Imbalances. The first hypothesis examined in this study postulates that the surge in Taiwan's overseas foreign direct investment resulted from a widening national savings-investment gap. During the 1970s and 1980s, Taiwan's conservative fiscal policy and recurrent budget surpluses contributed to a national savings rate that averaged about 30 percent of GNP. By the 1980's, Taiwan's robust national savings rate resulted in a savings-investment gap of about 20 percent of GNP, which was reflected in burgeoning merchandise trade and current account surpluses, and a rapid accumulation of foreign-exchange reserves, which served as an abundant source of overseas direct investment financing.

Declining domestic public and private sector investment contributed to the widening savings-investment gap. Anemic public sector domestic investment resulted from Taipei's conservative fiscal policies, while recurrent federal budget expenditures failed to keep pace with the dramatic increase in overall economic growth during this period.¹ In the private sector, lackluster capital investment expenditures in the contracting, traditional labor-intensive manufacturing export sector also contributed to the country's savings surplus. Following the predictions of the absorption approach to the international balance of payments, the resulting increases in current account surpluses were reflected in burgeoning capital account deficits, of which overseas direct investment comprised a significant portion.

Capital-Labor Ratios. Taiwan's Inspectorate General of Customs estimated that in the 1960s, the country's capital-labor ratio was 5 to 1. Rapid national income growth, however, led to a sharp increase in domestic capital-labor ratios, which exceeded 14 to 1 by 1993. This restructuring of Taiwan's industrial sector caused a

surge in foreign direct investment, principally from the less competitive sectors of the economy.

High capital-labor ratios also resulted from declining population growth in the 1970s and a rapid capital accumulation. The development of capital-intensive industries, which competed with traditional labor-intensive industries in the use of productive resources, also resulted in higher domestic factor prices. The rise in factor prices subsequently forced traditional labor-intensive manufacturing industries to contract domestic operations and expand overseas direct investment activities.

Growth in the Manufacturing Sector. Improvements in managerial and organizational techniques following the growth in the manufacturing sector during the 1960s and 1970s, which were difficult to patent but relatively easy to transfer to foreign production, stimulated overseas direct investment. These intangible assets were easily internalized and transferrable from parent company to subsidiary, and enabled Taiwanese companies abroad to compete more effectively against indigenous firms.

Labor Shortages. The rapid growth of the Taiwanese labor force between during this period also helps to explain the surge in outward-bound direct investment. During the 1960s, Taiwan's labor supply between the ages of 15 and 64 years grew in excess of 4 percent per year. Beginning in the 1970s, however, labor shortages began to appear as the country's population growth began to decline. Labor shortages became so severe during the 1980s and 1990s that continued rapid development in the industrial sector was threatened.

While labor shortages intensified, rapid development of new industries during this period was accompanied by increased labor demand causing a sharp increase in domestic wage rates, which discouraged domestic investment and further encouraged foreign expansion. Although

the Taiwanese government promoted domestic investment in automation as a substitute for labor by providing tax incentives, the high cost of replacing labor with machines hindered the development of automated production.

In 1993, Taiwanese firms spent an average of U.S. \$250,000 to replace one unit of labor, while the annual wage cost per worker was less than U.S. \$10,000. Prohibitive labor costs limited automated production methods to higher value-added industries and compelled many small and medium-sized firms in traditional, labor-intensive industries to relocate to low-wage countries.

Capital Controls. In the 1960s and 1970s, Taiwan maintained fixed foreign-exchange rates with tight controls on foreign exchange holdings and capital movements. The Central Bank of Taiwan pegged the official exchange rate at US \$1/NT\$40 until 1978. By 1978, however, excess market demand resulted in an appreciation of the official exchange rate to US \$1/NT\$38. Shortly thereafter, the central bank abandoned its system of fixed foreign-exchange rates in favor of floating foreign-exchange-rates (Auerbach 1994).

Accompanying the lifting of exchange controls, during the 1960s and 1970s Taipei promulgated incentive programs to encourage export-led economic growth. Government export subsidies, for example, ranged from 2.5 to 12.5 percent of export values. The Taiwanese government also implemented rigid controls to prohibit domestic firms and individuals from holding foreign-exchange assets. Foreign currency export proceeds, however, were to be redeemed at the central bank for domestic currency.

The resulting spate of foreign currency inflows, however, was not sterilized with a more restrictive monetary policy. Burgeoning trade and current account surpluses resulted in accelerated domestic money supply growth, which generated inflationary pressures. In response, Taipei reversed its policy of restricting capital

outflows. This action was interpreted by the business sector as a change in the government's policy to actively encouraging overseas investment activities.

Expressions (1a) and (1b) summarize the hypothesized relationship between Taiwanese foreign direct investment and a vector of macroeconomic explanatory variables.

$$FDI = f(s, k, m, l) \tag{1a}$$

where

$$f_s > 0; f_k > 0; f_m > 0; f_l < 0 \tag{1b}$$

Equation (1a) asserts that Taiwanese overseas foreign direct investment (FDI) during the period 1965-1993 was functionally related to the country's savings-investment gap (s), the capital-labor ratio (k), the average annual growth rate of the manufacturing sector (m), and the average annual growth of the labor force between the ages of 15 and 64 (l). Expressions (1b) are hypothesized first partial derivatives.

To empirically test the Equation (1a), the following three model specifications were estimated

$$FDI = \beta_0 + \beta_1 SSR + \beta_2 KLR + \beta_3 AMG + \beta_4 AGWP + \beta_5 D87 \tag{2a}$$

$$\ln FDI = \beta_0 + \beta_1 SSR + \beta_2 KLR + \beta_3 AMG + \beta_4 AGWP + \beta_5 D87 \tag{2b}$$

$$\ln FDI = \beta_0 + \beta_1 \ln SSR + \beta_2 \ln KLR + \beta_3 \ln AMG + \beta_4 \ln AGWP + \beta_5 D87 \tag{2c}$$

where *ln* represents natural logarithms, *FDI* outward foreign direct investment, *SSR* surplus savings ratio, *KLR* the domestic capital-labor ratio, *AMG* the annual manufacturing growth rate, and *AGWP* the annual growth rate of the working-aged population. The intercept dummy variable *D87* was included in Equations (2) to partially detect changes in the underlying data gen-

erating process following the removal of foreign-exchange and capital controls in 1987.

Microeconomic Specifications

Foreign direct investment may also be viewed from management's perspective. In the case of Taiwan, overseas foreign direct investment was largely driven by domestic wage increases, rapid currency appreciation, and the structure of product pricing. In the fact of intense international competition, Taiwan's export industries could be characterized as "price takers." To remain competitive in international markets, domestic producers were forced to absorb higher domestic wages, which resulted in narrower profit margins. Domestic producers reacted to these developments by accelerating its overseas investment activities to exploit international wage differentials arising from international division of labor and specialization. The combined effect of appreciating exchange rates, rising domestic wages, and international competition resulted in the rapid out-sourcing of relatively labor-intensive domestic production.

Foreign-Exchange Rate Appreciation. During the period 1986 to 1989, much of Taiwan's overseas investment activities were undertaken by export-oriented, labor-intensive manufacturing concerns that faced intense international competition. These industries were especially vulnerable due to rising domestic wages and fluctuating foreign-exchange rates. Moreover, incessant domestic wage increases and an appreciating currency made it difficult for local companies to reinvest in plant and equipment, which hampered productivity improvements.

As the NT dollar appreciated on the foreign-exchange bourse, the erosion of Taiwan's international competitiveness resulted in lost export sales, increased unemployment in export-oriented industries, and excess production capacity. In response, these industries accelerated the pace of its overseas investment activities by establishing off-shore production facilities.

Export Profitability. Prior to 1986, Taiwanese firms' exports were profitable because unit export values were higher than unit labor costs. After 1986, Taiwanese firms suffered losses in export sales as increases in unit labor costs accelerated. From 1982 to 1992, rising wages and sagging productivity improvements caused the unit labor cost to increase by more than 40 percent. As unit labor cost were increasing during this period, unit export values (price) fell by 12 percent. The resulting decline in export profits compelled labor-intensive manufacturers to exploit international division of labor and specialization to lower production costs and regain market share (IGCMF 1994).

Foreign Economic Growth. During the late-1980s and early-1990s, while the rate of increase in Taiwan's economic growth slowed, neighboring East and Southeast Asian economies, such as China, Indonesia, Malaysia, and Thailand, accelerated. Narrowing economic growth rate differentials between Taiwan and its Asian neighbors became a significant factor attracting Taiwanese foreign direct investment into these rapidly growing economies.

International Interest Rate Differentials. During the 1980s, the 90-day euro-dollar rate was higher than equivalent interest rates in Taiwan. MacDougall (1960) has argued that these interest rate differentials were largely responsible for the outflow of investment capital from Taiwan during this period.

Equation (3a) summarizes the hypothesized relationship between Taiwanese foreign direct investment and a vector of microeconomic explanatory variables.

$$FDI = g(x, \pi, y, i) \tag{3a}$$

where

$$g_x < 0, g_\pi < 0, g_y > 0, g_i > 0 \tag{3b}$$

Equation (3a) asserts that foreign direct in-

vestment activity at the firm level during the period 1965-1993 was motivated by exchange-rate fluctuations (x), a composite profit index using unit export values divided by unit labor cost (π), the national economic growth rate differentials between Taiwan and major investment recipient countries (y), and international interest rate differentials between Taiwan and major investment recipient countries (i). Expressions (3b) are hypothesized first partial derivatives.

To empirically test the Equation (3a), the following three model specifications were estimated

$$FDI = \gamma_0 + \gamma_1 FXR + \gamma_2 PROFIT + \gamma_3 DIFG + \gamma_4 DIFR + \gamma_5 D78 \tag{4a}$$

$$\ln FDI = \gamma_0 + \gamma_1 FXR + \gamma_2 PROFIT + \gamma_3 DIFG + \gamma_4 DIFR + \gamma_5 D78 \tag{4b}$$

$$\ln FDI = \gamma_0 + \gamma_1 \ln FXR + \gamma_2 \ln PROFIT + \gamma_3 \ln DIFG + \gamma_4 \ln DIFR + \gamma_5 D78 \tag{4c}$$

where \ln represents natural logarithms, FDI outward foreign direct investment, FXR the NT\$:US\$ exchange rate, $PROFIT$ a profitability index, $DIFG$ economic growth rate differentials, and $DIFR$ international interest rate differentials. The intercept dummy variable $D78$ was included in Equations (2) to partially detect changes in the underlying data generating process following the decision by Taipei to allow the NT dollar to float. Table 1 summarizes the variable definitions in Equations (2) and (4).

III. Empirical Results

Macroeconomic Specification

Table 2 summarizes the ordinary-least-squares parameter estimates for the macroeconomic specifications summarized in Equations (2a)-(2c) corrected for first- and second-degree serial correlation. ρ_1 and ρ_2 are the first- and second-order serial-correlation coefficients. The numbers in parentheses are t -statistics. The

TABLE 1. Definitions

Dependent Variable	Description
FDI	The ratio of Taiwanese outward-bound foreign direct investment to the total gross domestic investment
Independent Variables	
SSR	Surplus savings ratio
KLR	Capital-labor ratio
AMG	Annual domestic manufacturing growth rates
AGWP	Annual growth rates of working population 15 to 64
D87	Dummy variable representing the lifting of exchange and capital control in the year 1987, i.e. D87=0 before 1987; D87=1 for 1987 and afterwards
FXR	Foreign-exchange rates (N.T.\$/U.S.\$)
PROFIT	A profit index defined in the ratio of unit export values to unit labor costs
DIFG	Differential ratios in national economic growth rates between major investment recipient countries and Taiwan
DIFR	Differential ratios of international interest rates between the Taiwan and Euro-dollar 90-day interbank offer rate
D78	Dummy variable representing the adoption of floating exchange rate system in the year 1978, i.e. D78=0 before 1978; D78=1 for 1978 and afterwards

coefficient of determination (R^2), adjusted R^2 , Durbin-Watson statistic (DW), F -statistics, degrees of freedom (df), and Chow F -statistic are also included in Table 2.

The results presented in Table 2 indicate that each of the models estimated fit the data well, although the best fit appears to be model (2c) with the highest adjusted R^2 . Of the hypothesized explanatory variables in Equations (2a)-(2c) the surplus savings ratio (SSR) was eliminated as statistically insignificant at traditional confidence levels.

The remaining explanatory variables in model (2c) explain 87 percent of the total variation in foreign direct investment during the period 1965-1993. The high F -statistic indicates that the set of explanatory variables is statistically significant at the 99 percent confidence

level. After correction for second-degree serial correlation the Durbin-Watson statistic indicates that the standard errors of the parameter estimates and related summary statistics are unbiased.²

The parameter estimates of a double-log specification, which are constant elasticity, indicate that Taiwanese overseas foreign direct investment increased by nearly 3 percent for every one percent improvement in the capital-labor ratio. This supports the observation that overseas direct investment was highly correlated with Taiwan's rapid capital accumulation and industrial expansion during the period of this study.

The data presented in Table 2 for model (2c) also supports the hypothesis that Taiwan's overseas foreign direct investment was positively related to the rate of expansion in the domestic

TABLE 2. Ordinary-Least-Squares Equation (2) Parameter Estimates Corrected for Second-Order Serial Correlation

Parameter	(2a)	(2b)	(2c)
Constant	-0.072* (-4.50)	-8.405* (-6.14)	-11.752 (-3.82)*
SSR	--	--	--
KLR	0.014* (6.34)	0.350† (1.94)	2.861† (2.00)
AMG	--	--	0.417† (2.34)
AGWP	--	-0.250‡ (-1.65)	-1.505† (-2.04)
D87	--	1.877‡ (1.69)	1.936† (2.03)
ρ_1	1.209* (9.63)	0.817* (4.07)	0.797* (4.04)
ρ_2	-0.910* (-6.39)	-0.376† (-1.73)	-0.402† (-1.91)
Total R ²	0.87	0.86	0.90
Adj. R ²	0.86	0.83	0.87
D-W	1.63	1.89	1.80
F-statistics	53.01*	26.59*	30.33*
df	24	22	21
F _c	10.42*	4.11†	3.55†

Notes: (1) Where applicable, the *ln* designator has been omitted.

(2) "--" indicates statistical insignificance at traditional confidence levels.

(3) *, †, and ‡ indicates statistical significance for a one-tailed test at the 99, 95, and 90 percent confidence levels, respectively.

manufacturing sector. The data in Table 2 also indicates that overseas investment activity was more robust during periods of rapid expansion in the manufacturing sector. On the other hand, models (2a) and (2b) indicate that no statistically significant relationship exists between static growth rates in the manufacturing sector and overseas investment activity. In other words, it was not growth in manufacturing *pe se* that engorged overseas investment, but that this sector was growing at accelerated rates.

The parameter estimates in models (2b) and (2c) in Table 2 indicate that Taiwanese overseas foreign direct investment was negatively related to the annual growth rate of the working age population. In other words, declines in labor force growth rates, especially if the rate of change was accelerating, tended to exert a positive effect on overseas investment activity. Rapid industrial growth coupled with slowing labor force growth implies increased wage rates. As was noted above, industrialization in Taiwan accelerated following severe labor shortages dur-

ing the period considered in this study. This result reinforces the general observation that overseas investment activity was driven by growth in the capital intensive industrial sector.

The results presented in Table 2 also indicate that removing capital controls in 1987 resulted in a statistically significant average increase in overseas investment activity. Specifically, the parameter estimates in Table 2 indicate that the removal of capital controls in 1987 resulted in a nearly 2 percent average annual increase in Taiwanese overseas foreign direct investment.

The estimation results presented in Table 2 also support the hypothesis that Taiwanese overseas investment activity was driven by the trend towards more capital intensive production techniques. Somewhat surprisingly, the surplus savings ratio (the savings-investment gap) does not appear to have directly contributed to Taiwanese foreign direct investment, although it may have contributed indirectly through its effect on international interest rate differentials. The interest rate transmission mechanism will be examined more closely in subsequent discussions about microeconomic (firm-specific) motivations to invest overseas. Finally, the statistically significant constants in each of the model specifications suggests that other systematic factors affecting Taiwan's foreign direct investment were omitted from the model.

Structural Change in the Macroeconomic Specification

To further assess the effect of structural change in the underlying data generating process, Chow tests were performed on all three specifications (less the dummy variable *D87*) for the periods preceding and succeeding the removal of capital controls in 1987. This statistic is used to test the null hypothesis of structural stability against the alternative hypothesis of no structural stability.³ If the calculated Chow *F*-statistic (*F_c*) is greater than the critical *F*-value

(*F**) then we reject the null hypothesis in favor of its alternative. These results are presented in Table 2.

The Chow *F*-statistics (*F_c*) for the three specifications indicate that the underlying data generating process was statistically significantly different in the period following the abolition of capital controls in 1987. Prior to 1987, Taiwanese overseas direct investment activity was limited to large enterprises that were able to satisfy rigid financial requirements imposed by the central government.⁴ The removal of these financial restrictions resulted in a sharp increase in heretofore proscribed overseas direct investment by smaller firms (Auerbach 1994). This pattern was especially pronounced during periods of adverse domestic economic conditions as small- and medium-sized Taiwanese firms invested abroad to bolster profits and remain competitive with larger companies. Unfortunately, separate analyses for the sub-periods before and after 1987 failed to yield any meaningful statistical results because of data restrictions and a small sample set (*n*=29). Further research is needed as more data becomes available.

Discussion

The early years of post-World War II Taiwanese economic development was characterized by contemporaneous increases in national savings and investment rates, which may be traced to the country's abundant labor supply, productivity growth, and industrial expansion in the export sector. Rapid improvements in Taiwan's current account contributed to increased economic growth, incomes levels, and national savings rates. The rapid and steady accumulation of domestically sourced savings and capital accumulation soon resulted in a fundamental restructuring of Taiwanese economy.

During this period, labor intensive traditional industrial and agrarian production soon gave way to capital intensive industrial development. The restructuring of the Taiwanese econ-

omy accelerated as labor shortages became more severe. The contraction of labor-intensive industries, particularly in the external sector, created a short-term disequilibrium in the savings-investment relationship due to low investment returns in the labor-intensive export sectors.

Imbalances in the Budget and External Accounts. On theoretical grounds, a statistically significant relationship was expected between Taiwanese overseas direct investment and the surplus savings ratio. The data presented in Table 2, however, does not confirm this relationship. The mere existence of investable savings does not appear to have been a determinant in the decision by Taiwanese firms to invest overseas. While an abundant pool of savings makes overseas direct investment possible, it does not by itself justify such activity. These excess savings might otherwise just as easily take the form of portfolio investments.

Capital-Labor Ratios. The empirical results in Table 2 does, on the other hand, indicate that positive changes in the capital-labor ratio is statistically significant in explaining Taiwanese foreign direct investment. The statistical significance of capital-labor ratios in explaining foreign direct investment supports the Rybczynski (1955) theorem, which predicts that the disproportionate growth of production factors, as evidenced in a high capital-labor ratio, discourages the development of labor-intensive industries by making production factors more expensive. Thus, adverse domestic factor supplies caused Taiwanese labor-intensive industries to relocate overseas to continue business operation.

Growth in the Manufacturing Sector. The statistical significance of annual manufacturing growth rates indicates the importance of intangible assets, such as manufacturing experience, technological innovation, and market connections, in explaining Taiwanese foreign direct investment. The statistical significance of manufacturing growth rates supports the internal hypothesis of the industrial organization approach

to foreign direct investment, which indicates that the need to internalize intangible assets increases firms' incentive to invest abroad.

Labor Shortages. Table 2 indicates that annual growth rates of the labor force between the age of 15 and 64 was negative and statistically significant in explaining Taiwanese foreign direct investment in models (2b) and (2c). Model (2b) indicates that a one percent increase in the growth in the labor force resulted in a one-quarter percent drop in outward-bound foreign investment. In other words, overseas foreign investment was negatively inelastic with respect to labor supply growth. Model (2c) indicates that the pace of overseas foreign investment was also negative related to the rate at which the labor supply was growing. These results seem to suggest that upward pressures on wage rates not only stimulated the outflow of foreign direct investment, but that overseas investment was positively affected by the rate of wage increases.

Capital Controls. The statistical results presented in Table 2 indicate that the dummy variable *D87* was statistically significant at traditional confidence levels in models (2b) and (2c). These results appear to verify the success of government's policy of lifting foreign exchange and capital controls, and promulgating incentive programs to encourage export-led economic growth.

Microeconomic Specification

Table 3 summarizes the ordinary-least-squares parameter estimates for the microeconomic specifications summarized in Equations (2a)-(2c) corrected for first- and second-degree serial correlation. ρ_1 and ρ_2 are the first- and second-order serial-correlation coefficients. The results presented in Table 3 indicate that each of the models estimated fit the data well. Although model (4b) marginally fits the data better with a slightly higher adjusted R^2 , model (4c) is more robust with each of the hypothesized ex-

TABLE 3. Ordinary-Least-Squares Equations (4) Parameter Estimates Corrected for Second-Order Serial Correlation

Parameter	(4a)	(4b)	(4c)
Constant	0.296* (8.63)	2.443† (2.13)	16.595* (3.02)
FXR	-0.006* (-5.33)	-0.157* (-4.76)	-6.327* (-4.16)
PROFIT	-0.046† (-2.23)	-3.791* (-6.72)	-4.023* (-5.52)
DIFG	--	1.026* (3.89)	0.559† (2.18)
DIFR	--	--	1.248† (1.87)
D78	--	1.727* (5.98)	1.129† (2.47)
ρ_1	0.897* (6.49)	0.561* (3.94)	0.432* (2.77)
ρ_2	-0.852* (-5.37)	-0.801* (-5.30)	-0.738* (-4.76)
Total R ²	0.86	0.93	0.93
Adj. R ²	0.84	0.91	0.90
D-W	2.08	2.01	2.56
F	34.98*	46.61*	33.71*
df	23	21	20
F _c	0.04	3.09†	3.23†

Notes: (1) Where applicable, the *ln* designator has been omitted.

(2) "--" indicates statistical insignificance at traditional confidence levels.

(3) *, and † indicate statistical significance for a one-tailed test at the 99, and 95 percent confidence levels, respectively.

planatory variables being statistically significant at traditional confidence levels.

The parameter estimates for all three model specifications have the correct signs and are statistically significant at traditional confidence levels. The parameter estimates for model (4c) in Table 3 support the microeconomic hypothesis that Taiwanese foreign direct investment is significantly affected by explanatory variables that impact directly on the firm's operations and profitability, including foreign-exchange rate ap-

preciation, export profits, economic growth and international interest rate differentials. Model (4c) indicates that 90 percent of variations in the rate of growth of Taiwanese foreign direct investment during the period 1965 to 1993 can be explained by percentage variations in the complete set of explanatory variables hypothesized in Equation (3a).

The high *F*-statistics indicate the statistical significance of the unrestricted models (4a)-(4c). Parameter estimates suggest that the variations in

Taiwan's foreign direct investment are elastic relative to changes in foreign-exchange rates, export profitability index, and international interest rate differentials, but inelastic relative to changes in national economic growth rates. The statistical significance of the dummy variable (D78) in models (4b) and (4c) underscore the importance of the government's decision in 1978 to allow the NT dollar to float.

Discussion

This study posited that export profitability, foreign-exchange rate appreciation, economic growth rate and international interest rate differentials were instrumental in the decisions of firms in Taiwan to directly invest abroad. Faster foreign economic growth and higher interest rates resulted in higher returns on investments, which attracted foreign capital. The burgeoning markets of East and Southeast Asia represented particularly fertile ground for Taiwanese overseas investment to take advantage of plentiful and inexpensive sources of labor, and as sources of abundant raw materials.

Foreign Exchange Rate Appreciation. The parameter estimates for the three model specifications for Equations (4a)-(4c) reveal that the appreciation of the NT dollar strongly influenced Taiwanese foreign direct investment. The results summarized in Table 3 for model (4c), for example, indicate that a one percent appreciation in the NT\$:US\$ exchange rate resulted in this period with more than a 6 percent increase in foreign direct investment spending by Taiwanese firms.

Export Profitability. The results presented in Table 3 also verify the importance of the export incentive for directing the outflow of foreign direct investment. The parameter estimates for model (4c), for example, indicate that for the period under consideration a one percent increase in the profitability index resulted in a more than 4 percent increase in outward bound direct investment activity by Taiwanese firms.

Foreign Economic Growth. Table 3 also indicates the significance of differential rates of economic growth in explaining Taiwan's overseas direct investment activities. In particular, the parameter estimates for model (4c), for example, indicate that Taiwanese foreign direct investment was inelastic with respect to changes in economic growth rate differentials. The data indicate that a one percent widening of this variable resulted in a 0.56 percent increase in foreign direct investment by Taiwanese firms.

International Interest Rate Differentials. The results presented in Table 3 support MacDougall's findings that higher international interest rates tend to draw investment capital out of a country. International interest rate differentials were found to be statistically significant in explaining Taiwan's overseas direct investment activities during the period examined in this study. During the 1980s, the 90-day Eurodollar rate was higher than Taiwan's interest rates, which contributed to an outflow of Taiwanese portfolio and direct investment capital. In fact, changes in Taiwanese overseas direct investment was elastic relative to changes in international interest rate differentials. As shown in Table 3, a one percent widening in interest rate differentials resulted in a nearly 1.25 percent increase in outward-bound direct investment.

IV. Conclusions

At the macroeconomic level of generality, the empirical analysis presented above confirms that increases in Taiwanese foreign direct investment during the period 1965-1993 resulted from rapid capital accumulation, which encouraged the development of capital-intensive industries, the accumulation of manufacturing intangible assets, and labor shortages. The above results also verify that overseas direct investment activity was stimulated by the government's decision to abolish capital controls, which provided domestic firms a convenient overseas exit for their investment capital.

At the firm (microeconomic) level of generality, the empirical analysis presented above verifies that appreciating foreign-exchange rates, higher export profits, wider differential economic growth and international interest rates were important determinants in the decisions of firm management to invest overseas. The results presented above show that the government's decision to allow the NT dollar to float was also statistically significant in explaining Taiwanese foreign direct investment activity. In general, the surge in overseas investment by Taiwanese firms was the natural consequence of the dynamic restructuring of the domestic economy towards more capital-intensive production techniques, and the rise in domestic wage rates following the slowdown in labor supply growth. The increase in foreign direct investment also resulted from the government's decision to follow a more export-led economic development program.

Economic factors that significantly influenced Taiwan's foreign direct investment behavior can be sub-divided in terms of its short-term and long-term effects. While foreign-exchange rate and interest rate fluctuations only have short-term effects, market disequilibrium theory predicts that once these differentials are eliminated, investment flows will cease. Nevertheless, Taiwanese enterprises began to invest abroad in the 1960s and 1970s when foreign exchange rates and interest rate movements were not favorable. Moreover, Taiwanese firms continued to invest overseas in the 1990s even when the economic growth rate and interest rate differentials had largely disappeared. Other long-term variables, such as capital-labor ratios, foreign economic growth rates, and manufacturing growth rates, played more important roles in affecting Taiwanese foreign direct investment. Specifically, Taiwanese manufacturing growth in previous decades developed specific industrial and managerial strengths that enabled Taiwanese enterprises to compete effectively against their international competition, and that encouraged overseas direct investment.

V. Suggestions for Further Research

This study examined the relationship between changes in macroeconomic and microeconomic (firm-specific) determinants and changes in foreign direct investment made by Taiwanese firms. The general paucity and frequency of comprehensive time series data, however, restricted the analysis of annual data for the period 1965-1993. One obvious direction for further research would be to determine whether the general trends and underlying causes of Taiwanese foreign direct investment have continued to the present, especially given the growing importance of East and Southeast Asia in international economic affairs, and as markets for Taiwanese manufactures. In addition, the static analyses presented above were restricted to single equation models of various specifications. Further research in this area is warranted, as well as the estimation of Taiwanese overseas direct investment within a dynamic general equilibrium framework.

Endnotes

1. Insufficient public investment in the 1980s caused shortages of electricity, transportation facilities, and urban facilities, such as parks, libraries, and sewage systems, etc.
2. Serial correlation (autocorrelation) refers to correlation of residual terms in the regression analysis of a time-series data in which the standard errors and *t*-statistics of parameter estimates are biased and need to be corrected before interpreting final results.
3. The relationship between the dependent and independent variables may undergo a structural change over time. The Chow test, which is a popular test of structural stability, is given by the expression

$$F_c = \{(S_i - S_i')/k\} \{S_i' / (n_1 + n_2 - 2k)\}^{-1}$$

at *k* and $n_1 + n_2 - 2k$ degrees of freedom, where n_1 is the number of observations for the first sampling period, n_2 is the number

of observations for the second sampling, k is the number of parameter estimates in the restricted model, S_i is the error variations for the entire sampling period, and S_i' is the combined error variation for the two sub-periods. This statistic has an F distribution with k and $n-2k$ degrees of freedom (see, for example, Intriligator, Bodkin and Hsiao 1996).

4. Rigid financial requirements in owner's equity, debt and profit ratios prohibited Taiwanese small- and medium-sized businesses to invest abroad before the government abolished capital controls in 1987.

References

1. Auerbach, J.D., D. Dollar and K.L. Sololoff, eds., *The Role of the State in Taiwan's Development*, M.E. Sharpe, Armonk, New York, 1994.
2. Akamatsu, K., "A Historical Pattern of Economic Growth in Developing Countries," *The Developing Economies*, The Asian Economic Institute, Tokyo, 1962.
3. Anderson, G.H., "Three Common Misperceptions About Foreign Direct Investment," *The Federal Reserve Bank of Cleveland*, July 25, 1988.
4. Bhagwati, J., E. Dinopoulos and K. Wong, "Quid Pro Quo Foreign Investment," *American Economic Review*, Vol. 82, No., 3, pp. 186-90, 1992.
5. Chung, C., *Taiwan's Direct Foreign Investment in Mainland China: Impact on the Domestic Host Economy*, Chung Hua Economic Institute, Taipei, 1994.
6. Froot, K.A. and J.C. Stein, "Exchange Rates and Foreign Direct Investment: An Imperfect Capital Market Approach," *Quarterly Journal of Economics*, Vol. 106, No. 4, pp. 1191-217, 1991.
7. Froot, K.A. ed., *Foreign Direct Investment*, The University of Chicago Press, Chicago, 1993.
8. Graham, E.M. and P.R. Krugman, *Foreign Direct Investment in the United States*, Institute for International Economics, Washington, D.C., 1991.
9. Grub, P.D., *Foreign Direct Investment in China*, Quorum Books, New York, 1991.
10. Inspectorate General of Customs (IGCMF), *Monthly Statistics of Exports and Imports: Taiwan Area*, Ministry of Finance, Taiwan, 1994.
11. Intriligator, M.D., R.G. Bodkin and C. Hsiao, C., *Econometric Models, Techniques, and Applications*, Prentice Hall, Upper Saddle River, NJ, 1996.
12. Kojima, K., *Direct Foreign Investment: A Japanese Model of Multinational Business Operations*, Praeger, New York, 1978.
13. Li, K.T., *Economic Transformation of Taiwan*, Shephard-Walwyn, London, 1988.
14. Lin, C., *Industrialization in Taiwan, 1946-1972*, Praeger, New York, 1973.
15. MacDougall, G.D.A., "The Benefits and Costs of Private Investment Abroad: A Theoretical Approach," *Economic Record*, Vol. 36, No. 1, pp. 13-35, 1960.
16. Rybczynski, T.M., "Factor Endowment and Relative Commodity Prices," *Economia*, Vol. 22, pp. 336-341, 1955.
17. Yoshida, M., "Micro-Macro Analysis of Japanese Manufacturing Investment in the United States," *Management International Review*, Vol. 4, 1987.

Notes