Market Structure and Inter-industry Profit Differences in Taiwan

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A high degree of openness and labour-intensive production are the two main features of Taiwan's manufacturing sector. This study uses the export/sales ratio and the K/L ratio to divide the sector into two groups: (1) the export-oriented and domestic market-oriented industries, and (2) the capital-intensive and labour-intensive industries. The Chow test confirmed the two-regime hypothesis for both the groups, supporting the validity of our dualistic analysis. Using 1986 census data, the distribution of profit rates in the two groups are compared. The major determinants of inter-industry profit differences are the domestic sales ratio and the capital/output ratio; the other variables have either little impact or generate unsystematic effects.

1. INTRODUCTION

The Proposition

During the process of rapid economic development (1950–1980), Taiwan was known for its growth with equality [see, for instance, Fei, Ranis and Kuo (1979)]. Literature on Taiwan's income distribution is abundant, as one can find from the EconLit CD-ROM. However, the relationship between market structure and income distribution is not yet fully investigated in Taiwan or in other economies.

The problem of income distribution is multi-dimensional and complex, including economic, social, political, and historical factors. Even if we confine ourselves to the economic dimension, the determinants of income inequality are numerous and the interaction among these elements is also ambiguous. Economists analyse income distribution (or income inequality) from different points of view with various explanatory variables. Income distribution can be analysed from an angle of international comparison (between developed countries [DCs] and less developed countries [LDCs], or within a community such as the EEC); or from a macroeconomic point of view (e.g., how the degree of income inequality evolved during the process of growth); or from an economic development point of view (how development strategies have affected income distribution); or from a regional economics point of view (inter-regional income inequality); and so forth.

Explanatory variables generally include, (1) at the macroeconomic level, how taxation, employment policy, social security policy, etc., affect income distribution; (2) from the viewpoint of characteristics of income-earners: how the individual's education, social background, family size, age, sex, race, profession, dwelling locality (urban or rural), and other pertinent factors induce different earnings to result in income disparity.

My approach is somewhat different. The basic idea is as follows. Suppose that there are ten breadwinners working in ten different industries with identical personal characteristics and identical macroeconomic backgrounds. The received theory suggests that their incomes (wage and profit) are identical. However, as everybody knows, this is untrue. Among other possible factors, I try to hypothesise that income differentials are attributed partly to the market structure (or market imperfection) of the industry to which they are affiliated.

This effect differs from the neoclassical marginal-productivity theory of income distribution, in which incomes are distributed according to the factors' marginal productivities within the paradigm of perfect competition, perfect information, perfect rationality, etc. In reality, however, oligopoly and monopolistic competition prevail in most non-centrally planned economies. For an understanding of the reality of the situation, income distribution economics needs explanations from the perspective of imperfect competition.

The term "income" contains many sources. I shall confine myself to one particular source of income: profit. The determinants of wage income have been treated in another paper [Lai (1989)]. The main objective of this study is to investigate whether market structure is a significant factor affecting profit rate inequality in Taiwan. The main features of this study are that it is restricted to the *industry* level, rather than at the national or the household level in the conventional way and the key concept is the market structure which is borrowed from industrial economics. The elements of market structure include the degree of industrial concentration (measured by various indices), product differentiation, barriers to entry, and economies of scale [Scherer (1980)].

Tool of Analysis

Economists of income distribution have tried from various angles to analyse the factors that affect income disparity at the national and sectoral (industrial, farm sectors, etc.) levels, but little has been done at the industry level. I propose to analyse profit income distribution at the industry level by borrowing the Structure-Performance (S-P) method from Industrial Organisation (I. O.). In other words, departing from the neoclassical marginal productivity approach and other approaches used in income distribution economics, the S-P method offers a market imperfection method to analyse profit differences among industries.

In short, the S-P paradigm can be described as an investigation into the determination of average levels of profitability across industries, by testing the significant differences associated with variations in the level of industry concentration and other market structure variables. The literature published in the 1960s and the 1970s has persuaded many scholars that the S-P relationships do exist and these are important. The period of the 1960s and the 1970s can be named as the *classical* era of I. O., because it is a direct heritage of the tradition founded by Mason in the 1930s and Bain in the 1950s. The standard method of this "paradigm" is to test a central hypothesis: Did that increase in seller concentration tend to raise industry-wide profits by facilitating collusion? Most published studies confirmed this relationship and, based on this "evidence", some public policies were proposed.

Some different views, however, also emerged during that time. For example, since about the second half of the 1970s an anti-classical, or *revisionist* approach, as Schmalensee (1985) describes it, has arisen. A major difference is that the revisionist predicts a positive correlation between concentration and profitability in cross-section at the industry level, even though, by assumption, concentration does *not* facilitate the exercise of market power.

2. DUALISTIC STRUCTURE

In his comprehensive survey on the inter-industry study of market structure and performance, Schmalensee (1989) re-examines this field pioneered by Joe Bain since the 1950s, and evaluates the main findings of this empirical approach. However, there is an insufficient inclusion of cases from less developed countries (LDCs) in his survey. The purpose of this empirical study is to find out the determinants of inter-industry profit differences in the manufacturing sector of Taiwan, taking its two main features into account: the small open economy and the labour-intensive mode of production.

In terms of partition thresholds, the export-oriented sector is defined as industries whose export ratio is larger than the average of the whole sector; and the domestic-oriented sector consists of the rest. The mean value of export ratio for all the manufacturing sector (160 industries) was 37 percent in 1986. Applying this principle to the K/L ratio criterion, the average K/L of the whole manufacturing sector was US$ 30,745. These two criteria (37 percent and US$ 30,745) were used to split the 160 industries into two groups. It is interesting to note that, according to the K/L criterion, there are 57 capital-intensive and 103 labour-intensive industries. This is very close to that using the export ratio criterion: 58 export-oriented and 102 domestic-oriented industries.

This similarity is surprising. I think there are overlappings when dividing industries in this way: some industries are both labour-intensive and export-orient-

ed; some are both labour-intensive and domestic market-oriented, etc. I regret that, given the statistical information available, I am not able to detect and pick out these overlapping industries to make a clear-cut testing. To test the dualistic-structure hypothesis, I present five "groups" of industry (see Fig. 1): the whole manufacturing sector, the export-oriented sector, the domestic market-oriented sector, the capital-intensive sector, and the labour-intensive sector.

Figure 1A shows the distribution of average profit rates in the whole manufacturing sector. The average profit rate is 6.45 percent with 3.59 percent standard deviation. Industries in Fig. 1B are those with a higher export ratio (>37 percent), while industries with lower export ratio are contained in Fig. 1C (<37 percent). Although their average profit rates are about the same (6.51 percent and 6.41 percent), the export-oriented industries have slightly higher profit rates and lower standard deviation. Also, the shapes of Figs. 1B and 1C are very similar. In other words, they do not display a "significant asymmetry" phenomenon as expected in the dichotomous (dual) economy model.

Another evidence is to use the mean and standard deviation of Figs. 1B and 1C to calculate the Z-value (standard normal distribution); the higher the degree of significance in Z-value, the higher the degree of asymmetry between the two sectors. The Z-value of Figs. 1B and 1C is 0.160, which is statistically insignificant, suggesting that profit patterns are not "significant asymmetry" in this group.

The contrast is better illustrated in the group of Fig. 1D and Fig. 1E by using the K/L criterion. The higher K/L ratio industries have lower profit rates (5.60 percent) and higher standard deviation (4.46 percent); the lower K/L ratio industries have higher profit rates (6.92 percent) with lower standard deviation (2.92 percent). The Z-value is 1.99, significant at the 5 percent level. Also, the shapes of the curve in this group are more asymmetrical than in the previous group. The impression from this evidence is that, on average, higher profits can be earned through investing in lower capital-intensity industries, an impression that is corroborated by regression analysis (K/output ratio in Table 1).

3. REGRESSION ANALYSIS AND CHOW TEST

Regressions

The following hypotheses were tested: (1) More concentrated industries earn higher profits; (2) Industries with larger size (more number of firms) have lower profitability; (3) Sales volume is positively correlated to profitability; (4) Similarly, higher value-added industries have a higher profit rate; (5) Higher export ratio industries earn more; (6) Degree of capacity utilisation is correlated to profitability; (7) More capital-intensive (higher capital/output ratio) industries earn less.
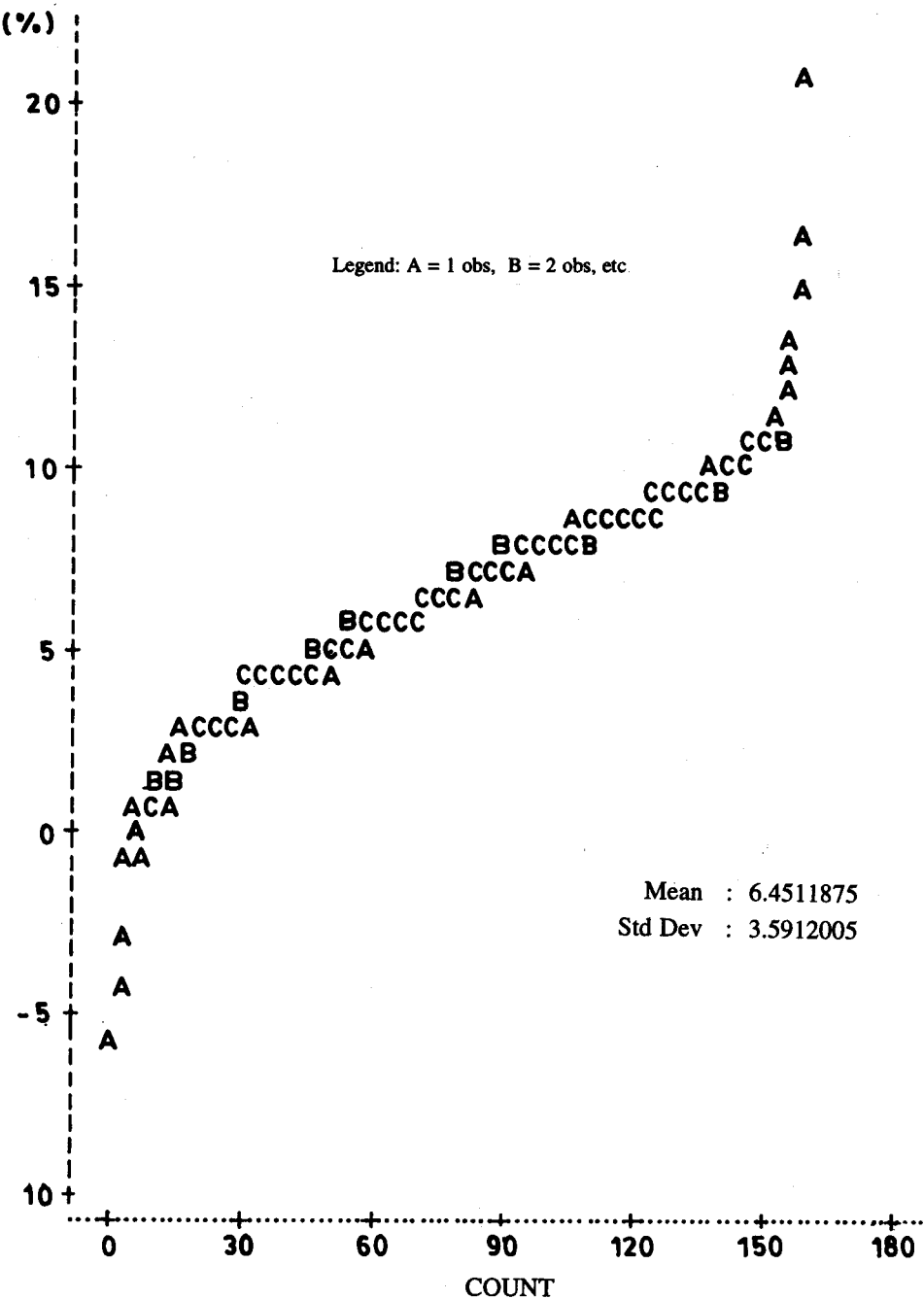
Fig. 1A. The Distribution of Profit Rate in the Manufacturing Sector
Profit Ratio in 1986 (%)
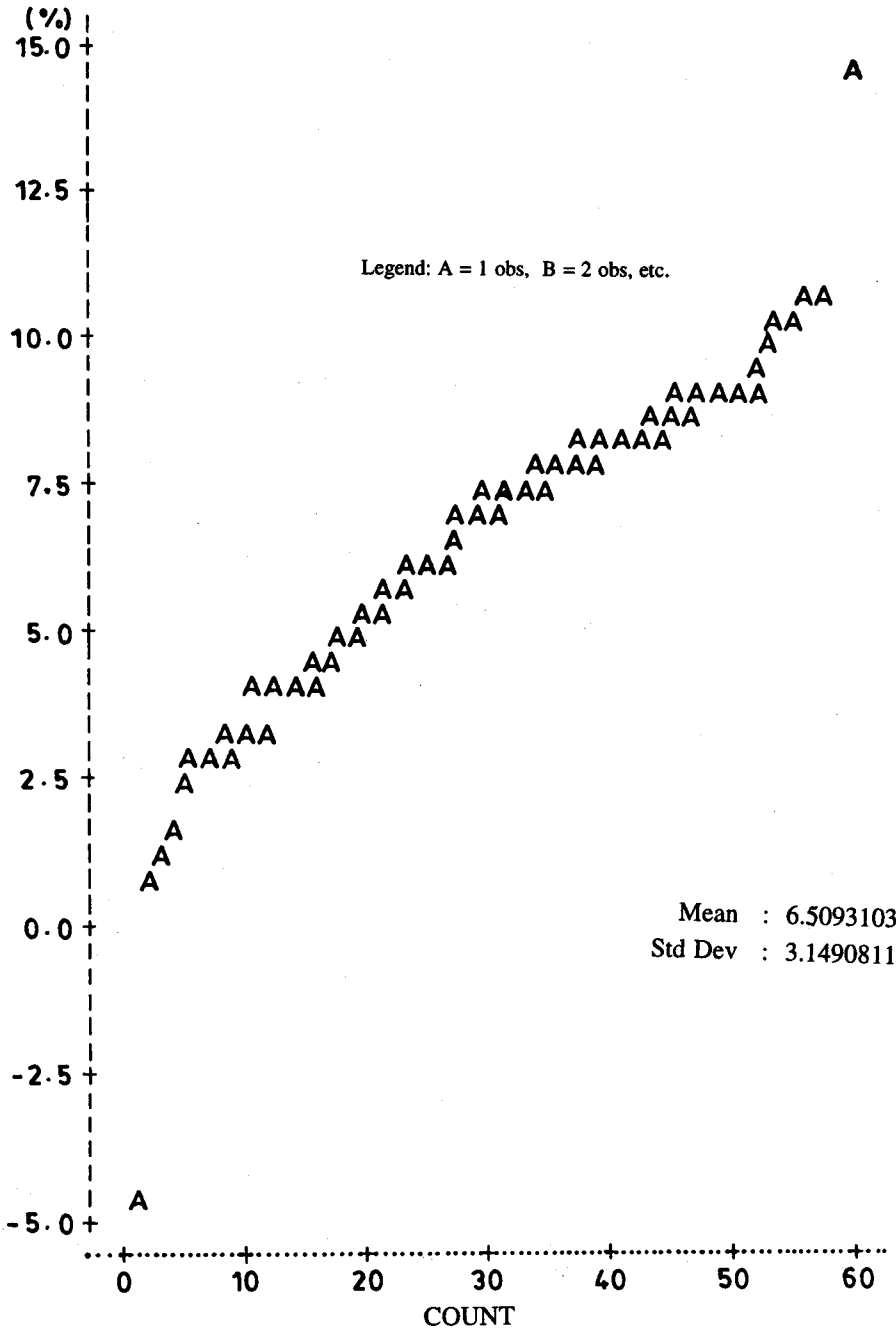All the Industries, N = 160.

Fig. 1B. **The Distribution of Profit Rate in the Manufacturing Sector**
Profit Ratio in 1986 (%)
Export/Sales Ratio > 37%, N = 58.

Fig. 1C. The Distribution of Profit Rate in the Manufacturing Sector Profit Ratio in 1986 (%) Export/Sales Ratio < 37%, N = 102.

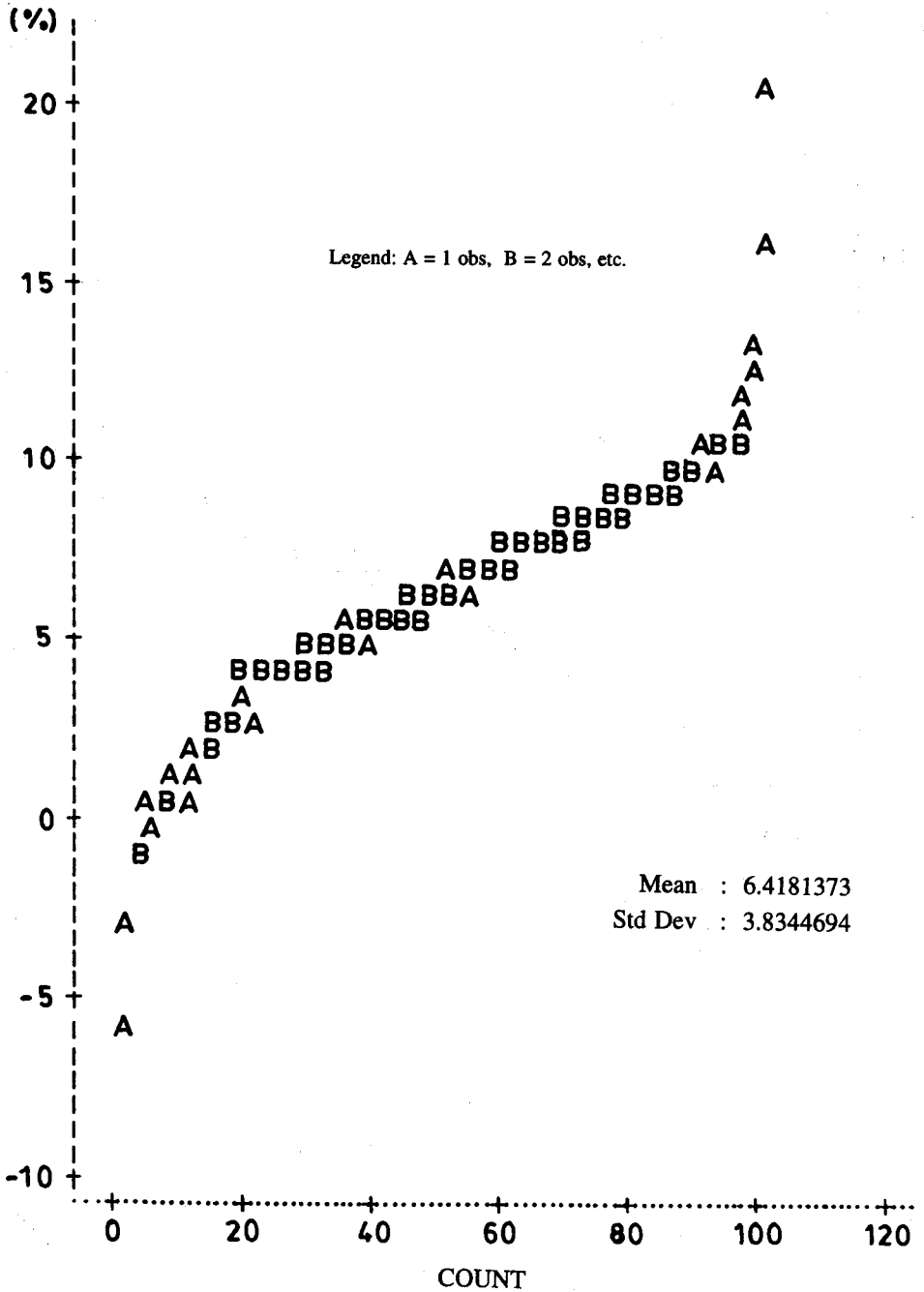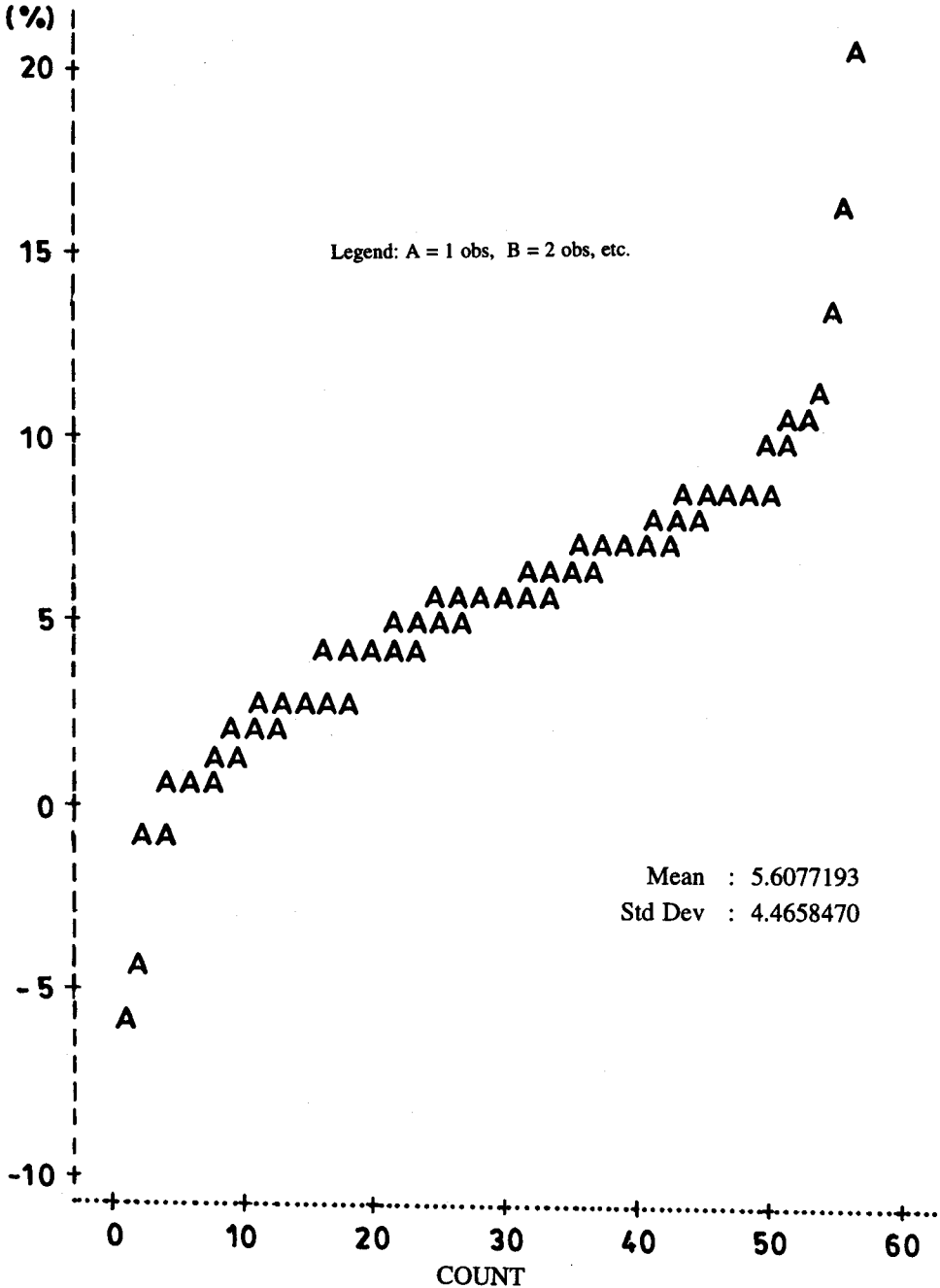Fig. 1D. The Distribution of Profit Rate in the Manufacturing Sector
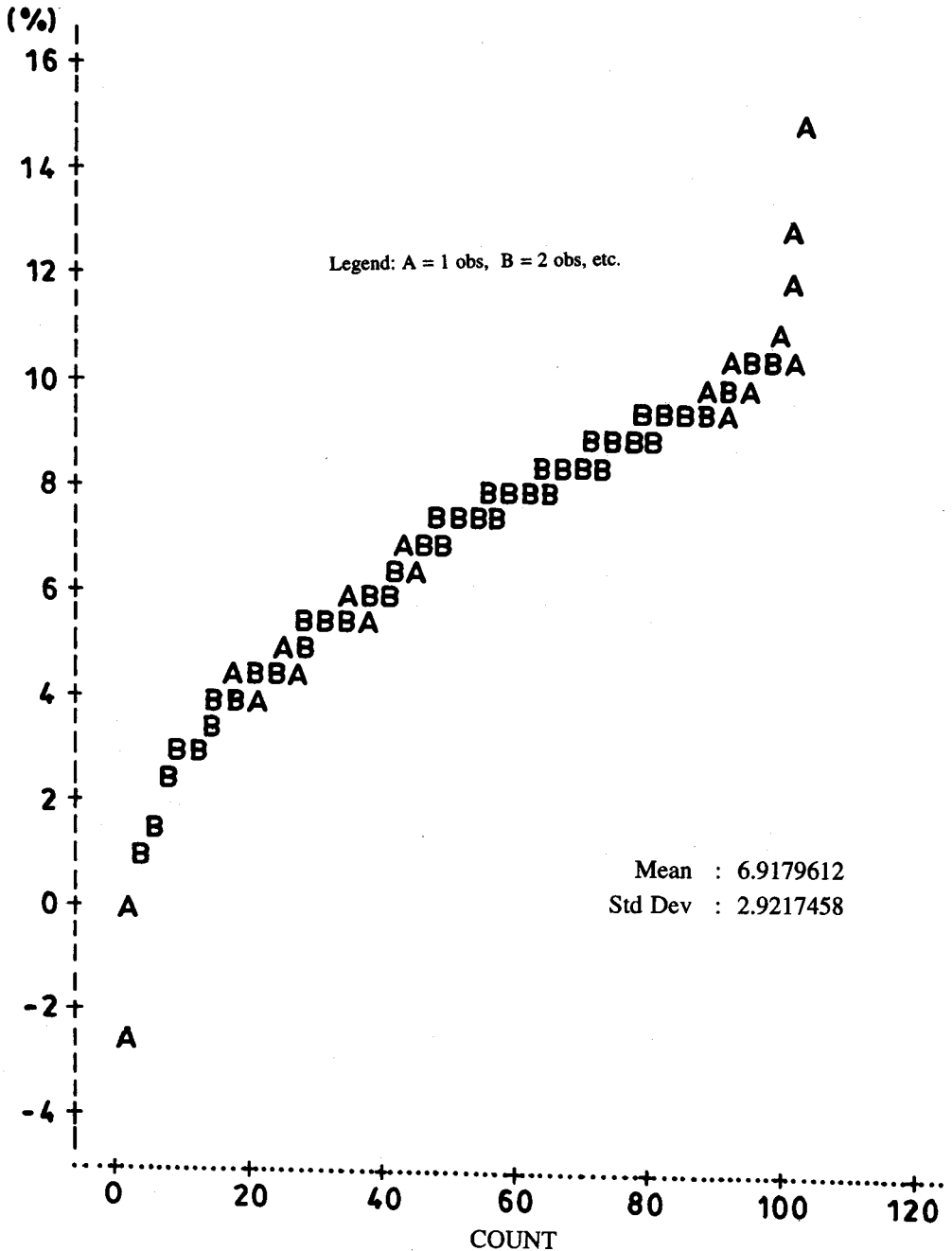Profit Ratio in 1986 (%)
Capital/Labour > US$ 30,745, N = 57.

Fig. 1E.   The Distribution of Profit Rate in the Manufacturing Sector
Profit Ratio in 1986 (%)
Capital/Labour < US$ 30,745, N = 103.

Table 1

Determination of Profit Rate in the Manufacturing Sector of Taiwan:
1986 (160 Industries), 4-Digit Level

$$\text{Profit Rate} = \frac{\text{Profit}}{\text{Net Value of Asset}}$$

Dependent Variable	Equation 1 Overall N=160	Equation 2 Export/Sales>37% N=58	Equation 3 Export/Sales<37% N=102	Equation 4 K/L>US$30,745 N=57	Equation 5 K/L<US$30,745 N=103
Constant	4.46** (2.29)	12.62*** (3.33)	6.28** (2.10)	0.53 (0.14)	8.97*** (3.51)
Industrial Concentration Ratios#					
CR4 Overall	−0.3543 (−0.29)	0.7585 (0.40)	−0.8277 (−0.53)	1.1773 (0.45)	−2.5126** (−2.00)
CR8 Overall	0.9343 (0.77)	−0.8417 (−0.47)	1.6213 (1.07)	0.6385 (0.23)	0.4299 (0.36)
CR4* (Exports excluded)	0.0326 (0.02)	2.3303 (1.08)	−0.9527 (−0.49)	0.8127 (0.23)	−1.8410 (−1.25)
CR8* (Exports excluded)	1.5414 (1.06)	−0.3159 (−0.14)	2.4196* (1.37)	−1.1456 (−0.30)	2.1850* (1.59)

Continued–

Table 1 – *(Continued)*

Industry Size (Number of Firms)	0.0005** (1.88)	0.0008* (1.59)	0.0003 (0.95)	-0.0018 (-0.63)	0.0004** (1.68)
Sales Volumes	-0.0005 (-0.58)	-0.0020 (-1.23)	0.0011 (1.00)	0.0029** (2.04)	-0.0046*** (-2.72)
Value-added	0.0044* (1.62)	0.0077 (1.19)	0.0009 (0.29)	-0.0029 (-0.75)	0.0156*** (2.42)
Domestic/Sales Ratio	2.5686** (2.07)	5.2030** (2.03)	-0.4157 (-0.16)	1.9680 (0.76)	3.4445*** (2.54)
Capacity Utilisation Ratio	0.0356** (1.75)	-0.0308 (-0.78)	0.0382* (1.56)	0.0433* (1.37)	0.0110 (0.43)
Capital/Output Ratio	-3.5988*** (-5.16)	-7.9916*** (-4.86)	-3.1340*** (-3.94)	-2.3715** (-2.20)	-4.48355*** (-4.51)
R^2	.31	.54	.34	.45	.38
F	8.57	7.15	6.08	4.84	7.35

Notes: 1. t-value in parentheses.

2. ***, **, * = significant at the 1 percent, 5 percent, and 10 percent levels respectively.

\# Although four industrial concentration ratios are presented simultaneously, yet they are estimated in four different regressions. The coefficients of other variables are almost the same when different industrial concentration ratios are used.

The econometric method (OLS technique) estimated five single equations. The first estimation shows the overall effect; the other four equations test two groups of industry. Specifically,

$$\text{Profit rate} = a1 + a2 \text{ Concentration ratios} + a3 \text{ Industry} + a4 \text{ Sales volume}$$
$$+ a5 \text{ Value-added} + a6 \text{ Domestic sales ratio} + a7 \text{ Capacity}$$
$$\text{utilisation rate} + a8 \text{ K/output} + \mu$$

All variables, except for industry size, were expected to generate positive signs. One remark, however, is necessary on the industrial concentration ratios used in Table 1. Since usually the concentration indices are calculated on overall sales, export volumes were not excluded. For a small and (very) open economy like Taiwan, this undoubtedly underestimated the real domestic concentration level and understated the true relationship between market structure and profit rates. With this concept in mind, this paper uses two sets of concentration ratio: overall concentration ratio (without excluding exports, such as CR4 in Table 1) and real domestic concentration ratio (exports are excluded, such as CR4* in Table 1). Exports-excluded concentration ratios are expected to generate stronger effects. With each concentration ratio I run a regression together with other independent variables.

The same procedure applied to other variables. In other words, each equation in Table 1 is a condensed form of four regressions. The same is true for R^2s: I report only the most "representative" ones. It has been proved both that it is neither possible nor useful to report all of them. A grain of salt is needed when reading this Table: this is not a precise way to report regression results as one can find in professional journals: rather, it is a summary of general results. For interested readers, the sources and the definitions of variables used are available in the Appendix.

1. *Industrial Concentration Ratios*

In general, while half of the concentration ratio sets generate unexpected (though insignificant) negative sign, only three cases are significant: CR4 (Eq. 5), CR8 (Eqs. 3 and 5). This result is somewhat surprising and confusing. Let us examine each equation in turn. In Eq. 1 (overall effect), none of the concentration ratios is significant, suggesting that industrial concentration is not an important factor in determining profit differences. Similarly, in the group of export ratio (Eqs. 2 and 3), only CR8 is slightly positively significant (at the 10 percent level), meaning that the degree of concentration scarcely matters at all. The same is true in the next group (Eqs. 4 and 5). All in all, this variable contributes little in explaining profit variations.

2. *Industry Size, Sales Volume, Value-added*

These three variables generate low coefficients (less than 0.005) when they are significant. They, too, are not important in determining profit variations.

3. *Capacity Utilisation Rate*

The coefficients are around 0.03. Being significant only at the 10 percent level, this variable also does not advance our understanding of profit variations.

4. *Domestic Sales Ratio*

The high degree of significance and high coefficients here indicate that domestic-oriented industries earn better profits. This is contrary to Figs. 1B and 1C, in which export-oriented industries have slightly higher average profit rates. A possible explanation of this discrepancy is that although domestic-oriented industries have lower average profit rates (6.41 percent), they posses higher standard deviation (3.83 percent).

5. *Capital/Output Ratio*

This alternative to the K/L ratio measures the degree of capital intensity. In every equation, its effect is strongly negative and very significant. This suggests that capital-intensive modes of production generate less profit–a result consistent with the facts presented in Figs. 1D and 1E.

I have tried some more different regressions, dropping out or putting in some other variables, thinking about the problem of collinearity among variables, but this does not change the results of my main concern: the sign and degree of significance between concentration ratios (my proxy for market structure or market power) and profit rates.

Chow Test for the Two-regime Hypothesis

Our dualistic structure framework uses the export and K/L ratios to divide industries into two groups, each group is then divided into two categories. Chow test (*F*-test) is used here to check if the coefficients between Eqs. 2 and 3 and between Eqs. 4 and 5 are statistically different; in other words, testing the regime-change hypothesis to see if our divisions of category are statistically acceptable.

For the export/sales ratio division (Eqs. 2 and 3), the Chow test coefficient is calculated as 2.54 (significant at 5 percent level), and the null hypothesis is rejected, meaning the coefficients of Eqs. 2 and 3 are statistically different. For the K/L ratio group, the Chow test coefficient is 4.63, significant at 1 percent level, accepting the regime-change hypothesis. The results suggest that both criteria are valid to the

present dualistic analysis.

4. CONCLUSION

It is important to take the dualistic structure features into account when analysing the determinants of inter-industry profit differences in a small open developing country like Taiwan. Two criteria are used to divide the sector into as many groups: the export/sales ratio (degree of openness), and the K/L ratio (degree of capital-intensiveness). Using the 1986 census data, the results suggest that the dualistic structure hypothesis is only weakly confirmed by using the export/sales ratio criterion, but it is better illustrated when the K/L ratio criterion is used.

As to the determinants of profit differences, the domestic sales ratio and the K/output ratio have consistent and strong effects and they best explain the inter-industry profit differences. All the other variables have either little impact or they generate unsystematic effects. Contrary to the initial hypothesis and the main evidence from developed countries, industrial concentration was not an important factor in explaining the inter-industry profit differences in the manufacturing sector of Taiwan.

Sources and Definitions of Regression Variables, Manufacturing Sector of Taiwan, 1986 (160 Industries)

	Variable	Source	Definition
1	CR4 Overall (0.586; 0.257)	(1)	Four Largest Firms' Sales Share in the Industry.
2	CR8 Overall (0.732; 0.229)	(1)	Eight Largest Firms' Sales Share in the Industry.
3	CR4 Exports Excluded (0.681; 0.235)	(1)	Four Largest Firms' Sales Share in the Industry, but Export Volumes are excluded.
4	CR8 Exports Excluded (0.815; 0.120)	(1)	Four Largest Firms' Sales Share in the Industry, but Export Volumes are excluded.
5	Industry Size (686.3; 1059.5)	(2)	Number or Enterprise Units.
6	Labour (16928; 24101)	(2)	Number of Persons Engaged.
7	Sales (20306115; 23575658)*	(2)	Annual Total Revenue.
8	Wage Payrolls (3412339; 5198070)*	(2)	Annual Expenses of Labour Compensation.
9	Output (20050885; 22857443)*	(2)	Annual Total Value of Production.

Appendix –(*Continued*)

Variable	Source	Definition
10 Value-added (5068735; 6848837)*	(2)	Annual Gross Value-added.
11 Capital (10913055; 16114298)*	(2)	Net Value of Assets in Operation.
12 Staff (3847; 4499)	(2)	Salaried Workers.
13 Workers (11899; 18176)	(2)	Wage-earners.
14 Domestic Sales (6617532; 12627785)*	(2)	Domestic Sales.
15 Export Sales (12651445; 17702122)*	(2)	Foreign Sales.
16 Profit Rate (6.45%; 3.58%)	(2)	Profit/Net Value of Assets in Operation.
17 Capacity Utilisation Rate (77.73%; 12.36%)	(2)	Average Production Capacity Utilisation Rate.
18 Female (7873; 15763)	(2)	Female Employees.

Notes: a. Mean and standard deviation in parentheses.

b. Data sources:

  (1) Chou (1988) Industrial Concentration Ratios in an Open Economy: A Case Study of Taiwan's Manufacturing Sector. *Academia Economic Papers* 16(1):113–150. (In Chinese.)

  (2) *The Report on 1986 Industrial and Commercial Census.* (Published by Directorate-General of Budget, Accounting and Statistics, Taiwan), Volume 3: *Taiwan District Manufacturing,* Tables 1, 5, 20, 25, 37, 42.

c. The above data is stored in the ASCII format, available from the author by sending a diskette.
*In 1,000 New Taiwan Dollars (NT$ 1,000 = US$ 28.17, in 1986).

REFERENCES

Fei, J. C. H., G. Ranis, and S. Kuo (1979) *Growth with Equality: The Case of Taiwan.* Oxford: Oxford University Press.

Lai, C. (1989) Market Structure and Inter-industry Wage Differences: The Case of Taiwan. *Economics Letters* 31: 2 199–204.

Scherer, F. (1980) *Industrial Market Structure and Economic Performance.* (2nd ed.) Chicago: Rand McNally & Co.

Schmalensee, R. (1989) Inter-industry Studies of Structure and Performance. In R. Schmalensee and Willig (eds) *Handbook of Industrial Organization.* Amsterdam: North-Holland 1: 952–1010.