A SIMULTANEOUS EQUATION MODEL OF
PROFITABILITY AND TARIFFS IN AUSTRALIAN
MANUFACTURING INDUSTRIES

David K. Round*

Working Paper 79-6

Department of Economics, University of Adelaide,
Adelaide, South Australia, 5000,
AUSTRALIA.

Preliminary: Not to be quoted.
A SIMULTANEOUS EQUATION MODEL OF PROFITABILITY AND TARIFFS IN AUSTRALIAN MANUFACTURING INDUSTRIES

David K. Round

University of Adelaide

I. Introduction

Research on structure-performance relationships in Australia and in most other countries so far has proceeded mainly by means of ordinary least-squares estimation of single-equation models. Yet the direction of causation is not uniquely from structure to conduct to performance, as feedback effects undeniably exist. In addition, the interplay between markets and Government controls must also be recognized. Thus, a single-equation approach will be methodologically unsound if the relationship being estimated is part of a series of simultaneous relationships. This paper estimates a two-equation model involving profitability and tariffs as the endogenously determined variables. The Australian economy is relatively small and is heavily dependent on foreign trade. Tariffs are used widely to protect domestic industries, especially where their profitability (and therefore viability) is threatened by foreign competition. Thus, tariffs play an important role in determining (and in turn being determined by) profitability in Australian manufacturing industries.

The analysis is carried out at both the three- and four-digit levels of the Australian Standard Industrial Classification (A.S.I.C.). The estimated profit equations at the three- and four-digit levels disagree in terms of signs and significance levels of the coefficients on concentration and tariffs. Overall, the results for the profitability equation derived from the simultaneous model are not greatly different from those obtained from the single-equation model. The estimated tariff
equations generally agree closely at both levels of industry aggregation, although higher levels of significance are found at the three-digit level. An important finding with respect to the tariff equation is that at the four-digit industry level, profits are negatively and significantly associated with tariffs for a single-equation model, but the relationship becomes much weaker and lacks significance in the tariff equation estimated as part of the two-equation model.

In Section II we discuss the need for a simultaneous equations model, present the actual specification of the relationships determining profitability and tariffs, and briefly discuss the sample and the empirical measurement of some of the variables. The results of the single equation and simultaneous equations models are presented in Section III, and the implications of the results for public policy are discussed briefly. Section IV summarizes the results and offers suggestions for further research. An Appendix discusses the sources of the data used in the empirical analysis.

II. The Need for a Simultaneous Equations Model

The role of international trade factors in affecting domestic performance has not been widely investigated by industrial organization researchers. This is no doubt attributable to the fact that in the U.S., where most industrial organization research has been done, foreign competition has never loomed large across a broad spectrum of industries, and the importance of domestic competition has been emphasized so much by the antitrust enforcement agencies.¹ In contrast, in other countries which are heavily involved in the international economy, from an importing (as well as exporting) point of view, some research has incorporated the effect of foreign trade factors. Thus foreign trade variables (either in the form of an imports/sales ratio, or an effective or nominal tariff variable), were included in their analyses of the determinants of profitability by Jones, Laudadio and Percy (1973, 1977), McFetridge (1973) and Bloch
(1974) for Canada; by Hart and Morgan (1977), Hitiris (1978) and Khalilzadeh-Shirazi (1974) for the U.K.; by Pagoulatos and Sorenson (1976b) for the E.E.C. countries; and by Round (1979b, 1980) for Australia. All of these studies employed the traditional single-equation approach. It is now recognized, however, that such an approach can be methodologically inappropriate, because of the vast array of interrelationships and feedback effects between structure, conduct, performance, "basic" market conditions of supply and demand, and also Government intervention in its many forms. In such a system the estimation of any one equation singly, using ordinary least squares, may lead to biased and inconsistent parameter estimates.

We are primarily interested here in the interrelationships between profitability, tariffs (to represent protection from foreign competition) and concentration. A two-equation model is used, with profitability and tariffs being the endogenous variables. A third equation to explain concentration levels is not included in the model. Concentration levels in Australia have historically always been relatively high, and have not varied greatly over the years. Many reasons for this exist, among them the generally small size of most Australian markets and the accompanying belief that it was necessary for firms to be large in order to operate efficiently, and the lack of strong antitrust legislation until 1974. Thus it is argued that concentration levels are rather more likely to have been determined historically, rather than by currently observable values of explanatory variables such as advertising, capital intensity, minimum efficient scale and growth, and thus it is more appropriate to treat concentration as a predetermined variable. Our model, therefore, will be in the form

\[ P = f(C, T, X) \]
\[ T = f(P, C, X) \]  

(1)
where \( P \) is profitability, \( T \) is tariffs, \( C \) is concentration, and \( X \) represents other exogenous variables which are included either for their own sake or to represent other aspects of market structure such that the separate effects of concentration and tariffs, the two most policy-relevant variables, are isolated as much as possible.

As noted above, previous researchers have used either an imports/sales ratio or an effective or nominal tariff rate to represent foreign competition. Hitiris (1978) has shown theoretically that either real imports or the rate of tariff protection may be used to reflect the degree of foreign competition. Use of an imports/sales ratio was not feasible in our case, due to the nonavailability of the necessary data at the four-digit industry level. Tariffs are represented in our model by effective rates of protection. The reasons for preferring effective rather than nominal tariff rates in models designed to explain market performance have been explained in sufficient detail elsewhere (see, for example, McFetridge (1973), Caves (1976), and Hitiris (1978)), that we need only point out here that effective rates of protection more accurately depict the protection given both to the output and inputs of a production process, and thus are more pertinent in any study seeking to link tariffs with profitability, as they measure the real net effect on both the allocation of resources and the payment to factors of production.

We turn now to a discussion of the explanatory variables in our model. The equation explaining profitability is a standard linear specification, with the addition of the tariff variable, and thus needs no detailed justification. It reads

\[
P = \alpha_0 + \alpha_1 C + \alpha_2 T + \alpha_3 K + \alpha_4 A + \alpha_5 G
\]

(2)

where \( P \), \( C \) and \( T \) are as defined above, \( K \) represents an industry's capital intensity, \( A \) is a proxy for advertising intensity, and \( G \) is industry growth. In accordance with received theory and previous empirical findings, we expect the coefficients \( \alpha_1, \alpha_3, \alpha_5 \).
\(\alpha_4\) and \(\alpha_5\) to be positive, while \(\alpha_2\) could be either positive or negative. Tariffs could be linked positively with profitability, insofar as they provide insulation from overseas competition, allowing domestic firms to raise prices and earn higher profits. However, tariffs may also be linked with costs, resulting in a negative coefficient on the tariff variable. If domestic entry barriers are not high, at least for small-scale entry, any increased profits resulting from higher tariffs could be competed away by new, small domestic firms seeking to share in the protected profits. If continued high tariff protection seems likely, so much entry could be attracted that the industry could become overcrowded and profits could fall, either because of the existence of high-cost, suboptimal size plants or because of the excess capacity which could develop in such a situation, both possibilities leading to excess costs rather than excess profits. Accordingly, a two-tail test of significance is used on the coefficient found on the tariff variable.

The determinants of tariffs will include economic, political and sociological factors. Governments usually respond initially to some economic stimuli in investigating the need for changed levels of tariff protection, but final decisions are likely to be leavened heavily with political and social considerations. This traditionally has been the case in Australia, where tariff protection has been invoked heavily to protect local industries from low-cost imports from the developing (and developed) nations in Asia. As it is difficult to incorporate rigorously these noneconomic factors in a quantitative model, an equation is formulated in which tariffs are a function of several economic variables which may affect tariffs in their own right, as well as acting as a proxy for some of these other hard-to-quantify factors. Of course, with such a diversity of economic and noneconomic factors at work in determining tariffs, it could be expected that the explained variation in tariffs would be relatively small.

In many respects the Australian economy is not unlike that of Canada, with its
relatively small size, high levels of foreign investment, and heavy protection given to domestic industries. Therefore, in deciding which economic variables might determine tariff levels, we consider first the three models hypothesized by Caves (1976) to explain the determination of tariffs in Canadian manufacturing industries. His "adding machine" model is based on the assumption that a government implements the policies most likely to enhance the likelihood of its being returned to power, and accordingly incorporates as explanatory variables, factors which recognize the vote-winning potential of tariff support. In contrast, the "interest group" model sees tariffs as a function of those factors which determine the benefits and costs for industries when they organize to seek tariff protection. Finally, his "national policy" model ignores the bargaining process implicit in the previous two models and is based on the assumption that tariffs are set in such a way as to bring about the desired industrial output mix for the economy. Some explanatory variables are common to two or three models, although often with different expectations as to the sign of their estimated coefficients. While far from conclusive, Caves' results lend some support to the interest group model as being the most suitable for Canada.

Even though the history and structure of the Australian and Canadian economies are somewhat similar, it is proposed to adopt a different methodological approach here. While some differences in protection levels granted to different industries may be justified on economic grounds, the protection-granting mechanism is very much part of a political process. Any attempt to explain inter-industry differences in protection must take into account both the supply and demand factors which determine this assistance. Observed rates of protection represent a market equilibrium, determined by the interaction of the demand for protection by firms and industry groups and the incentives for the Government to supply protection. While this market equilibrium is essentially a political one, economic theory does suggest likely
determinants of the supply of and demand for protection. In a sense, the three separate models developed by Caves each do not allow for both sets of factors, as the adding machine and national policy models are essentially supply models, whereas the interest group model largely reflects demand factors. Our tariff equation therefore incorporates both supply and demand variables, and hence includes aspects of each of Caves’ three models. In some cases, we will be uncertain on a priori grounds of the direction of the demand (or supply) effect of an explanatory variable on tariffs, and so the significance of some estimated coefficients will have to be tested with a two-tail test.

It can be argued that tariff protection is provided by Governments with two distinct aims in mind. First, to try and ensure reelection and second, to further the national interest. However, these goals may at times conflict. Consider a proposal to increase protection for an industry facing strongly competitive pressures from overseas, this industry being largely located in relatively small rural cities whose employment levels depend heavily on the industry concerned, and which are located in marginal electorates. In such a case, consumers generally may be better off with lower-priced imports and resource efficiency could improve if the local industry were forced by the market to reorganize more efficiently, but the Government, perceiving a loss of electoral support (and possibly monetary support from the firms involved) should protection not be granted, is likely to grant the protection requested by the industry. Thus, care is necessary when hypothesizing about the expected signs of the relationship between tariffs and some of the exogenous variables.

The growth of an industry can be expected to be a major determinant of the protection granted to the industry. If an industry were to decline, the Government’s support from that industry (in terms of both votes and money) would be likely to decline, and thus we could expect a negative relationship between growth and tariff
However, high growth industries could be given greater consideration for protection by the Government, although such action would appear perhaps to be even less defensible on efficiency grounds. Such a positive association would certainly not be expected in long-run equilibrium.

Another important factor determining the supply of protection will be the industry's dependence on labor as a factor of production. More labor intensive industries, other things being equal, could normally be expected to be granted higher levels of protection, in order to retain as many votes as possible. In contrast, industries which are more capital intensive could expect lower rates of protection, as not only does capital not vote (while the owners of capital do vote, they are much less numerous than the owners of labor), but also capital intensive industries in Australia, with its relatively small markets, are believed to be more efficient and therefore less in need of assistance.

In terms of getting votes, Governments are more likely to give tariff increases to industries employing higher numbers of people. However, Caves (p. 284) has put forward several reasons for doubting whether size alone has much systematic effect on protection. Following Caves, however, we do incorporate in our model the effects of decentralization of industry activity on the supply of tariff protection. Decentralization can take two forms. Widespread geographical decentralization of industries may have no effect on tariffs, as votes are widely spread and are therefore less likely to be of as much value to a Government than votes in a crucial marginal electorate. Nevertheless, given the general problems of non-metropolitan unemployment, decentralized industries help to maintain employment in provincial towns and thus a positive relationship could be expected between tariffs and geographic decentralization. (In effect, given the construction of our index of decentralization (see Appendix), a negative relationship could be expected.) However, as many more electorates (and the substantial majority of the Australian population) occur in the
large urban areas, it is also reasonable to expect that tariffs will be granted to those industries which are more heavily concentrated in the major producing and employment states, leading to a negative (positive, given our definition of the decentralization variable) relationship.

Decentralization can also refer to the diffusion of economic power in an industry. The more concentrated an industry becomes, the less decentralized is its decision-making and the prospect of competitive conduct becomes less likely. Thus, the more concentrated an industry, the less votes a Government is likely to earn by supporting industries generally believed by the public to be profitable. A negative relationship between tariffs and concentration could also be expected from the national policy point of view, as low concentration industries could normally expect higher levels of protection to ensure the viability of their small firms.

Another factor affecting the supply of protection would be its effect on other industries which are either customers or input suppliers of the industry in question. The latter group obviously would support tariffs, whereas the former would likely oppose them, unless any harmful effect was likely to be compensated by increased tariffs to the customer industry. Thus, the lower the value added by an industry, the less likely a proposal to increase tariffs will be resisted by the industry's customers. However, this hypothesized negative relationship could disappear in the face of likely higher levels of Government support for industries with high ratios of value-added to turnover (which imply the existence of significant economic processes, rather than just mere assembly operations), where the Government's policy aim is to promote such depth in manufacturing processes as a matter of national interest.

Caves suggests that increased industrial decentralization corresponds to the absence of scale economies (p. 285). Thus, to get votes, tariffs should be related
negatively to a scale variable. However, as argued earlier, there is a likelihood that the scale of plants may itself be a function of tariffs, and so this relationship is difficult to incorporate into our model. We use a firm scale variable (which has some productivity overtones)\(^{10}\) developed by Parry and Watson (1977), which in effect measures the average market share of a firm which belongs to the group of the most efficient firms in an industry. From the national interest point of view, such efficient firms should be encouraged, thus leading us to expect a positive relationship with tariffs.

Finally, on the supply side, tariffs may be a function of profitability. Low profits in an industry could lead a Government to provide higher tariffs to protect the industry's viability and employment, especially if the low profits were thought to be the result of foreign competition. Other things being equal, high profit industries are much less likely to receive tariff support from a Government seeking to win votes at large and also seeking to promote competitive conduct and efficiency.

The demand for tariffs by an industry will be a function mainly of the expected costs and benefits associated with lobbying the Government for a favorable change in protection. Such an approach is based on the assumption that tariff protection will have the most noticeable effect on the returns to capital and entrepreneurship.

The more concentrated an industry, the greater the community of interest between rival sellers, the less the opportunity to free ride on another firm's expenditures designed to generate tariff protection, and the greater will be the expected benefits to these large firms. Thus a positive relationship should ensue between tariffs and concentration, and between tariffs and scale economies under this 'interest group' approach. There are, however, factors at work which could weaken this expected relationship. Monopoly power enables a firm to seek advantages of many different kinds, including tariffs. Thus firms in concentrated industries will use their power
to seek the public handout, or combination of handouts, which gives them the greatest utility. If tariffs do not loom large in the utility functions of such firms, then our expected positive relationship could weaken.\textsuperscript{11} Caves also suggests that tariffs may be a function of concentration because of the availability in concentrated industries of excess profits which can be used to finance lobbies seeking higher tariff protection.\textsuperscript{12} In fact, we hypothesize that tariffs are a function of both concentration and profits. Higher concentration, as just discussed, permits firms to marshall their forces more easily to press for higher protection. Higher profits provide the source of funds to finance lobbies designed to secure higher tariffs. However, fear of public pressure and associated costs (say, of greater trade union activity) could constrain highly profitable industries from actively seeking extra tariff protection. In addition, small-scale Australian industries have in the past been noted for their ability successfully to organize large numbers of small firms and press for increased tariff protection. Thus the direction of the relationships between tariffs and concentration and tariffs and the scale variable is difficult to specify on a priori grounds.\textsuperscript{13}

The factors just discussed related to an industry having the means to lobby for tariff protection. We now consider those factors which provide the incentive to seek such protection. Caves (p. 288) has argued that the incentive for an industry to organize to seek protection is likely to come from some setbacks, especially when such problems tend not to occur at large throughout the economy. Hence a positive relationship could be expected between tariffs and the degree to which an industry suffers (or is likely to suffer) from economic setbacks. These can arise from several sources. Low profits, for a number of reasons (especially if due to increased competition from overseas) may lead to demands for higher tariffs. Slackened growth should lead to demands for higher levels of protection. More diversified industries
are less likely to suffer relative to other industries, and thus could be expected, on average, to have lower tariffs. Smaller firms are more likely to be more specialized and therefore less adaptable and more prone to adversity. In the face of adversity, therefore, less diversified firms are more likely to react by lobbying for support, rather than by maneuvering in the market.  

A summary of the expected relationships between tariffs and the various supply and demand factors is provided in Table 1. The tariff equation is estimated in the form

\[ T = \beta_1 + \beta_2 P + \beta_3 C + \beta_4 K + \beta_5 GR + \beta_6 GI + \beta_7 D + \beta_8 VAT + \beta_9 SE \]  

(3)

As can be seen from the Table, we expect \( \beta_4, \beta_5, \beta_7 < 0; \) and the signs on \( \beta_2, \beta_3, \beta_6, \beta_8 \) and \( \beta_9 \) to be indeterminate, awaiting empirical investigation.

Equations (2) and (3) together comprise the model linking profitability, concentration and tariffs. Profits are a function of concentration and tariffs, among other things, and tariffs are a function of several variables, including profits and concentration. Thus tariffs and profitability are treated as endogenous variables whose values are determined jointly in a two equation system comprising equations (2) and (3). The order conditions for identifiability indicate that equation (2) is overidentified while equation (3) is exactly identified. The model's parameters are estimated using two-stage least squares estimation.

The results reported in this paper relate to the period 1968-69 to 1972-73, the longest suitable period permitted by the available data. Where possible, the variables were measured in terms of average values over the period, to try and eliminate the effect of the transitory factors which could be present in the analysis of single year data. It should be noted that current tariff rates are the result of political and economic decisions spanning several decades, and that any short-period cross-secti
analysis could therefore possibly yield misleading results, unless the determinants of tariffs have been reasonably stable over time or tariffs have been changed regularly in response to changes in these determinants. In fact, in Australia, the general structure of tariffs remained relatively stable for decades, the whole question of restructuring being debated (and beginning to be implemented) only in the mid 1970's as the long-term non-competitive position of many industries began finally to be accepted.

The analysis is conducted initially at both the three-digit and four-digit industry levels of the Australian Standard Industrial Classification, in order to see whether industry aggregation has any effect on our observed relationships. There are 40 three-digit industries, comprising 135 four-digit industries, for which all the necessary data are available. As well as estimating our model for the whole four-digit sample, we also estimate it for smaller sample groups of industries, delineated by certain critical values of tariffs and concentration, the two prime policy-relevant variables in our analysis. The variables used in the empirical work were defined largely along standard lines. A brief discussion of their definition, method of measurement and data sources is presented in the Appendix.

III. The Results

The results of the ordinary least squares (OLS) and two-stage least squares (2SLS) regressions are presented in Tables 2-4. We shall discuss first of all the results relating to the profitability equation. At the three-digit level (the first two columns in Table 2) all the significant coefficients estimated by OLS are positive. Tariffs and growth are both highly insignificant. The 2SLS estimates result in a stronger and more significant influence of concentration, growth becomes positively (but still not significantly) linked with profitability and the coefficient
on tariffs remains positive and is not far from being significant at the ten percent level. Overall, then, the 2SLS estimates present a picture more in accord with our a priori expectations.

The picture changes somewhat when we turn our focus to the four-digit level of aggregation. Here generally consistent results are obtained by both the OLS and 2SLS methods, but they differ from the three-digit results in two important aspects. Concentration now is negatively but not significantly linked with profitability. Most empirical research to date in Australia has concentrated on the three-digit industry level, and has found fairly generally that a positive (although not always significant) relationship exists, although a similar negative insignificant effect was found in a study linking industry welfare losses to concentration at the four-digit level. As the four-digit level of industry aggregation is more economically meaningful than the three-digit level, it would appear that care is called for when formulating antitrust policies against high concentration and mergers. As can be seen in the rest of Table 2 and in Table 3, concentration does not appear once as a significant determinant of profitability, and more often carries a negative rather than a positive sign, regardless of the sample investigated or whether the estimation was done by OLS or 2SLS. With the relatively high levels of concentration in Australia, the long-known predisposition of Australian businessmen for "mateship" and collusion, and the lack of stringent antitrust legislation and enforcement until 1974, it appears that concentration per se has played little part in affecting inter-industry profitability.

The other important difference between the three- and four-digit results involves the effect of tariffs. As can be seen in Table 2, tariffs are linked significantly (a two-tail test was used) and negatively with profits in the four-digit industries, suggesting that of the price and cost effects of tariffs, the latter takes precedence. This could arise either because tariffs encourage inefficient, high-cost producers to
stay in business, hopeful either of eventual improvement or continued tariff support, or because they encourage small scale firms to set up in an industry, creating excess capacity and inefficient sub-optimal size plants. Our results tend to suggest that exposure to overseas competition (via lower tariffs) seems more likely to reduce costs more than it exerts downward pressure on prices, and provide some support for the increasing pressure which has been developing in Australia in the 1970's for the restructuring of manufacturing industry away from the inefficient, import competing industries.

As can be seen in the remainder of Table 2 and in Table 3, our findings for the sample of four-digit industries are largely confirmed when the sample is divided into smaller groups, based on high \( (C \geq 50) \) and low \( (C < 50) \) concentration and high \( (T \geq 45) \) and low \( (T < 45) \) tariff industries. The coefficients on \( K \) and \( A \) are positive without exception in all OLS and 2SLS equations, and usually are significant at the one percent level. The coefficients on growth tend to be more variable, both between sub-sample groups and between the OLS and 2SLS estimates, although in the eight sub-sample 2SLS regressions, they are positive in six cases, being significant in two. The effect of concentration on profitability in the sub-sample groups of industries, as noted above, is at no time significant and indeed is negative in the high concentration and high tariff groups, and in each of the two smaller samples delineated by high concentration. None of the coefficients are close to being significant, however. We must conclude that caution is still necessary in Australia in formulating antitrust policy against bigness, as at most we can say only that we are unable to reject the hypothesis that there is no systematic relationship between concentration and profitability in Australia.

In contrast, the results of estimating the coefficients on the tariff variable provide an interesting picture. The negative coefficients found in the all industries sample reoccur in the two sub-samples of high concentration industries and high
tariff industries, although in each case the 2SLS coefficients are significant only at the ten percent level, using a two-tail test.\textsuperscript{21} The results in the high tariff industries are no doubt explained by the effect of high tariffs in both permitting inefficient large firms to survive and also in encouraging small firms to set up operations, resulting in an overcrowded industry. It is for these very reasons that the Industries Assistance Commission (Australia's independent authority charged with recommending to the Government on the need for any kind of assistance required by any industry) has recently been urging strongly for a review of tariff protection in Australia. That a similar negative coefficient occurs in highly concentrated industries is at first sight puzzling. A possible explanation is that in most highly concentrated industries in Australia, a relatively large fringe of small firms exists, serving regional markets or selling highly specialized products, and these small firms' cost inefficiencies outweigh the larger firm's profit advantages, such that increased tariffs provide little extra support for the large firms, but encourage excessive specialization or dreams of becoming successful by the small entrepreneur who already is in the industry or who is contemplating entry.

More easy to explain is the positive, strongly significant 2SLS coefficient on tariffs in the group of industries with low tariff protection (and to a slightly lesser degree, in terms of significance, in the two smaller samples derived from the low tariff group, in Table 3). Industries currently enjoying low tariffs presumably are either efficient, or are protected from overseas competition by transport costs, or have some comparative advantage. Either way, increased tariffs in this group of industries serve to have a price effect greater than a cost effect, such that firms grasp the opportunity to increase their profitability. It is noticeable that significance is obtained only in the 2SLS estimates involving these three sample groups, suggesting that simultaneous equation bias indeed is present in some single equation
estimates. Obviously, tariff increases in industries currently experiencing low tariffs would need to be considered carefully, on an industry-by-industry basis, to prevent the result of the tariff being merely to augment already comfortable earnings. 22

Finally, it is interesting to note the values of the coefficients on the advertising variable. Advertising is used as a proxy for product differentiation. With minimum efficient scale in many industries relatively large compared with the size of the market, product differentiation may provide some insulation from price competition and permit a fringe of small, inefficient firms to exist in the long-run with zero economic profits, instead of exiting as a result of continued losses as would happen if there were no product differentiation. This behavior could more confidently be anticipated in industries where tariffs are high, thus resulting in a likely weaker advertising-profitability relationship in these industries. This does in fact turn out to be true. Table 2 shows that the tariff coefficients in the low tariff sample group are some 50 percent higher than those in the high tariff group of industries. Similar, although as not as large, differences are seen in Table 3 when comparing the high and low tariff groups in highly concentrated industries (2SLS coefficients on A of 0.798 and 0.955 respectively) and in less concentrated industries (2SLS coefficients on A of 1.628 and 1.885 respectively).

In closing our discussion of the profitability equations, it can be seen that our results do differ somewhat when compared to overseas research in this area, especially with regard to the effect of concentration on profitability. As noted earlier, less attention traditionally has been paid to the effects of foreign competition on domestic profitability, in similar structure-performance studies. The few which do exist have used single equation models and have rarely found significance on the tariff variable. Whether this is due to different structural conditions in
other countries, compared to Australia, or whether it is due to simultaneous equations bias, cannot be determined here. Our results do show some evidence of the latter, cautioning against the indiscriminate use of single equation models, and they certainly emphasize the fact that both the OLS and 2SLS results for our key variables are sensitive to the level of industry aggregation employed in the empirical analysis.

We turn now to investigate the determinants of tariffs, using both OLS and 2SLS methods of estimation, at both the three- and four-digit industry levels. As can be seen in Table 4, only a relatively low percentage of the inter-industry variation in tariffs is explained by both the OLS and 2SLS equations, especially at the four-digit level, due no doubt, as was predicted earlier, to the multitude of political and social as well as economic factors which determine tariff levels. At the three-digit level, we find that those variables for which we were able unambiguously to predict their expected relationship with tariffs (K, GR and D) are correctly signed, and are significant at least at the ten percent level in the OLS equation. Significance is lost only on K in the 2SLS equation. The coefficient on GI, our (inverse) measure of geographic decentralization is positive and highly significant, suggesting that governments tend to protect industries more heavily when they are concentrated in one state rather than when they are widely dispersed throughout the country. The aim appears to be to maximize total votes rather than to seek votes in marginal electorates. Both P and C are linked negatively (but not significantly) with tariffs, suggesting the likelihood that the positive demand effects which could be exerted by both these factors on tariffs are not strong.

At the four-digit level, we see a dramatic drop in the explained variation. Signs on coefficients generally remain the same as at the three-digit level, with the exception of negative but non-significant coefficients on SE and VAT. The
coefficient on GI remains positive although significant only at the ten percent level. Of particular importance are the coefficients on P and C. Concentration appears to have no effect on tariffs at all, suggesting that Caves' hypothesis about concentrated industries having the funds to press for tariff increases is not applicable to Australia. Indeed, this is not really surprising, given the traditional disposition by successive governments to grant tariffs to support employment, whether this employment be in large-scale or small-scale industries. For example, the motor vehicle industry is highly concentrated (C = 88) while the refrigerators and household appliances industry (C = 30.5) and the leather and substitute products industry (C = 19.5) are much less concentrated. Some 54,000 people were employed in 30 firms in the motor vehicle industry in 1973-74, with 28,000 being employed in 252 firms in the refrigerator industry and only 4,500 employed in 339 firms in the leather and substitute products industry. Yet these industries had effective tariff rates of 51.6, 56.0 and 56.5 percent respectively. Thus, it has probably not been as necessary for firms to initiate moves for tariff protection, as suggested by Caves. Rather, it appears that government initiative can be relied on. This is confirmed by the negative coefficient on profitability in both the OLS and 2SLS regressions. However, it is important to note that while the coefficient on P is significant (although only at the ten percent level) in the OLS equation, the coefficient is very much weaker in the 2SLS equation, suggesting that, in a more properly specified model, profitability per se has no significant effect on tariff levels. A possible fruitful area for future investigation, when data for more years are available, would be to consider whether tariffs are determined either by profit variability or by trends in profitability over time, or by a combination of both factors.

Table 4 also shows the results of estimating the tariff equations for the four larger sub-samples. Generally speaking, in each of the four sets of results a high level of consistency (in signs, if not significance on coefficients) exists
between the OLS and 2SLS estimates, with the exception of the coefficients on profitability. All of the OLS coefficients are negative, being significant in the low concentration and high tariff industry groups, where it could be expected that decreased profitability would lead to increased tariff support. Significance is lost, however, in the two corresponding 2SLS estimates, cautioning against the indiscriminate use of single equation models. Of some interest is the relatively large (but not significant) positive 2SLS coefficient on P in the group of highly concentrated industries, suggesting the possibility that higher profits are indeed used to pursue lobbies which result in higher levels of tariff protection. Yet the coefficient on concentration, while positive, is very weak and insignificant. Thus the "Caves effect," if indeed it works at all in Australia, may work directly through profits and not indirectly through concentration. More detailed investigation of this area in the future could yield further insights into whether it is potential economic power (concentration) or the actual fruits of economic power (profits) which have the greatest effect on tariffs.

As predicted, the relationship between growth and tariffs generally was negative, although significant coefficients were found (in both the OLS and 2SLS regressions) only in the three-digit sample and the four-digit group of low tariff industries. Nonsignificant positive coefficients on growth were found in the 2SLS estimates for both the high concentration and high tariff industry groups, with the corresponding OLS coefficient in the latter group being significant at the ten percent level. Thus, in these two groups of industries which, ceteris paribus, should be of greater policy concern, it seems that higher growth could possibly be associated with higher tariffs, further distorting the allocation of resources, and suggesting that these industries are not in long-run equilibrium.

Capital intensity is generally negatively linked with tariffs, as expected. This consistent negative relationship (only in the 2SLS equation for the low tariff
group is the coefficient on K positive, and here it is extremely weak and insignificant) confirms the recent finding of Thomas (1978), who argues that the Australian tariff discriminates against resource-intensive industries in favor of labor-intensive industries, especially those employing unskilled labor with low productivity. Further confirmation of this may be found in the effect of SE on tariffs. As explained in the Appendix, SE is calculated as the market share of the group of firms with the greatest productivity advantage relative to all other firms in an industry. It can be seen in Table 4 that SE is strongly negatively (and significantly at the five percent level) linked with tariffs (in both the OLS and 2SLS equations) in low concentration industries which are the ones tending to be characterized by unskilled (low productivity) labor. Thus, the smaller the market share held by the group of most productive firms, or, alternatively, the larger the market share held by the group of least productive firms, the higher the tariff in this group of industries. The same effect might also be expected in high tariff industries, yet this does not appear. It is significant to note, however, that of the four smaller sample group regressions reported in footnote 25, in the group of industries with low concentration and high tariffs, SE is negatively and significantly linked with tariffs in both the OLS and 2SLS equations. It is perhaps noteworthy that only in the group of low concentration industries does the coefficient on concentration have a positive coefficient with a t value over one, thus suggesting the possibility of a trade-off. As concentration increases, productivity—presumably does the same. Thus firms use their extra market power to push for higher tariffs, to overcome the lower tariffs associated with higher productivity (the reasonably strong but not significant negative coefficient on the profitability variable supports this argument). Our results, then, do tend to support the traditional expectation of tariffs protecting industries using low productivity labor and discriminating against capital intensive
industries. However, in highly concentrated industries, there is some evidence in the 2SLS estimates that SE may be positively linked with tariffs, suggesting the possibility of the "national policy" effect at work, whereby governments seek to encourage efficient industries by providing tariff protection for them. The general lack of consistency of signs and absence of significance of the coefficients on SE, however, could possibly be due to the traditional difficulty in identifying scale and productivity factors accurately. More detailed investigation into the relationship between tariffs, labor productivity, scale, efficiency and capital intensity is suggested by these findings. 28

Also of some interest are the 2SLS results regarding the relationship of VAT to tariffs, in both the high tariff (negative and weakly insignificant) and the low tariff (positive and significant at the ten percent level) groups of industries. The positive relationship in the low tariff industries suggests that in the group of industries which need lower levels of protection, industries with greater depth in their manufacturing processes are given greater protection by the government. In contrast, in high tariff industries, industries with higher levels of value added relative to turnover enjoy lower tariff levels on average, possibly because of the effect of higher tariffs on the customers of these industries. An interesting area for further investigation, when suitable input-output data are available, would be to see whether these customers were themselves subject to import competition and hence reluctant to have tariff-inflated costs passed on to them in the absence of any guarantee about compensation.

Finally, the highly significant positive relationship between GI and tariffs in the less concentrated industry group is noteworthy. It suggests that the more one geographic area (state) is responsible for employment in an industry, the higher is the level of tariff protection, suggesting that the government protects industries which are
concentrated in one geographical area. Whether this is done for political reasons (the adding machine model) or for valid economic reasons (perhaps to support the infrastructure which has grown around the industries) needs further investigation.

If we compare the sets of 2SLS results for the samples delineated by critical concentration and tariff levels, it appears that tariffs are not equally affected by the explanatory variables in the high and low concentration groups, nor in the high and low tariff groups. Application of a Chow test resulted in an F value of 2.30 (significant at the five percent level) in the case of the concentration groups and 9.68 (significant at the one percent level) in the case of the tariff groups. Thus, tariffs are affected differently by the explanatory variables in high concentration and low concentration industries and also in high tariff and low tariff industries. In particular note, in the comparison of the concentration groups, the differential effects of GI and SE, and of GR, GI and VAT in the tariff groups comparison. It is also worthwhile to note the similar results obtained in the high concentration and high tariff 2SLS regressions.²⁹ As both groups of industries are ones likely to be of concern to policy makers because of their implications for resource allocation, it is interesting that tariffs in both groups seem generally to be associated in the same way with the explanatory variables.

It is appropriate at this stage to consider briefly which of Caves' three models might on balance be most dominant in the Australian scene.³⁰ Overall, at both the three- and four-digit level of analysis, our results do not support the adding machine model. In no case in all the regressions (both OLS and 2SLS) reported in Table 4 is there a significant coefficient which supports this model. As Caves found for Canada, our results tend weakly to support the suitability of the interest group model, although some aspects of the national policy model appear to be present in Australia. Given the aforementioned similarities between the Canadian and Australian
IV. Summary and Conclusions

This study set out to investigate whether the determinants of profitability, and of tariffs, were more appropriately estimated through single equation or simultaneous equation models. There were enough important differences to suggest that ordinary least squares estimates could lead to misleading conclusions, especially with regard to the role played by profitability in determining tariffs. Analysis of the data at both the three- and four-digit industry levels provided some minor conflicts in the tariff equation, but in the profitability equation some major discrepancies emerged. The significant positive coefficient on concentration in the three-digit analysis disappeared at the four-digit level, the coefficient becoming negative but non-significant. While this does not prove conclusively that no relationship exists between concentration and profitability in Australia, it does suggest that care be taken in formulating policy towards mergers, and that structural factors other than concentration per se should be investigated for their effect on profitability. With regard to tariffs, a positive but non-significant relationship between profitability and tariffs emerged at the three-digit level, yet a significant negative relationship was found at the four-digit level. It seems that increased tariffs may have a depressing effect on profitability, probably by allowing costs to rise (either through overcrowding or through allowing inefficient firms to stay in business) by more than prices are increased. Only in low tariff industries, which one would expect to enjoy cost advantages, did it appear that the price effect outweighed the cost effect. When suitable data become available, cost factors ideally should be included explicitly in any analysis of the determinants of profitability. Our results both support the move now slowly gathering momentum in Australia to restructure manufacturing industry, such
that assistance to industries whose long-term prospects for efficient operations are poor will be gradually phased out, and also indicate that care should be exercised before increasing indiscriminately the protection offered to industries which currently enjoy lower-than-average levels of protection.

The economic determinants of tariffs were, as predicted, difficult to determine, given that the process of tariff formation is in the final analysis a political one. It was not generally possible to evaluate whether supply or demand factors were more important in influencing tariff levels, but it was possible to conclude that one underlying mechanism in tariff determination was that of the interest group, whereby firms in an industry seek to weigh up the costs and benefits of seeking tariff protection. In addition, there was some evidence of tariff levels being affected by factors which could be called national interest variables, whereby higher tariff levels may ensue if they protect certain key variables which the Government considers to be of importance from the point of view of the country's economy.

The results presented here suggest many likely areas for further fruitful research. In particular, the role played by production and transport (both internal and overseas) costs in influencing, and in turn being influenced by, tariffs, is of great importance, if we wish to be able accurately to incorporate tariffs into industrial organization models. Other cost-related factors such as scale economies, productivity and the decentralization of productive activity need to be investigated further for their effect on the tariff determination process to be fully understood. The role played by buyers in trying to prevent tariff increases which affect them could be studied to see if buyer concentration helps hold down tariff increases. Finally, more work needs to be done on the determinants of profitability, to see whether in fact concentration does play any significant role as a determinant of profitability at the more meaningfully defined four-digit level of analysis, and
to investigate whether the entry barriers raised by scale factors and absolute cost advantages (for neither of which variables do satisfactory data currently exist) are of importance in affecting profitability, either by enabling prices to be raised without attracting entry, or by yielding efficiencies such that profitability is increased as a result of lower costs.
FOOTNOTES

* The paper was written while the author was Visiting Associate Professor at the University of Delaware. I am indebted to Gene Pierce for his invaluable computing assistance.

1. However, studies by Esposito and Esposito (1971) and Pagoulatos and Sorenson (1976a) have incorporated foreign competition variables into their analyses.

2. See, for example, Strickland and Weiss (1976) and the references cited therein.

3. Notably absent from this specification is a variable representing scale economies. The available Australian data do not permit the accurate calculation of minimum efficient scale. One method which can utilize the available data has been developed by Parry and Watson (1977) as a refinement of the method of Caves, Khalilzadeh-Shirazi and Porter (1975). It has been suggested, however, (Round (1979a)) that this variable may more likely represent productivity factors rather than scale factors. Use of this variable to represent productivity is discussed later in the text.

4. Our argument for a two-tail test is supported by Caves (1976, p. 283).

5. Caves (1976, p. 279) neatly sums it up when he says "That tariffs result from a process of political bargaining and logrolling is a commonplace," and later (p. 296) that tariffs are simply "bargains struck in the political arena of a parliamentary democracy."

6. No direct recognition is made of any consumer-led role in the process of tariff formation. Any benefits from tariff protection tend to be concentrated in the hands of a relatively small number of firms, whereas the costs are widely spread, affecting any given consumer generally to only a small degree. Thus, given the free-rider problem, it is likely that consumers will not be able to organize widely into effective consumer lobby groups, and so consumers largely need to rely on policymakers to protect their interests. As will be discussed below, consumers as labor inputs may well be considered more than in their role as purchasers of goods.

7. In fact, as will be seen below, it is possible for four of our explanatory variables to have both a demand and a supply effect on tariffs.

8. Indeed, such increased assistance could be justified by the Government as representing a gain in welfare, as it could be portrayed as stemming what might otherwise be an undesirably precipitous structural change.

9. In his national interest model, Caves suggests also that a positive relationship might eventuate (although his results did not support this) between tariffs and labor intensity (measured as value added per employee), as it is arguable that an "industry intensive in ... human capital probably contributes more to national esteem than one dependent on low-skill labour" (p. 291).

10. See Round (1979a).
11. A similar qualification applies to the other interest group variables discussed below. The point is raised in Caves (p. 289).

12. While not always especially strong or significant, the Australian evidence to date (summarized in Round (1979c)) does suggest the existence of a positive relationship between profitability and concentration.

13. The demand for assistance is likely to be tempered by the extent of opposition to tariff increases from a firm's customers. Unfortunately no data are available such that buyer concentration ratios can be calculated.

14. This could weaken the hypothesized positive relationship between concentration and tariffs, as industries with small firms tend to be less concentrated. Also, tariff assistance may well increase the number of small firms, which could further weaken the positive effect of concentration on tariffs.

15. In addition, a 25 percent across-the-board tariff cut took place in 1973 soon after the new Labor Government came to power (for the first time in nearly 30 years). Such an action would have left the economic (and political) market in a state of disequilibrium for some time. Thus, while tariff data are available for a longer period, they are not utilized in our analysis.

16. These points are dealt with at greater length in Caves (1976, pp. 291-292).

17. A labor-intensity variable, measured as value-added per employee, was also included in the model but was never significant, and subsequently was omitted from the final specification.

18. A brief summary of these results is provided in Round (1979c).

19. The results for the 79 low concentration industries are not reported here. Only K and A were significant (at the one percent level) in both the OLS and 2SLS estimates. The coefficients on growth and concentration were positive in both sets of estimates, while the coefficient on tariffs was negative in the OLS equation (t = -0.42) and positive in the 2SLS equation (t = +0.72).

20. The critical tariff value chosen was the mean tariff level for the entire sample of four-digit industries.

21. In the high tariff group, given the feeling in Australia over the last decade or so that high tariffs have led to inefficiencies and inflated costs, a one-tail test of significance might be more appropriate, in which case the 2SLS coefficient on tariffs becomes significant at the five percent level.

22. The mean profitability figure for industries in the low tariff group was 20.1 percent, compared with 18.0 percent in the high tariff group.

23. Some important differences in significance levels do occur between the OLS and 2SLS estimates. Where signs differ between the two sets of estimates, only in one case (involving growth in the low tariff sample) is the 2SLS estimate significant.
24. Given the construction of this variable, we cannot say whether this means high tariffs are set for industries which are highly decentralized within a given state.

25. These regressions were also repeated for the four smaller sub-samples reported in Table 3. With only a relatively few degrees of freedom, significance was not common. Signs and significance levels of coefficients were as follows:

<table>
<thead>
<tr>
<th>Condition</th>
<th>2SLS</th>
<th>OLS</th>
<th>P</th>
<th>C</th>
<th>K</th>
<th>CR</th>
<th>D</th>
<th>GI</th>
<th>SE</th>
<th>VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>C ≥ 50 and T ≥ 45</td>
<td></td>
<td></td>
<td>-c</td>
<td>+</td>
<td>+</td>
<td>-c</td>
<td>-</td>
<td>+</td>
<td>SE</td>
<td>VAT</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C &lt; 50 and T ≥ 45</td>
<td></td>
<td></td>
<td>+c</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-c</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C &lt; 50 and T &lt; 45</td>
<td></td>
<td></td>
<td>+c</td>
<td>+</td>
<td>+</td>
<td>+c</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4b</td>
</tr>
<tr>
<td>C ≥ 50 and T &lt; 45</td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

26. The mixed signs and the absence of significance of the coefficients on concentration in the various sample groups suggest that the qualifications discussed above in the text (tariffs are just one way in which a firm may seek to enjoy public handouts) and in footnote 14 (the effect of tariff assistance on the number of small, specialized firms) may indeed be at work to nullify the expected market power effect of concentration on tariffs.

27. As noted earlier, the coefficient on our productivity measure (value added per employee) was never significant, although was usually negative. The failure of this variable to be significant may be due to the presence of SE, which may partly be representing the effects of productivity, as is explained in the text below.

28. Also of interest would be to investigate whether there is some critical level (or range) of concentration above which productivity is such that tariffs are used in the national policy sense, yet below which tariffs are used as hypothesized in the adding machine model, as is suggested by a comparison of the 2SLS coefficients on SE in our high concentration and low concentration industry groups.

29. As can be seen from Table 3, only 29 industries were common to both groups.

30. The signs predicted by his three models, for the variables common to this analysis and that of Caves, are as follows:

<table>
<thead>
<tr>
<th>Model</th>
<th>C</th>
<th>SE</th>
<th>GI*</th>
<th>CR</th>
<th>D</th>
<th>VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adding Machine</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Interest Group</td>
<td>+?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>National Policy</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Because of differences in our definition of the geographic index, this expectation is opposite to that hypothesized by Caves.
REFERENCES


Gorecki, Paul K., Economies of Scale and Efficient Plant Size in Canadian Manufacturing Industries (Ottawa: Bureau of Competition Policy, 1976).


________, "Concentration and the Level and Variability of Rates of Return in Australian Manufacturing Industries," (mimeo, 1979c).


APPENDIX

VARIABLE MEASUREMENT AND DATA SOURCES

The measure of industry performance takes the form of an industry-wide price-cost margin (P), averaged over the years 1968-69 to 1972-73. The margin is defined as turnover less industry variable costs, divided by turnover. Not all relevant cost data are available, so it was possible to deduct from turnover only the following: changes in the value of inventories; purchases of inputs, including raw materials and wages and salaries; rent and leasing expenses of vehicles, buildings, plant and equipment, and machinery; vehicle running expenses; freight, repair and maintenance expenses and sales commissions. No data are available on depreciation, insurance payments, rates and taxes, advertising and interest, although as discussed below, we use one data series, available only for 1968-69, as a proxy for advertising. Data were taken from the annual surveys of Australian manufacturing establishments, published by Australian Bureau of Statistics, Manufacturing Establishments. Details of Operations by Industry Class, Australia. 1972-73. (Canberra: Australian Bureau of Statistics, 1975.) (Also issues for years since 1968-69.)

Effective rates of protection (T) were provided by the Industries Assistance Commission, Assistance to Manufacturing Industries in Australia, 1968-69 to 1973-74 (Canberra: Australian Government Publishing Service, 1976). This publication explains their method of calculation. Our effective tariff rates are averaged over the years 1968-69 to 1972-73. Industry concentration (C) was measured as the percentage of total industry turnover held by the four largest firms, and was averaged from data for the years 1968-69 and 1972-73, provided in Australian Bureau of Statistics, Integrated Economic Censuses: 1968-69. Industry Concentration Statistics. Details by Industry Class. (Canberra: Australian Bureau of Statistics, 1974) and
Capital intensity (K) data are provided by the Industries Assistance Commission, Annual Report 1973-74. (Canberra: Australian Government Publishing Service, 1974.) Capital intensity is measured as the book value of fixed tangible assets per person employed, expressed as an index, using as a base (= 100) the capital intensity of the whole manufacturing sector. This index is available only for 1968-69; no other satisfactory data series exists on capital stock or working capital, and thus we assume that the 1968-69 values will be representative for the entire period under consideration. A similar assumption must also be made for the data used as a proxy for advertising (A), which is included in the analysis to represent the entry barriers established by product differentiation. No specific data on advertising expenditures in Australian manufacturing industries have been published, although for 1968-69 only, data at the three-digit level only have been published for a category labelled "other business expenses" by the Australian Bureau of Statistics, Integrated Economic Censuses 1968-69. Enterprise Statistics. Details by Industry Class. (Canberra: Australian Bureau of Statistics, 1974.) This category includes advertising expenses, as well as travelling expenses, insurance premiums, hire purchase interest expenses, office costs and accounting, legal and bank charges. The ratio of this series to turnover is used as a proxy for an advertising/sales ratio. Inspection of the calculated ratios indicated—that there was close correspondence between industries with high values of this ratio and those which casual observation leads one to conclude are characterized by high levels of advertising activity.

Growth (GR) is measured by the annual rate of change in industry value added over the period 1968-69 to 1972-73, the data coming from the same source as the
figures used to calculate the price-cost margins. No data are published on plant size distributions in Australia such that a simple Comanor and Wilson (1967) estimate can be made of minimum efficient scale. However, a variant of their technique, and its extension by Caves, Khalilzadeh-Shirazi and Porter (1975) has been developed by Parry and Watson (1977). This technique permits the calculation of economies of firm size (SE) in the form of the share of total industry value added accounted for by the group of firms with the relatively greatest productivity advantage. Being based on a productivity calculation, however, leaves open the possibility that this variable may partly reflect the efficiency of large firms (see Round (1979a)) in the use of either capital or labor.

Geographic decentralization (GI) is measured along the lines suggested by Gorecki (1976). He argues that markets are more likely to be national, the more geographically concentrated is the total production of an industry. Thus our (inverse) index of state-wide decentralization (it does not identify intra-state decentralization) is measured as the proportion of total Australian employment by which is accounted for by the state which employs most people in that industry. Information on employment by state for 1968-69 was taken from the individual state editions of the data source Manufacturing Establishments, referred to above in the discussion on the calculation of the price-cost margins. Diversification (D) is measured as 1 minus an industry's enterprise specialization ratio, multiplied by 100. The enterprise specialization ratios (provided in the same Australian Bureau of Statistics publication from which the data for advertising were taken (see above)) measure for an industry, the proportionate contribution, in terms of value added, by plants mainly engaged in the same industry as the enterprise, to the total value added of all enterprises mainly engaged in that industry. In some cases, to preserve confidentiality, the A.B.S. does not provide a specific specialization
ratio, but rather a range (0.70 to 0.84, 0.85 to 1.00), in which case the mid-point of the range is used as the value of the ratio for these industries. Such a procedure could be expected to weaken any observed relationship involving D, due to the similarity of values for some industries. Finally, the depth or significance of the economic processes in an industry (VAT) is measured by the ratio of value added to turnover, expressed as a percentage, averaged over the years 1968-69 to 1972-73. The data were taken from the same source as were those used in the calculation of the price-cost margins.
### TABLE 1

**Summary of Expected Influences of Explanatory Variables on Tariffs**

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Factors Affecting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supply</td>
</tr>
<tr>
<td>Profitability (P)</td>
<td>-</td>
</tr>
<tr>
<td>Concentration (C)</td>
<td>-</td>
</tr>
<tr>
<td>Capital Intensity (K)</td>
<td>-</td>
</tr>
<tr>
<td>Growth (GR)</td>
<td>-</td>
</tr>
<tr>
<td>Decentralization (GI)</td>
<td>+ or -</td>
</tr>
<tr>
<td>Diversification (D)</td>
<td>n.a.</td>
</tr>
<tr>
<td>Depth of Processes (VAT)</td>
<td>+ or -</td>
</tr>
<tr>
<td>Scale Economies (SE)</td>
<td>+ or -</td>
</tr>
</tbody>
</table>

n.a. = not applicable
### TABLE 2
Ordinary Least Squares and Two Stage Least Squares Estimates of the Profitability Equation

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>Sample (Number of Observations)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All (3 digit) (40)</td>
<td>All (4 digit) (135)</td>
</tr>
<tr>
<td></td>
<td>OLS 2SLS OLS 2SLS OLS 2SLS OLS 2SLS OLS 2SLS OLS 2SLS OLS 2SLS</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>7.011 (-0.322) 2.530 (4.547) 10.981 (3.438) 18.865 (3.049) 15.834 (3.525) 20.531 (3.053) 8.970 (2.964) 13.115 (2.518) -11.334 (-1.784)</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>0.056 (2.110) 0.074 (2.644) -0.011 (-0.619) -0.010 (-0.549) -0.023 (-0.507) -0.001 (-0.020) -0.024 (-1.083) -0.026 (-1.161) -0.007 (-0.271) 0.016 (0.639)</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.005 (0.158) 0.088 (1.517) -0.020 (-1.784) -0.139 (-1.845) -0.023 (-1.361) -0.159 (-1.918) -0.041 (-2.428) -0.122 (-1.851) 0.040 (1.028) 0.496 (4.224)</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>0.012 (3.198) 0.016 (3.635) 0.015 (4.404) 0.008 (1.314) 0.003 (3.529) 0.008 (1.540) 0.025 (3.666) 0.024 (3.333) 0.014 (3.277) 0.024 (5.304)</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>1.430 (5.549) 1.388 (5.537) 1.383 (7.411) 1.267 (7.236) 0.954 (3.898) 1.127 (4.304) 1.078 (5.593) 1.043 (5.266) 1.518 (5.213) 1.500 (5.797)</td>
<td></td>
</tr>
<tr>
<td>GR</td>
<td>-0.581 (-0.179) 3.219 (0.826) -0.219 (-0.166) -1.168 (-0.808) -1.296 (-0.580) -1.505 (-0.684) 3.148 (1.818) 4.690 (2.191) -1.551 (-0.780) 4.281 (1.881)</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.63 0.66 0.63 0.38 0.38 0.38 0.40 0.48 0.46 0.37 0.37 0.50</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.58 0.61 0.36 0.36 0.36 0.31 0.34 0.44 0.42 0.32 0.32 0.46</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>11.74 (15.93) 12.98 (16.00) 15.93 (6.00) 16.00 (6.57) 11.29 (11.29) 10.42 (10.42) 7.32 (7.32) 12.57 (12.57)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Numbers in parentheses in the body of the table are t-values. a, b, c represent significance at the one, five and ten percent levels respectively.
### TABLE 3

Ordinary Least Squares and Two Stage Least Squares Estimates of the Profitability Equation

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>Sample (Number of Observations)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C ≥ 50 and T ≥ 45 (29)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OLS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2SLS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.757)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(1.669)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(1.139)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(-0.552)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(0.956)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(-1.012)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(2.137)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>(0.544)</td>
</tr>
<tr>
<td>C</td>
<td>-0.044</td>
<td>-0.029</td>
<td>0.034</td>
<td>0.024</td>
<td>0.001</td>
<td>0.046</td>
<td>-0.025</td>
<td>-0.066</td>
</tr>
<tr>
<td></td>
<td>(-0.653)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(-0.388)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(0.811)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(0.574)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(0.011)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(0.683)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(-0.375)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>(-1.023)</td>
</tr>
<tr>
<td>T</td>
<td>-0.042</td>
<td>-0.072</td>
<td>-0.026</td>
<td>0.100</td>
<td>0.052</td>
<td>0.323</td>
<td>0.022</td>
<td>0.393</td>
</tr>
<tr>
<td></td>
<td>(-1.412)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(-1.032)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(-1.259)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(1.589)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(0.922)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(2.739)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(0.359)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(2.137)&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>K</td>
<td>0.022</td>
<td>0.022</td>
<td>0.048</td>
<td>0.073</td>
<td>0.025</td>
<td>0.018</td>
<td>0.012</td>
<td>0.023</td>
</tr>
<tr>
<td></td>
<td>(2.525)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(2.513)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(2.442)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>(3.217)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(1.657)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(1.303)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(2.689)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(3.531)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>A</td>
<td>0.755</td>
<td>0.798</td>
<td>1.480</td>
<td>1.628</td>
<td>1.789</td>
<td>1.885</td>
<td>1.315</td>
<td>0.955</td>
</tr>
<tr>
<td></td>
<td>(2.577)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(2.562)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(5.204)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(5.630)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(4.245)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(4.847)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(2.931)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>(2.160)&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>GR</td>
<td>2.731</td>
<td>3.584</td>
<td>2.189</td>
<td>-0.917</td>
<td>-0.536</td>
<td>2.447</td>
<td>-3.724</td>
<td>1.221</td>
</tr>
<tr>
<td></td>
<td>(0.834)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(0.949)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(1.069)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(-0.367)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(-0.201)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(0.901)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(-1.110)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>(0.318)</td>
</tr>
<tr>
<td>R&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.38</td>
<td>0.35</td>
<td>0.66</td>
<td>0.67</td>
<td>0.35</td>
<td>0.45</td>
<td>0.46</td>
<td>0.55</td>
</tr>
<tr>
<td>R&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.24</td>
<td>0.21</td>
<td>0.61</td>
<td>0.62</td>
<td>0.26</td>
<td>0.38</td>
<td>0.33</td>
<td>0.45</td>
</tr>
<tr>
<td>F</td>
<td>2.79&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.51&lt;sup&gt;c&lt;/sup&gt;</td>
<td>12.57&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.10&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.82&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.82&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.57&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.19&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note: Numbers in parentheses in the body of the table are t-values. a, b, c represent significance at the one, five and ten percent levels respectively.
TABLE 4

Ordinary Least Squares and Two Stage Least Squares Estimates of the Tariff Equation

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>All (3 digit) (40)</th>
<th>All (4 digit) (135)</th>
<th>C $\geq$ 50 (56)</th>
<th>C $&lt; 50$ (79)</th>
<th>T $\geq$ 45 (67)</th>
<th>T $&lt; 45$ (68)</th>
<th>OLS</th>
<th>2SLS</th>
<th>OLS</th>
<th>2SLS</th>
<th>OLS</th>
<th>2SLS</th>
<th>OLS</th>
<th>2SLS</th>
<th>OLS</th>
<th>2SLS</th>
<th>OLS</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>36.445 (0.989)</td>
<td>38.179 (0.964)</td>
<td>71.603 (2.843)</td>
<td>72.970 (2.859)</td>
<td>58.847 (1.107)</td>
<td>24.507 (2.421)</td>
<td>57.965 (1.883)</td>
<td>53.255 (1.593)</td>
<td>99.562 (2.804)</td>
<td>105.130 (2.867)</td>
<td>25.880 (1.747)</td>
<td>26.041 (1.768)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>-0.855 (-0.918)</td>
<td>-0.710 (-0.463)</td>
<td>-1.209 (-1.556)</td>
<td>-0.116 (-0.085)</td>
<td>-0.691 (1.026)</td>
<td>2.861 (-1.661)</td>
<td>-1.349 (-1.698)</td>
<td>-1.919 (0.166)</td>
<td>-1.423 (0.065)</td>
<td>0.277 (-1.935)</td>
<td>-0.292 (-1.031)</td>
<td>-1.063 (-0.585)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>-0.253 (-1.103)</td>
<td>-0.257 (-1.099)</td>
<td>0.035 (0.198)</td>
<td>-0.001 (0.005)</td>
<td>0.072 (0.175)</td>
<td>0.043 (0.195)</td>
<td>0.392 (1.047)</td>
<td>0.404 (1.067)</td>
<td>0.073 (0.340)</td>
<td>-0.149 (0.653)</td>
<td>-0.097 (0.850)</td>
<td>-0.091 (0.575)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>-0.331 (-1.314)</td>
<td>-0.033 (-1.128)</td>
<td>-0.034 (-1.068)</td>
<td>-0.058 (-1.287)</td>
<td>-0.041 (-1.028)</td>
<td>-0.108 (-1.735)</td>
<td>-0.162 (-2.070)</td>
<td>-0.143 (-2.522)</td>
<td>-0.004 (-0.662)</td>
<td>-0.060 (-0.762)</td>
<td>-0.011 (-0.677)</td>
<td>-0.002 (-0.652)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER</td>
<td>-23.432 (-1.431)</td>
<td>-26.635 (-1.316)</td>
<td>-7.699 (-0.713)</td>
<td>-10.481 (-0.912)</td>
<td>2.580 (0.132)</td>
<td>2.301 (0.119)</td>
<td>-6.730 (-0.333)</td>
<td>-4.627 (-0.333)</td>
<td>20.710 (1.545)</td>
<td>13.013 (0.857)</td>
<td>-15.349 (-1.665)</td>
<td>-5.593 (-1.499)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>-0.728 (-1.661)</td>
<td>-0.721 (-1.617)</td>
<td>-0.145 (-0.497)</td>
<td>-0.164 (-0.554)</td>
<td>-0.024 (-0.047)</td>
<td>-0.019 (-0.614)</td>
<td>-0.287 (-0.637)</td>
<td>-0.287 (-0.702)</td>
<td>-0.240 (-0.586)</td>
<td>-0.206 (-0.638)</td>
<td>-0.128 (-0.615)</td>
<td>-0.115 (-0.614)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CI</td>
<td>106.720 (2.810)</td>
<td>106.482 (2.773)</td>
<td>34.922 (1.619)</td>
<td>31.535 (1.417)</td>
<td>-15.168 (-0.499)</td>
<td>-16.562 (-0.549)</td>
<td>-96.936 (3.111)</td>
<td>102.711 (3.236)</td>
<td>-0.920 (-0.041)</td>
<td>-6.327 (-0.270)</td>
<td>17.278 (1.118)</td>
<td>20.527 (1.297)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td>0.870 (0.540)</td>
<td>0.798 (0.464)</td>
<td>0.715 (0.638)</td>
<td>-0.444 (-0.374)</td>
<td>1.065 (0.697)</td>
<td>2.323 (-2.356)</td>
<td>-4.861 (-2.520)</td>
<td>-4.832 (-2.441)</td>
<td>0.557 (0.215)</td>
<td>0.320 (0.397)</td>
<td>0.305 (-0.397)</td>
<td>0.400 (-0.529)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAT</td>
<td>0.507 (1.041)</td>
<td>0.456 (0.718)</td>
<td>0.040 (0.110)</td>
<td>-0.272 (-0.093)</td>
<td>-0.082 (-0.146)</td>
<td>-0.850 (-1.095)</td>
<td>-0.031 (-0.221)</td>
<td>0.164 (-1.088)</td>
<td>-1.055 (-1.547)</td>
<td>0.298 (1.336)</td>
<td>0.525 (1.525)</td>
<td>0.525 (1.525)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.52</td>
<td>0.51</td>
<td>0.09</td>
<td>0.07</td>
<td>0.07</td>
<td>0.08</td>
<td>0.31</td>
<td>0.30</td>
<td>0.15</td>
<td>0.10</td>
<td>0.17</td>
<td>0.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$F$</td>
<td>4.12$^a$</td>
<td>3.95$^a$</td>
<td>1.50</td>
<td>1.13</td>
<td>0.43</td>
<td>0.53</td>
<td>3.85$^c$</td>
<td>3.68$^a$</td>
<td>1.26</td>
<td>0.86</td>
<td>1.53</td>
<td>1.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Numbers in parentheses in the body of the table are t-values. $a$, $b$, $c$ represent significance at the one, five and ten percent levels respectively.