

STEEL INTENSITY AND GNP STRUCTURE IN TAIWAN, R.O.C.

吳質義

中國鋼鐵公司業務助理副總經理吳質義學長於今年三月十七日在澳洲新堡 (New Castle) 東南亞鋼鐵協會澳洲大會所發表之論文，對中華民國台灣地區的人口，國民生產毛額結構及用鋼能量作一詳盡的描述。由於鋼鐵工業對一個國家的工業化，特別是自開發中國家邁進開發國家的重工業化時期，扮演著極為重要的角色，根據該文分析的結果顯示，台灣地區在 1979 年的平均每人國民生產毛額已達到 511 美元 (1963 年美元幣值)，平均每人粗鋼消耗量為 317 公斤，按照國際鋼鐵協會所訂的指標顯示出中華民國台灣地區目前已越過工業起飛時期而進入加速工業化的階段。由於文中分析精闢深入，特予刊登。唯原文附表及數字限於篇幅，割愛節略，如有興趣欲閱者，請來函，當影印奉上。 編者

1. INTRODUCTION

There is a close correlation between steel consumption and economic development, but the relationship between them is not always the same in all stages of economic development, and it cannot be expressed with a straight line.

So far as we know, in the initial stage of economic development, as construction of infrastructure and industries is just starting, the demand for steel is urgent as well as great; and, consequently, the growth rate of steel consumption is high. Gradually, when the economic development goes on at a steady pace with gross national product (GNP) and steel demand increasing continuously, the growth rate of steel consumption becomes slowing down.

The International Iron & Steel Institute (IISI) uses steel intensity to indicate the correlation between economic development and the demand for steel. By steel intensity, it means the average steel consumption by each dollar of GNP (ASC/GNP, Kg/\$). The value of 1963 U.S. dollar is used in the above expression. IISI suggests a theoretical steel intensity curve to show the steel consumption when a country is being developed from a developing country to a developed country. IISI divides the economic development of each country into four stages.

- (1) When GNP per capita comes to \$400, the country is said in a take-off stage and the steel intensity curve rises rapidly. It is called the initial stage of steel intensity.
- (2) When GNP per capita is between \$400 and \$1 200, the country is put into a stage of accelerated industrialization. In this stage, the growth rate of steel consumption is more than that of GNP.
- (3) When GNP per capita is between \$1 200 and \$2 000 the economic growth of the country becomes steady. In this stage, the steel intensity remains nearly constant, while GNP increases at a steady pace.
- (4) When GNP per capita is more than \$2 000, the steel intensity decreases despite the growth of GNP. This shows that the steel consumption increases very slowly at a rate slower than that of GNP.

2. GROSS NATIONAL PRODUCT STRUCTURE AND POPULATION ANALYSIS

2.1 Gross National Product Structure

GNP growth rate of Taiwan has increased a great deal in the past. Each year's current prices were used to express GNP amount as shown in Table 1. However, if link index was adopted in the calculation of GNP annual growth rate, all ratios in the past years exceeded 10% with the exception of 1975. If the value of 1963 N.T. Dollar were used, the annual average GNP growth rate is about 10%. This indicates that there is a steady increase in GNP as shown in Table 2.

Next, let us examine gross domestic product (GDP) structure in order to analyze the industry structure of Taiwan. Table 3 shows that the ratio of gross domestic capital formation (GDCF) to gross domestic product is increased from 19.7% in 1961 to 28.5% in 1978. Besides, the manufacturing industries share an increasing bigger portion in GDP, while the ratio of agricultural product to GDP dwindled as the years went by. This shows that there is an tendency the manufacturing will play a more important role than that of agriculture and will become the core industry of the whole economic structure. Please see Figure 1. If GDCF is classified by fixed capital formation, the first rank is machinery & equipment, construction gradually increasing in recent years comes as the second. Please see Table 4.

A study of the six-year's economic planning project prepared by the council for economic planning and development (CEPD) indicates that the GNP growth rate increases 8.5% per annum for the period of 1979 through 1981. And it is expected that the economic development will keep a similar growth rate in the years to come.

2.2 Population

The natural increasing rates of population in Taiwan were above 3% before 1965, but it has been decreased to 1.8% in recent years. A study compiled by council for economic planning and development indicates that the population natural increasing rate may decrease to 1.7% by the year of 1981. By then, the population will only increase to 17.98 million persons from the 17.05 million persons in 1978. Table 5 shows population and natural growth rate from 1961 through 1978. Regarding the distribution of occupations among the population, there is a tendency of increasing the proportion of those people who engage in industries. And the people who work in the fields of agriculture, forestry & fisheries will decrease gradually. As a matter of fact, agriculture, forestry & fisheries being the major occupation years before. For example, the share of industry and that of agriculture, forestry & fisheries are 28.3% and 31.8% respectively in 1978. Although the percentage of employees of agriculture, forestry & fisheries is higher than that of industry.

We can predict that the share of industry employees will exceed that of agriculture, forestry & fisheries in the near future. In 1978, we also know that the services is at a level of great percentage of total employment, i.e., 24.2% the shares of employment for commerce, transportation and other occupation are smaller than those aforementioned. Please see Table 6.

3. APPARENT STEEL CONSUMPTION

The GNP data selections and population are explained in sections 2-1 and 2-2 respectively. The apparent steel consumption is derived from the equation: Production + Imports - Exports = Apparent Steel Consumption. So the apparent steel consumption ignores inventory factor. The apparent steel consumption has greatly increased in Taiwan during recent years. For example, there is a significant growth rate during the years shown in Table 7 except for 1975 which was affected by the world economic recession. The apparent steel consumption and crude steel equivalent are shown in the same table. The steel product quantities were converted to crude steel equivalents by uniform yield factor 1.3 set by IISI.

The demand for bar came to the first place in 1978. Section followed next, sheet (thickness under 3mm) and wire rod were the third and fourth. The annual increasing rate of the steel products mentioned above are 23%, 112%, 13%, 22% respectively compared with 1977.

4. STEEL INTENSITY

Having observed the data of GNP, population and apparent steel consumption aforementioned, we can calculate the historical steel intensity (see Table 8) as follows: $\text{Steel Intensity} = \text{Crude Steel Consumption per Capita} / \text{GNP per Capita}$

In the above expression we can calculate the individual value of numerator denominator from the equations listed below:
 $\text{Crude Steel Consumption per Capita} = \text{Crude Steel Equivalent/Population and GNP per Capita} = \text{GNP/Population}$.

The value of 1963 U.S. Dollar is used in the above expression. Therefore, according to the predicted data of GNP, population and steel consumption we can forecast the crude steel consumption and steel intensity in Taiwan for the period of 1980 through 2000. The predictive variables are briefed as follows.

(1) GNP: The growth rate is set 8.5% per annum by CEPD for the period 1979 through 1981. We use the same predicted growth rate 8.5% after 1982.

(2) Population: CEPD predicted population natural increase rate at a level of 1.8% for 1979 through 1980 and 1.7% for 1981. From 1982 to 2000 the natural growth rates are listed below:

| <u>Period</u> | <u>1982-1985</u> | <u>1986-1990</u> | <u>1991-2000</u> |
|---------------------|------------------|------------------|------------------|
| Natural Growth Rate | 1.7% | 1.6% | 1.5% |

(3) Apparent Steel Consumption: The increasing rate for example

| | | | |
|------------------|------------------|------------------|------------------|
| <u>1985/1980</u> | <u>1990/1985</u> | <u>1995/1990</u> | <u>2000/1995</u> |
| 4.60% | 4.03% | 3.78% | 3.78% |

Conversion rate of steel product and crude steel is 1.3

Steel intensity is expressed in Figure 2. Data was based on Table 8 and Table 9. From Figure 2, we observe that steel intensity (0.646) reached to the peak in 1978, then it will decline gradually.

5. CONCLUDING REMARKS

The relationship between GNP and crude steel consumption is closely correlated, just as the four different stages of economic development assessed by IISI. The growth rate of GNP and crude steel consumption is quite different in each stage resulted in different types of steel intensity. From the above analysis we know that Taiwan has passed the take-off stage and is now in the stage of accelerated industrialization, and we can prove that by the term "take-off" defined by IISI, i.e.,

- (1) GDCF at a level of at least 20% of GDP.
- (2) More than 20% of GDP originating in manufacturing.
- (3) Less than 30% of GDP originating in agriculture.
- (4) More than 700 tons of steel consumed per \$1 million of GDCF.

Please refer to Table 3, we can see the indicators regarding GDCF/GDP is above 20% since 1965. The percentage of Manufacturing/GDP is over 20% since 1970. On the other hand, the share of agriculture/GDP declined to under 25.4% since 1961. If the value is expressed by 1963 U.S. dollar, we get an over 750 metric tons steel consumed per million of GDCF. From these indicators, we believe Taiwan is now put into a stage of accelerated industrialization and the growth rate of steel consumption will rise rapidly.

Steel intensity reached the peak in 1978, from then on the growth rate of GNP increased more rapidly than that of steel consumption so steel intensity gradually decreased.

The average GNP per capita will come to 1 200 U.S. dollars and we expect GNP will continuously rise. However, the demand for steel increased very slowly. At this stage, the economic growth will become steady and economic development will be put into the third stage and Taiwan will be regarded as one of the developed countries. Up to the year 2000, GNP per capita will exceed 2 000 U.S. dollars. At that time the economic development will enter into maturity period.

美洲快訊

諸位學長：

五年前，美洲交大校友會在加州的Asiloman舉辦了一次非常出色的第三屆全美洲校友聯誼會，當時決定在一九八〇年，由陳國祥學長負責，於芝加哥地區舉辦五年一度的第四屆全美洲校友聯誼會。一個月前，陳國祥學長致函校友總會，謂陳國祥學長因工作變動之故，不能負責這次的聯誼活動。因此總會王安學長向校友總會建議改處由總會負責，以紐英倫分會為幹事主力及聯合各分會會長為贊助，在波士頓地區舉辦這次第四屆全美洲交大校友聯誼會。王會長的建議獲得總會執行委員會的一致同意及紐英倫分會的熱烈支持。初步商討交通大學美洲同學會第四屆聯誼會籌備委員會於一九八〇年三月十九日正式成立，並且在王安學長家中舉行第一次會議，會議擬定下列事項：

- 一. 會議決定這次聯誼會以“交大在美國”作專題演講，由何應榮學長負責。
- 二. 聯誼會日期為一九八〇年八月廿二日至廿四日。
- 三. 地點：Wang Institute, Tyngsborough, Mass.
- 四. 費用：不超過 \$95 一人，包括吃住及當地交通與機場接送。
或 \$50 一人，包括吃及當地交通（住宿自理）。
或 \$10 一人，未成年學長家眷。
- 五. 分派負責幹事及職務。
- 六. 初擬開會節目程序。

籌備委員會希望諸位學長撥冗攜眷參加，並歡迎諸學長提供意見及餘興節目，使此次聯誼會能辦得更生動及出色。

一九八〇年交通大學美洲校友會
第四屆聯誼會籌備委員會 敬啟 三月三十一日

第四屆聯誼會通告

會場地點：Wang Institute, Tyngsborough, Mass.

日期：一九八〇年八月廿日至八月廿四日

費用：預計不超過 \$95 per adult, 包括吃住及當地交通。

\$50 per adult, 包括吃及當地交通。

\$10 per child, 十八歲以下，包括吃住與家人一起。

從校友居住地往返波士頓的交通費用自理。

住宿：Chalet Motor Lodge (Rt. 128 & Rt. 4)

440 Bedford Street

Lexington, Mass. 02173

註冊：為便於預訂住食交通各方面的需要，確保此次聯誼會的成功，希望諸學長於五月三十

一日以前向聯安學長辦理之，註冊表請寄 PETER TENG,

24 Dudley Rd., Billerica, Mass. 01821