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Robert Dixon

Change in Recent Australian Economic Growth
The Role and Consequences of Structural
Recent Australian Economic Growth
Papers Arising from the Conference

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THE ROLE AND CONSEQUENCES OF STRUCTURAL CHANGE IN RECENT AUSTRALIAN ECONOMIC GROWTH

Robert Dixon
University of Melbourne

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</table>

#### SUMMARY

A comparison of both relative price variability and the variability of output growth rates across a number of countries indicates that the structure of production in Australia is less responsive to relative price changes than is the case in (say) Japan and West Germany. It also appears that the sectors which are expanding the fastest in Australia are becoming less backwards integrated with other sectors in the economy. Evidence on changes in the composition of manufacturing employment is consistent with the view that ossification (observed in the 'sixties') is fostered by a heavily regulated environment. Marked changes in structure seem to occur only in response to severe external shocks.

Turning to an examination of the concentration of firms in different industries, it would appear that rates of adjustment in concentration in Australia are comparable with the United States, but considerably slower than has been observed in the UK. A more detailed study of the market shares of large firms in manufacturing industries suggests that their behaviour predominantly reflects the prevailing economies (or diseconomies) of firm and plant size in relation to the size of the market.
STRUCTURAL CHANGE
Robert Dixon
University of Melbourne

I  INTRODUCTION

To attempt to discuss structural change is to deal with a topic which is huge and amorphous. It is also a topic which seems to invite sweeping generalizations which are often unsubstantiated, unfalsifiable and which amount to little more than dogma. I have decided to approach the subject by way of four essays dealing with (i) changes in the structure of expenditure and output (ii) changes in the composition of employment (iii) the rate at which 4-firm concentration ratios adjust and (iv) the determination of the relative size of large firms in a number of industries. I focus on these topics not only because they are of interest to me, but also because I believe they are important. Other topics are also important, but I do not see the point in recapitulating the commentaries on the patterns of industry growth which may be found in (say) the Industries Assistance Commission (1977) or the Bureau of Industry Economics (1979). Likewise there has been widespread discussion of the 'Gregory thesis' (Gregory, 1976) for some time now and I will simply assume that readers are familiar with the original article and the ensuing debate.

The study by the Industries Assistance Commission (1977) mentioned above, is of interest not least because of its attempt to compare rates of structural change across countries. Using as an indicator of the rate of structural change the standard deviation of sectoral growth rates within each country, it is found that "the extent of structural change in the period 1950 to 1975 varied widely among countries" (1977, p.14). The study also reported evidence that, compared with the experience of many other countries over the period, Australia (together with the U.S. and Britain) exhibited a low level of structural change.

I have performed similar calculations for both output and price changes using data for 9 'industrial sectors' (as distinct from 'producers of government services') in a number of countries over the period 1970-1980. The data is obtained for each country from Tables 1.10 and 1.11 of the U.N. National Accounts Statistics (U.N., 1985). A cross-country comparison of the
degree of variability in both changes in output and changes in sectoral implicit deflators should be of interest, and all the more so given the period chosen. For each country I have computed the standard deviation across 9 sectors in the ratio of sectoral output at constant prices at the end of the period i.e. the beginning. I have then repeated the calculation comparing the level of the implicit deflator for each sector at output at the end of the period i.e. the beginning. I have then calculated the standard deviation of these ratios across sectors within each country. (The implicit deflators were obtained by a comparison of constant price with current price data for each sector). The countries included in the study are: United Kingdom; Japan; Federal Republic of Germany; Canada; Australia, and the United States. The nine industrial sectors for which data is reported for each country are: Agriculture, hunting forestry and fishing; Mining and Quarrying; Manufacturing; Electricity, gas and water; Construction; Wholesale and retail trade, restaurants and hotels; Transport, storage and communication; Finance, insurance, real estate and business services, and; Community, social and personal services. The standard deviations of sectoral movements within each country (output and prices) are reported in Table 1 below.

Table 1

<table>
<thead>
<tr>
<th>Country</th>
<th>Standard Deviation of changes in Output Levels</th>
<th>Standard Deviation of changes Price Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.K.</td>
<td>0.59</td>
<td>1.813</td>
</tr>
<tr>
<td>Japan</td>
<td>0.45</td>
<td>1.551</td>
</tr>
<tr>
<td>F.R.G.</td>
<td>0.34</td>
<td>1.295</td>
</tr>
<tr>
<td>Canada</td>
<td>0.30</td>
<td>1.242</td>
</tr>
<tr>
<td>Aust.</td>
<td>0.26</td>
<td>0.998</td>
</tr>
<tr>
<td>U.S.</td>
<td>0.18</td>
<td>0.939</td>
</tr>
</tbody>
</table>

It is interesting first, that two of the countries with relatively high rates of 'structural change' (i.e. a high degree of variability in sectoral output growth rates) also exhibit a relatively high degree of uniformity in sectoral price movements. (The expansion of the 'mining sector' in the U.K. over the period accounts for the major part of its structural change.) Secondly, we see that Australia ranks second from bottom in terms of

'structural change' although it does clearly outperform the U.S. Thirdly, it is interesting that Australia with some 7% more relative price variability than the U.S. (i.e. comparing .998 with .933) has 40% more variability in sectoral growth rates. If we compare Australia with Canada, Australia's price variability is 0.80 that of Canada's, yet Australia's output variability is 0.86 that of Canada's. It would appear that judged by the IAC's criterion (variability in sectoral growth rates) Australia is performing relatively poorly, yet at the same time there is a relatively high degree of variability in price movements in Australia. Presumably the key to understanding these issues lies in understanding pressures to innovate and re-allocate in the absence of relative price movements, and also in understanding the reasons for the different degree of responsiveness of relative output levels to relative price movements (i.e. for different elasticities of supply between sectors).

It is precisely in attempting to deal with these issues that I believe the study by the Bureau of Industry Economics (1979a) is most relevant, for it is argued in that work that whereas "discussion on industry policy is usually couched in terms of industries and their growth patterns ... a more appropriate unit of analysis from the view point of structural change in the firm and the market structure within which it operates". (1979, p.120). It is for this reason, and also because I believe the area has been much neglected in the Australian literature, that I will devote so much space to industry concentration.

Whilst each essay contains a concluding section there is one theme which unites all of them, and which I would like to stress here, at the very beginning - that growth and change go hand in hand, or to put the same thing a different way, sustained growth is accompanied by increased specialisation and re-orientation in the division of labour. It follows that structures, attitudes or policies which inhibit change, inhibit growth.
II CHANGES IN THE COMPOSITION OF EXPENDITURE AND OUTPUT

1 Introduction

This essay is largely descriptive, it deals firstly with changes in the structure of aggregate demand and expenditure, and secondly with the sectoral shares of output. The final section attempts to examine, with the aid of inter-industry analysis, some of the consequences of these changes. We begin with a brief overview of changes in the composition of final demand (as revealed by the national income and expenditure accounts) and in the sectoral composition of output.

2 Composition of GNE and GDP

The major movements in the components of aggregate expenditure in the post WWII period are: (i) a fall in the ratio of Private Final Consumption Expenditure to Gross National Expenditure, (ii) a steady rise in the ratio of (total) government expenditure to GNE, (iii) initial steadiness and (since the mid-sixties) a persistent rise in the ratio of all Government Final Consumption Expenditure to Public Gross Fixed Capital Expenditure, (iv) a steady rise in the ratio of Private Gross Fixed Capital formation to GNE until 1970 then a fall until the mid 70's, a rise until the early years of this decade and then a fall thereafter, and (v) a relatively steady balance of trade until the mid seventies, and a steady deterioration thereafter.

Turning to the sectoral composition of output there has been a steady decline in the shares of gross farm product and of manufacturing output in GDP at factor cost. The two relatively fast growing sectors are: Mining, which appears to have risen from a low share of some 1/2% of GDP in the early fifties to around 7% today, and Services, although the growth is mainly associated with the Finance and Community Services industries.

The reasons for the expansion in the share of services has been explored by Hsiaig (1975), Carter (1984) and the NIEIR (1985) amongst others.

Hsiaig simulates a system of equations for output and employment in the different sectors, expenditures and relative prices (the latter being accounted for in terms of a time trend and relative labour productivities). He argues that the main factors in leading to a faster relative growth of service employment is the slower rate of growth of productivity in this sector than in manufacturing. The net effect of demand factors is neutral *(1975, p.42). The

NIEIR (1985) study is broader in scope, seeking to account for changes in employment by sector over the period 1968/69 to 1982/83 by simulation experiments of changes in consumption expenditure levels and patterns, and certain other variables. In the Appendix to the study it is claimed that "... changes in consumption patterns have had a relatively minor effect on manufacturing industries ..." the main stimulus ... arising from the change in consumption patterns is [the] growth in employment in the finance and community and business service industries ..." Essentially this is because of the higher income elasticities of demand for these products. Using the language of linear expenditure systems (see for example Topliss & Powell (1978)) we can account for this high income elasticity in terms of both a relatively low 'subsistence' or 'minimum required quantity' and a relatively high (and frequently above unity) marginal budget share (i.e. a high marginal propensity to spend on services out of supernumerary income).

Carter (1984) points out that the development of the service sector in Australia parallels that of other industrialised countries and stresses that growth has been confined to particular service activities such as health, education, finance and business services. He concludes, that, with the exceptions of education and health, the growth in employment and output "can be attributed to a process of specialisation and division of labour accompanying the maturation of the economy and spurred on by certain technological developments" (p.41) 5.

2 Inter-Industry Linkages

In order to further our understanding of the impact of these changes I have attempted to investigate the levels of, and the extent of changes in, the "backward linkages" of broad sectors of the economy, and mining and services in particular. To this end I have derived the leontief inverse of the 9 x 9 Gross Flows Table for 1968/69 reported by Parmenter (1982). I have also constructed a 9 x 9 version of the published flow table for 1978/79 (ABS, 1984) on a comparable basis to the Table constructed by Parmenter. This flow table was then manipulated to yield a matrix of total (direct and indirect) requirements coefficients. Table 2 overleaf reports the total requirements coefficients for the two years - the flow tables from which these matrices are derived record gross flows at basic values, with direct allocation of imports. Industries are grouped into sectors as follows:
### 6.

**Sectoring for the 1968/9 and 1976/7 Tables**

<table>
<thead>
<tr>
<th>Sector No.</th>
<th>Name</th>
<th>1-5 classification (76/7)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Primary</td>
<td>01.01 - 0.400</td>
</tr>
<tr>
<td>2</td>
<td>Mining</td>
<td>11.01 - 16.00</td>
</tr>
<tr>
<td>3</td>
<td>Food, Beverages and Tobacco</td>
<td>21.01 - 22.01</td>
</tr>
<tr>
<td>4</td>
<td>Textiles, Clothing &amp; Footwear</td>
<td>23.01 - 24.03</td>
</tr>
<tr>
<td>5</td>
<td>Other Manufacturing</td>
<td>25.01 - 34.05</td>
</tr>
<tr>
<td>6</td>
<td>Electricity, Gas and Water</td>
<td>36.01 - 37.01</td>
</tr>
<tr>
<td>7</td>
<td>Building and Construction</td>
<td>41.01 - 42.02</td>
</tr>
<tr>
<td>8</td>
<td>Trade, Transport, Storage and Communication</td>
<td>47.01 - 56.01</td>
</tr>
<tr>
<td>9</td>
<td>Finance &amp; Services</td>
<td>61.01 - 93.01</td>
</tr>
</tbody>
</table>

*Source: ABS (1984).*

Rasmussen (1956) has suggested one possible measure of backward linkage whereby we simply sum the column elements of the total requirements matrix to give a figure (I.J in Rasmussen’s notation) which can be interpreted as “the total increase in output from the whole system of industries needed to cope with an increase in the final demand for the products of industry j by one unit.” (Rasmussen, 1956, p.133). These sums, and their percentage changes, are reported in Table 3.

### 7.

#### Table 2

**Total Requirements Coefficients for a 9 x 9 Input-Output Table Australia**

<table>
<thead>
<tr>
<th>Sector</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<tr>
<td>1</td>
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<td>.020</td>
<td>.502</td>
<td>.095</td>
<td>.016</td>
<td>.004</td>
<td>.007</td>
<td>.005</td>
<td>.008</td>
</tr>
<tr>
<td>2</td>
<td>.009</td>
<td>1.182</td>
<td>.015</td>
<td>.012</td>
<td>.067</td>
<td>.061</td>
<td>.041</td>
<td>.012</td>
<td>.013</td>
</tr>
<tr>
<td>3</td>
<td>.052</td>
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<td>1.236</td>
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<td>.007</td>
<td>.002</td>
<td>.004</td>
<td>.004</td>
<td>.012</td>
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<td>.003</td>
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<td>1.399</td>
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<td>.125</td>
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<td>1.321</td>
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<th>6</th>
<th>7</th>
<th>8</th>
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<td>1978/79</td>
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<td>.036</td>
<td>1.252</td>
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<td>.009</td>
<td>.007</td>
<td>.005</td>
<td>.006</td>
<td>.009</td>
<td>1.005</td>
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<td>.097</td>
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<td>.189</td>
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<td>.090</td>
<td>.116</td>
<td>.091</td>
<td>.120</td>
<td>1.139</td>
</tr>
</tbody>
</table>

### Table 3

**Sums of the columns in Table 2**

<table>
<thead>
<tr>
<th>Sector</th>
<th>1968/9</th>
<th>1978/9</th>
<th>$ change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.573</td>
<td>1.517</td>
<td>- 4</td>
</tr>
<tr>
<td>2</td>
<td>1.667</td>
<td>1.542</td>
<td>- 8</td>
</tr>
<tr>
<td>3</td>
<td>2.342</td>
<td>2.241</td>
<td>- 4</td>
</tr>
<tr>
<td>4</td>
<td>1.955</td>
<td>1.851</td>
<td>- 5</td>
</tr>
<tr>
<td>5</td>
<td>1.876</td>
<td>1.837</td>
<td>- 2</td>
</tr>
<tr>
<td>6</td>
<td>1.414</td>
<td>1.672</td>
<td>+ 18</td>
</tr>
<tr>
<td>7</td>
<td>1.980</td>
<td>1.874</td>
<td>- 5</td>
</tr>
<tr>
<td>8</td>
<td>1.557</td>
<td>1.501</td>
<td>- 4</td>
</tr>
<tr>
<td>9</td>
<td>1.773</td>
<td>1.410</td>
<td>- 20</td>
</tr>
</tbody>
</table>
There are a number of reasons for treating those figures with some caution. Amongst other things one has to be concerned about the "grossness" of the 1968/69 table, about the influence of changes in ASIC, about the effects of concentration and vertical integration upon the accuracy of the reported intra-industry flows and the treatment of "business expenses", to say nothing about relative price changes etc. However, it does appear that in most industries there was a reduction in the magnitude of the Z.j's over the period, and that those reductions were most marked in the two sectors which we have identified as the fastest growing, i.e. mining and finance and community services. The reduction in the unit demands for intermediate goods from mining is associated with a marked rise in the (comparing) import content of output and a (smaller) rise in the share of (direct) primary inputs in production. The change for Finance and Services is associated with a reduction in the import content of output and a large increase in direct primary input content. The latter change reflects: (i) a rise in the wage and salary share in Health, education and welfare and also in Entertainment and Personal Services, and (ii) a rise in the Gross Operating Surplus share in Health, education and welfare. (It may also reflect in some part the revised treatment of business expenses and the imputed bank service charge in 1978/9).\footnote{1}

In the absence of simulations with an economy-wide model it would be unwise to make sweeping generalizations on the basis of the very limited analysis presented above. At the same time it is interesting that the fastest growing sectors are also becoming markedly less (backwards) integrated with other sectors in the economy.

III. VARIATIONS IN THE COMPOSITION OF MANUFACTURING EMPLOYMENT

1. Introduction

In this essay we examine rates of change in the industrial composition of employment in Australian manufacturing. I will focus on the post-WWII period but some historical comparisons will be made. This material constitutes an updating of the material contained in my 1982 paper, to which the reader is referred.

2. The Coefficient of Compositional Change

As our measure of the pace at which the structure (or 'pattern') of employment is changing we use the 'Coefficient of Compositional Change'. Over any period (i.e. between two dates denoted by 't' and 't-1') we define the Coefficient of Compositional Change (CCDC), as:

\[ \text{CCDC} = \frac{1}{2} \ln \frac{X_{t} - X_{t-1}}{1} \]

where \( X_{t} \) and \( X_{t-1} \) represent the proportion which each sector's employment bears to total employment at the end of the period and at the beginning of the period, respectively.

If, when comparing the composition of employment at different dates, we simply summed the differences in each industry's share of employment, taking into account their positive and negative signs, gains and losses would cancel out and the sum would be zero. For this reason these differences \( X_{t} - X_{t-1} \) are summed disregarding their signs, and then halved to facilitate interpretation. A shorter computational procedure would be to sum only the positive (or negative) changes. The value of the coefficient can range between zero and unity. A value of zero indicates that each of the industries had the same percentage shares of total employment at the end of the period as in the beginning. A value of unity would be observed when every industry had either zero employment at the beginning of the period or zero employment at the end of the period. (For example if there were only two sectors in the economy and the entire work force was employed in one sector at the beginning and then moved in its entirety to the other sector over the period, we would find a value for the Coefficient of Compositional Change of unity.)
It may thus be seen that the Coefficient of Compositional Change yields a statistic which is equivalent to the figure we would obtain if we measured the proportion of total employment at the end of the period, which would have to be allocated to other sectors in order to re-establish the sectoral distribution of employment prevailing at the beginning of the period. (I stress that the measure is equivalent to the re-distribution of the employed work force, it is not a measure of the number of workers who have actually moved between industries over the period. The coefficient does not discriminate between changes which reflect re-deployment of the (pre-) existing labour force and that changes which reflect the fact that net additions to the work force are being 'allocated' across industries in different proportions to which existing employment are apportioned between industries.)

In what follows I report calculations of the coefficient of compositional change drawn from estimates of the sectoral composition of factory (or manufacturing sector-) employment over the period 1910-1984.

In the earlier paper I presented a series (which in fact is made up of three series spliced together) for the coefficient of compositional change calculated for each year over the period 1910-1978. (The series is based on twelve classes of manufacturing). I have updated the series by using data for the twelve two-digit categories of manufacturing reported in the annual ABS publication Manufacturing Establishments: Summary of Operations by Industry Class. (The changes in ASIC in 1978 have been adjusted for by comparing the results for 1977/8 under the 1969 and the 1978 ASIC and that comparison has been used to put the series on a common standard.) This series has then been spliced on to the 1910-1978 estimates. The resulting series is graphed in Chart A on the following page. To assist in the interpretation of this series I present in Chart B a plot of a four-year (centered) moving average of the series for the rate of change in the structure of manufacturing employment. (The apparent breaks in the series are indicators of the beginning and end of the distortions associated with the 'war-periods'.)

3 Some Features of the Series
3.1 A caveat: the level of aggregation and the data base

Clearly the results, to the extent that they have any meaning at all, are contingent upon the level of dissagregation of the industrial classification
upon which they are based. Cet. Par. we would expect the more disaggregated the data base, the greater the coefficient of compositional change will be.\footnote{8}

A second problem which ought to be mentioned is that the results we have found, and the features of the series we shall identify, may be a statistical artifact of the particular data base, and classification system used. I mean this in two senses. First, it may be that there is a great deal of change going on within classifications which is undetected by our measure. Secondly, it may be that a different data base, e.g. using output rather than employment, or employment by occupation rather than by industry, would give quite different results.

Thirdly, it could be that the series is picking up changes which are 'reversed', and is not reflecting irreversible or secular change. In my earlier paper (Dixon, 1982) I discussed this issue in the context of cycles in activity and in the series for the coefficient of compositional change. Suffice to say here that because the cycles in the Compositional Change series one of roughly the same duration as the business cycle, I believe the COCO-series is tending to pick up evolutionary or ratchet-like effects, rather than the mere impact of cyclical fluctuations about a stationary trend.\footnote{9}

3.2 Movements in the Post-WWII Period

The slowing down of the rate of change in the structure of manufacturing employment in the fifties and sixties is clearly evident in Chart B, as is the upturn in the level of structural/compositional change in the seventies and early eighties. The evidence presented here is consistent with the view that ossification occurs in a heavily regulated environment, an environment which encourages, indeed rewards, rent-seeking behaviour. Such an environment, sustained by both microeconomic regulation and macroeconomic stabilisation is structure preserving. Contrast this with the seventies and eighties where external shocks have tended to affect both the structure of industry and the policies which influence the rigidity or otherwise, of the structure of industry.

3.3 A (tentative) model of the Coefficient of Compositional Change

It will be recalled (from p.2) that the value of the Coefficient of Compositional Change over any period is equivalent to the figure we would obtain if we measured the proportion of total employment at the end of the period, which would have to be allocated to other sectors in order to re-
establish the sectoral distribution of employment prevailing at the beginning of the period.

In actual fact, the changing pattern of employment between periods reflects the extent to which either workers already in employment changed their industry of employment between the two periods or, people not employed in the previous periods took employment in industries in differing proportions than the proportional distribution of the (pre-) existing workforce across industries.

From the definition of the Coefficient of Compositional Change given above we may say that it is equal to the ratio of 'Hypothetical Total Reallocation' (NTR) to the total workforce (N). The number of Hypothetical Total Reallocations (NTR) will equal the sum of the number of existing workers who were re-deployed during the period (RD) and the 'differential deployment' of net additions (i.e. new entrants less exits of 'old' workers) to the total number employed (DD). Thus we may write for the Coefficient of Compositional Change:

(1) \[ \text{COC} = \frac{\text{NTR}}{N} = \frac{\text{RD} + \text{DD}}{N} = \frac{\text{RD}}{N} + \frac{\text{DD}}{N}. \]

We may think of the number of (net) re-deployments of the existing workforce as some fraction (rdr) (not necessarily a constant) of the size of the existing work force (N). We may think of the hypothetical number of differential deployments as being some fraction (ddr) (again, not necessarily a constant) of the change in the total number employed over the period (AN).

All of which is to say that:

(2) \[ \text{DD} = (\text{ddr}) \text{(AN)} \]

(3) Substitution into (1) yields:

(4) \[ \text{COC} = (\text{rdr}) + (\text{ddr}) (\text{AN}/N). \]

Since \((\text{AN}/N)\) is simply the rate of growth in total employment over the period (G) we may write:

(5) \[ \text{COC} = (\text{rdr}) + (\text{ddr})(G). \]

which is to say that there is a relationship between the rate of compositional change, and the rate of growth of total employment such that, for the rate of compositional change to increase relative to the rate of employment growth, there will have to be an increase in the re-deployment rate (rdr) or an increase in the differential deployment rate (ddr).

In Table 4 I report the values of the (year on year) Coefficient of Compositional Change and the (year on year) growth rate of total manufacturing employment over the post-WWII period.\textsuperscript{10}

An inspection of a scatter-diagram of COCC against G would seem to indicate that the relationship between the two is quadratic, with "abnormal", (i.e. both relatively low and relatively high) growth rates of total employment being associated with high levels of compositional change.

Over the whole of the period it would appear that the Coefficient of Compositional Change is non-linearly related to the (year on year) Growth rate, such that:\textsuperscript{11}

\[ \text{COC} = 0.7211 + 0.0100G^2 \]

\[ (9.48) \quad (2.68) \]

\[ R^2 = .162 \]

However there are quite clearly two years of unusually high rates of compositional change these being 1951/2 and 1974/5, both years of marked disturbance largely on account of external factors. If dummies are introduced for these two years, we find:\textsuperscript{12}

\[ \text{COC} = 0.6711 + 0.0090G^2 + 0.92101 + 0.95302 \]

\[ (11.32) \quad (3.24) \quad (3.47) \quad (3.56) \]

\[ R^2 = .515 \]

where: D1 is unity in 1951/2 and zero otherwise.

D2 is unity in 1974/5 and zero otherwise.

It is of interest that the Coefficient of Compositional Change and the growth rate are related in this particular (non-linear) fashion. Note first, that even when no growth is occurring compositional change will none-the-less be taking place - indeed the estimate of the constant in the equation is approximately 80% of the mean value of the coefficient of compositional change over the period. Secondly, the equation indicates that the coefficient of compositional change will be a minimum when the rate of growth is zero. Thirdly, the "U" shape of the function indicates that relatively low and
relatively high growth rates are both associated with relatively high coefficients of compositional change. All of which is to say that growth (whether positive or negative) and changes go hand in hand.

A model which is consistent with this particular form of non-linear relationship, and one which I think has a great deal of intuitive appeal is where both the re-deployment rate (rdr) and the differential deployment rate are positively related to the absolute level of the growth rate (i.e., the rate of growth disregarding sign). It is possible to explore this relationship by regressing the coefficient of compositional change on the absolute growth rate (AO), when this is done we find:

\[
\text{COC} = 0.551 + 0.079 \text{AG} + 0.978 \text{D1} + 0.916 \text{D2} \\
(6.47) (3.34) (3.68) (3.43) \\
R^2 = .523
\]

which is consistent, disregarding dummies, with the relationship depicted below.

<table>
<thead>
<tr>
<th>Year</th>
<th>COCC ($)</th>
<th>C ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>48-49</td>
<td>0.6</td>
<td>4.7</td>
</tr>
<tr>
<td>49-50</td>
<td>0.6</td>
<td>3.3</td>
</tr>
<tr>
<td>50-51</td>
<td>1.4</td>
<td>5.4</td>
</tr>
<tr>
<td>51-52</td>
<td>1.6</td>
<td>0.9</td>
</tr>
<tr>
<td>52-53</td>
<td>0.9</td>
<td>-4.6</td>
</tr>
<tr>
<td>53-54</td>
<td>0.8</td>
<td>6.2</td>
</tr>
<tr>
<td>54-55</td>
<td>1.3</td>
<td>4.1</td>
</tr>
<tr>
<td>55-56</td>
<td>1.4</td>
<td>2.9</td>
</tr>
<tr>
<td>56-57</td>
<td>0.7</td>
<td>0.1</td>
</tr>
<tr>
<td>57-58</td>
<td>0.8</td>
<td>1.1</td>
</tr>
<tr>
<td>58-59</td>
<td>0.7</td>
<td>1.3</td>
</tr>
<tr>
<td>59-60</td>
<td>1.1</td>
<td>4.3</td>
</tr>
<tr>
<td>60-61</td>
<td>0.7</td>
<td>1.3</td>
</tr>
<tr>
<td>61-62</td>
<td>0.7</td>
<td>-2.8</td>
</tr>
<tr>
<td>62-63</td>
<td>0.7</td>
<td>5.0</td>
</tr>
<tr>
<td>63-64</td>
<td>0.7</td>
<td>3.1</td>
</tr>
<tr>
<td>64-65</td>
<td>0.7</td>
<td>4.9</td>
</tr>
<tr>
<td>65-66</td>
<td>0.4</td>
<td>1.9</td>
</tr>
<tr>
<td>66-67</td>
<td>0.6</td>
<td>1.1</td>
</tr>
<tr>
<td>67-68</td>
<td>0.6</td>
<td>1.7</td>
</tr>
<tr>
<td>69-70</td>
<td>0.3</td>
<td>2.7</td>
</tr>
<tr>
<td>72-73</td>
<td>0.7</td>
<td>-0.3</td>
</tr>
<tr>
<td>73-74</td>
<td>0.9</td>
<td>3.2</td>
</tr>
<tr>
<td>74-75</td>
<td>1.9</td>
<td>-5.5</td>
</tr>
<tr>
<td>75-76</td>
<td>1.2</td>
<td>-3.5</td>
</tr>
<tr>
<td>76-77</td>
<td>0.8</td>
<td>-1.9</td>
</tr>
<tr>
<td>77-78</td>
<td>0.7</td>
<td>2.7</td>
</tr>
<tr>
<td>78-79</td>
<td>0.9</td>
<td>-2.2</td>
</tr>
<tr>
<td>79-80</td>
<td>0.5</td>
<td>3.2</td>
</tr>
<tr>
<td>80-81</td>
<td>0.6</td>
<td>-0.4</td>
</tr>
<tr>
<td>81-82</td>
<td>0.3</td>
<td>0.8</td>
</tr>
<tr>
<td>82-83</td>
<td>1.4</td>
<td>-9.3</td>
</tr>
<tr>
<td>83-84</td>
<td>0.8</td>
<td>-1.2</td>
</tr>
</tbody>
</table>
Given the above, it seems sensible to enquire into the possibility that the two "arms" of the relationship have different slopes, that is that periods of negative growth impact differently upon compositional change than do periods of positive growth. To test this two variables measuring the absolute growth rate were used. One, AGP adopts a value of zero in years of negative growth and the observed growth rate in years of positive growth. The second, AGN, adopts a value of zero in years of positive growth and records the absolute value of the growth rate in years of negative growth. The estimated equation turns out to be:

\[
\text{COCG} = 0.569 + 0.064\text{AGP} + 0.088\text{AGN} + 0.972\text{P1} + 0.842\text{P2}
\]

\[
(6.57) \quad (2.35) \quad (3.35) \quad (1.64) \quad (3.06)
\]

\[R^2 = .519\]

Since the coefficients on the two growth rates are not significantly different, we must reject the hypothesis of asymmetry. (This is interesting because many have believed that "resistance" to change in its many forms may have resulted in asymmetry, with the coefficient on AGN being less than the coefficient on AGP.)

Evidence on the "Pressure" of Structural Change

An examination of trends in the rate of compositional change relative to the rate of growth in employment may be an indicator of the pressure of structural adjustment.\(^{13}\)

In Chart C I plot for each year between 1948 and 1984 the difference (in per cent per annum) between the year-on-year value of the coefficient of compositional change and the year-on-year growth rate of total manufacturing employment as a time series. It is clear from the chart that, whilst there are recurrent oscillations in the series, there was a persistent tendency for the rate of compositional change to increase relative to the growth rate (i.e. for (COCG-G) to rise). Not only, therefore was the pressure of structural adjustment greater in recent times than in earlier periods, but the pressure seems to have been increasing during the seventies and eighties.

A simple time trend fitted to the level of (COCG-G) over the whole post-WWII period yields:
IV. THE DYNAMICS OF INDUSTRY CONCENTRATION – AN INTERNATIONAL COMPARISON

1. A Model of Adjustment

It has become common, especially in the U.S. literature, to study the dynamics of industry concentration using an econometric model which incorporates partial (stock) adjustment such that:

\[ C_t - C_{t-1} = \lambda (C_t^* - C_{t-1}) \]

where: \( C_t^* \) is the concentration ratio observed at time \( t \).

\( C_{t-1} \) is the concentration ratio observed at an earlier date.

\( C_t^* \) in the 'optimal' or 'desired' concentration ratio at time \( t \).

\( \lambda \) is the (assumed constant) rate of adjustment (0≤ 1).

An excellent account of the economic rationale behind partial adjustment models may be found in Griliches (1967). He shows in that paper the dependence of the rate of adjustment (1) on the costs of adjustment (and also upon the costs of being 'out of equilibrium'). Discussions of the reasons for the slow adjustment of industry concentration ratios, and especially the relationship between the adjustment of market shares and the pricing policy of the firms in the industry, may be found in Martin (1979), Curry and George (1983) and Levy (1985).

It is usual to estimate the rate of adjustment as follows: Suppose we believe that the optimal concentration ratio \( C_t^* \) can be expressed as a linear combination of certain explanatory variables (say, \( X_1 \) and \( X_2 \)). It would then be possible to estimate \( \lambda \) and test various hypotheses relating to the variables \( X_t \) and \( X_{t-1} \) if we were able to estimate an equation of the form:

\[ C_t - C_{t-1} = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 - \lambda C_{t-1} \]

Models of this type have been estimated for the U.S., and the U.K. (although published research is rather dated, as we shall see).15 In this essay I intend to discuss the results of overseas studies and then examine the results of fitting similar models to Australian data. I hope that, in so

5 Conclusions

The key conclusions of this section of the paper are as follows – (i) whilst there appears to have been a tendency for ossification in the industrial structure in the fifties and sixties, more marked changes have been observed in the seventies and eighties. (ii) Even if there were to be no change in the aggregate level of employment we would nonetheless observe re-allocations of the work force between sectors involving approximately 2/3 of 1% of the work force. (iii) The rate of compositional change is lowest when there is no change in the aggregate level of employment (iv) both positive and negative growth of aggregate employment tend to have the same effects on the rate of compositional change, i.e., there is no evidence of significant asymmetry.

\[ [\text{COCC-G}] = -3.145 + 0.178 \times \text{TIME} \]

\( R^2 = .252 \)
doing, we might obtain some understanding of the rate of adjustment in Australia.

II. U.S. and Australia Compared

Most U.S. studies have included as explanatory variables (in addition to the lagged concentration ratio) the ratio of advertising to sales, industry size and the rate of growth in value added by the industry. This research tends to be limited to the manufacturing sector with cross-sectional regressions being performed across a large number of observations at the four-digit level. Mueller and Hamm (1974) estimated an equation for the change in the four-firm concentration ratio between 1958 and 1970. They estimate the stock adjustment parameter to be 0.12. (Mueller and Hamm (1974), p. 516). In a more recent study Mueller and Rogers (1980) examine changes in the four-firm concentration ratio in the U.S. manufacturing over the period 1958-72 and estimate a lag coefficient of 0.15. (Mueller and Rogers (1980), p. 94). In the context of a discussion of appropriate measures of the change in concentration Wright (1978) examined the eight-firm concentration ratio over the period 1947-1963. He estimated a lag coefficient of (approximately) 0.13. (Wright (1978), p. 630).

These results are summarised in the table below, the dependent variable in each case is the change in the concentration ratio (measured in percentage points) between the beginning and end period.

<table>
<thead>
<tr>
<th>Study</th>
<th>Period</th>
<th>No. of Years</th>
<th>Estimate of λ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mueller and Hamm (1974)</td>
<td>1958-70</td>
<td>12</td>
<td>0.12</td>
</tr>
<tr>
<td>Mueller and Rogers (1980)</td>
<td>1958-72</td>
<td>18</td>
<td>0.15</td>
</tr>
<tr>
<td>Wright (1978)</td>
<td>1947-63</td>
<td>16</td>
<td>0.13</td>
</tr>
</tbody>
</table>

I have estimated a similar equation to that reported in the U.S. studies for Australian manufacturing at the four-digit level over the period 1968/9 to 1982/3. Owing to the revisions to ASIC we are restricted to 101 comparable estimates for the four-firm concentration ratio at the four-digit level. As the dependent variable I used the observed change in the concentration ratio between 1968/9 and 1982/3 (the mean value of this was 4.3 percentage points). As explanatory variables I used the initial concentration ratio, the ratio of advertising to sales (derived from IBIS (1984), the data is actually reported at the 3-digit level), value added in each industry in 1982 and the growth rate of value added between the beginning and end of the period. These variables were included in an attempt to ensure that the results for Australia are comparable with the studies reported earlier.

The coefficient on the lagged concentration ratio was (−)0.12 and was significant at the 1% level. This estimate yields a rate of adjustment which is only slightly lower than the estimates for the U.S. reported by Mueller and his co-researchers and is virtually the same as that reported by Wright. Given that the estimates for Australia are not significantly different from those obtained in the three studies for the U.S. (mentioned above) we must conclude that, on the basis of these comparisons at least, there is no evidence of any greater "structural" rigidity in Australian manufacturing than in U.S. manufacturing. However, if research using more recent data were available for the U.S. it may be that faster adjustment would be observed for that country than has been reported in the studies considered here.

3 U.K. and Australia Compared

Unfortunately there are few studies for the U.K. which replicate the research which has been undertaken in the U.S.. There are, however, three studies which may enable some comparisons to be made, these are (in the order we shall deal with them) by Hart and Clarke (1980), Shepherd (1972) and Levy (1985).

Hart and Clarke (1980, p. 47 ff.) report a regression study for the proportionate change in the 5-firm employment concentration ratio in British manufacturing industries (76 in all) over the period 1958-1968. They regress the change in the logarithm of the employment concentration ratio on (inter alia) logarithmic changes in a measure of median plant size, industry size and the logarithm of the initial concentration ratio. Their estimate of the (logarithmic) adjustment coefficient is 0.24 (1980, p.48, Table 4.2).

I have collected data for the 4-firm employment concentration ratio for 101 Australian manufacturing industries for which comparable data was available at the 4-digit level for years 1968/9 and 1977/78. The logarithmic changes in the concentration ratio were regressed on logarithmic changes in minimum efficient scale in industry size (value added, $m) in
the ratio of advertising to sales and on the logarithm of the initial concentration ratio. The estimated coefficient on the concentration ratio is \((-0.014, \text{ at the } 1\% \text{ level})\). This figure, which is over nine years, is lower than the coefficient estimated by Hart and Clarke for the U.K. for a decade earlier. Whether the difference reflects the timing of the studies or the sluggishness of the labour market in Australia or the U.K. is a moot point, although one suspects that both are relevant.

Shepherd (1972) considers a model for changes in the 5-firm sales concentration ratio expressed in terms of the initial concentration ratio and the percentage changes in industry sales over the period 1958 to 1963. For the whole sample of 235 industries he finds an adjustment coefficient (which is significant at the 1% level) of 0.063. Using exactly the same model but with the 4-firm sales concentration ratio we find for 101 Australian manufacturing industries over the period 1968/9 to 1977/8 the adjustment coefficient is 0.054. A rate which, allowing for the different time periods between the two studies, is lower than that which Shepherd estimated for the U.K. However, Sawyer (1971, p. 363) has shown that the adjustment coefficient at the 4-firm level in the U.K. is lower than the adjustment coefficient at the 5-firm level. Indeed Sawyer estimates an adjustment coefficient (in an equation where the only explanatory variable is the lagged concentration ratio) of \(-0.05\) (which is not significantly different from zero) over the period 1958 to 1963. In this light the adjustment rate for Australia may be nearer to the U.K. rate than would appear from a comparison of a 5-firm ratio in one country and 4-firm ratio in another.

Levy (1980) examines changes in concentration in British manufacturing over the period 1962-1973. The dependent variable is the change in the 4-firm sales concentration ratio at the four-digit level, weighted to take account of the closeness of the initial concentration ratio to the bounds of zero and unity (in doing this he is following a procedure suggested by Wright 1978). The dependent variables include a measure of advertising intensity, minimum efficient scale, the lagged concentration ratio and the growth rate of industry sales. If Levy's equation is estimated using the Australian data described above, but with the dependent variable being the weighted change in the concentration ratio (as calculated by Levy and Wright) the coefficient on the lagged concentration ratio for the period 1968/9 to 1982/3 is \((-0.024\%\) which is significant at the 1% level). For the period 1968/9 to 1977/8 the coefficient \((\hat{\beta})\) is estimated as \((-0.015\%\). The coefficient on the lagged concentration ratio as estimated by Levy is \((-0.023\%)\) (Levy, 1980, p.65). Clearly the estimates for Australia are very very low by comparison. However, Levy's coefficients have to be regarded with some concern as I feel they are suspiciously high, given the weighting scheme used on the dependent variable (which reduces its mean value, and the value of individual observations relative to mean, quite considerably). Indeed Wright (1978), who Levy claims to be following, estimated a log coefficient for U.S. manufacturing (using the same weighting procedure for the changes in the concentration ratio as the dependent variable) in the range 0.004-0.005 for a sixteen year period (1947-1963). Wright's results are closer to ours (although the evidence here is that adjustment in Australia is occurring at a faster rate than that for the U.S.).

4 Conclusions

It would appear that the rates of adjustment in the degree of industrial concentration in Australia are comparable with that of the U.S. (for slightly earlier time periods) but there is some evidence that the rate of adjustment in Australia is considerably slower than that for the U.K. (again in earlier time periods).
V. FACTORS WHICH INFLUENCE MARKET CONCENTRATION

1 Introduction

In this essay I aim to explore in greater detail a particular model of changes in concentration in Australian industry. The model which is developed here draws heavily upon recent applied research on oligopoly and especially the work of Cowling and Waterson (1976), Clarke and Davies (1982) and Neumann (et al) (1985). This essay is a summary of a part of a considerably larger research project which is being undertaken at the University of Melbourne. (See Dixon (1986) and Dixon & Gunther (1986) for more extensive reports on the progress of that research). The model presumes a market form in which a few (potentially collusive) large firms operate in industries in which there is a fringe of (numerous) other local producers and actual or potential foreign producers. I begin this essay by identifying an appropriate measure of industry structure for this type of market form. I then develop and estimate a model of market structure. This necessarily involves the estimation of a small system of equations for margins, structure and advertising. The penultimate part of this essay explores, in more detail, the determination of the size distribution of firms (i.e. the Hirschman-Herfindahl index). I hope that, albeit in a very tentative way, that this exercise may yield some clues as to the origins, and consequences, of changes in market structures in Australian industry (although our empirical work is, because of data limitations, confined to only a few manufacturing industries).

2 An Appropriate Measure of Structure

An interesting, and important, feature of modern models of oligopoly is an open economy concerns the role not of the concentration ratio, nor of the Hirschman-Herfindahl index acting alone, but of both variables interacting jointly with the import share. In a sense therefore the recurrent debate over whether the CR-index or the H-index is the most appropriate is a little misplaced—both it would appear are relevant.

Let us define:

\[ C_R L = X_L / X, \]
\[ (1-m) = X/S, \]
\[ H_L = \frac{1}{X_L} \left( \frac{X_L}{X} \right)^2 \]

where:
\( S \) = total sales (including imports)
\( X \) = total sales of local firms
\( X_L \) = total sales of large local firms
\( X_L \) = sales of the 1st large firm
\( m \) = the import share

\( H_L \) = the large-firm Hirschman-Herfindahl Index.

The most appropriate structure variable turns out to be:

\[ [C_R L (1-n) H_L] - \frac{(X_L / S) H_L}{X} \]

In other words, our structure variable stands for the adjusted or weighted large-firm Hirschman-Herfindahl index, where the weight is the share of large firms in total market sales (including imports).

3 Towards an Empirical Model of Industry Structure

Our empirical work shall consist of two parts. First, I will construct a very simple linear model of industry structure margins and advertising. In no doing I draw heavily on the earlier work of Strickland and Weiss (1976), Martin (1979) and also Paoulatos and Sorensen (1981). An examination of each equation, and their interaction, should serve to help us to understand the forces leading to, and the role of, changes in market structure. This is the task of the present section and of section 1. Secondly, we will try to focus in more detail on the determinants of the large-firm Hirschman-Herfindahl index. That material is developed in the section which follows.

As a measure of market structure in our simple model I will use the adjusted (or weighted) Hirschman-Herfindahl index for the large firms (AHIL). This measure, which was discussed in Section 2 above is defined as:

\[ AHIL = C_R L (1-n) H_L \]
In modelling structure it seems sensible to take into account the fact that we have available to us industry concentration data over four different years (1968/9, 72/3, 77/8 and 82/3). Obviously, industry structure may be regarded as adjusting in a distributed lag fashion to various shocks. We will therefore express structural change (ie. the change in AHL between two dates) in terms of a stock adjustment model, such that:

\[ \text{AHL}_t - \text{AHL}_{t-1} = \lambda (\text{AHL}^* - \text{AHL}_{t-1}) \]

where \( \text{AHL}^* \) indicates the desired or "optimal" structure.

As explanatory variables for the "optimal" or "fully-adjusted" structure I will use the following:

(i) the margins of the large firms (MARL). The expected sign being negative so, with a fringe of local producers and importers, relatively high margins for the large firms will ceteris paribus tend to attract entry and expansion of the fringe.

(ii) a series of variables designed to pick up barriers to entry. I have included: (a) The average size of large firms (ASLF) which is an attempt to estimate the minimum efficient scale for the industry, (b) A cost advantage ratio (CAR) which, following Caves et al. (1975) is an attempt to measure the steepness of the relevant variable cost functions. I have chosen to use as a measure of cost advantage the ratio of average value added per worker (measured in current prices) in large firms to the average (current price) value added per worker in the remainder of the industry (ie. in the "small" firms), and (c) The ratio of advertising expenses to sales (ADV).

Our linear model of the adjusted R-index is therefore:

\[ \text{AHL} = a_0 + a_1 \text{MARL} + a_2 \text{ASLF} + a_3 \text{CAR} + a_4 \text{ADV} + a_5 \text{AHL}_{t-1} \]

Our model of structure contains two variables which ought properly be modelled as endogenous, namely margins (MARL) and advertising expenditure (ADV). It is important that we take this into account.

In modelling margins I will depart radically from earlier empirical work in Australia and attempt to strike a balance between the desire to keep the model simple yet still retain some of the flavour of the Couling-Watson model developed in section I of the paper. First, I will allow for sub-optimisation by allowing only partial adjustment of margins through time, secondly I will include the adjusted R-index as an explanatory variable (perhaps this should be allowed to enter non-linearly and should be adjusted for the demand elasticity and also the supply elasticity of the fringe). I will also include advertising expenses as an explanatory variable, especially since it is likely to indicate not only demand-curve shifting, but also the possible extent to which non-price competition is replacing price-competition (ie. it may be an index of (implicit or explicit) collusion with respect to price). Our estimating equation for (large-firm) margins is:

\[ \text{MARL} = b_1 + b_2 \text{AHL} + b_3 \text{ADV} + b_4 \text{MARL}_{t-1} \]

We have noted the likely role of advertising in the determination of margins and also, because it may constitute a barrier to entry, in the determination of industry structure. Both theory and overseas evidence suggest, however, that margins and concentration levels are themselves likely to influence advertising levels.

As explained by Schmalensee (1972) the optimal advertising to sales ratio of an individual firm may be expressed in terms of the firms price- (marginal) cost margin, the elasticity of sales to advertising outlay and a variable which takes account of rival's reactions. We will include in our equation for the ratio of advertising to sales two variables in addition to the (gross) margin. First, we will include a variable measuring the size of market share, because it "... is expected that concentration should exert a positive influence upon advertising intensity because increases in market share allow firms to internalise a greater proportion of the industry-wide effects associated with advertising may become the main instrument of rivalry ..." (Pagoulatou and Sorensen, 1981, p. 735). Secondly, we will include a variable measuring the proportion of sales which goes to consumer demand (FSC), on the grounds that ceteris paribus the level of advertising will be higher, the lower the proportion of output which is exported or which is sold as intermediate or capital-goods.

Conner and Wilson (1974, Ch.7) argue that we should also include the elasticity of demand. One would expect for example that the more elastic in
industry demand, the greater would be the advertising and product differentiating activities of the firms.

Our expression for advertising expenditure is thus:

$$ADV = c_1 + c_2 MARL + c_3 AH + c_4 PSC + c_5 ETA$$

I turn now to a brief discussion of the data sources and the techniques used to estimate our three equation linear model. We will then discuss the results.

### Data and Estimation

Our data on industry elasticities of demand was derived for use in the ORANI model of the Australian economy. Since the elasticities refer to household demand we have only included in our study those industries where sales to private consumers make up a significant part of total gross output. Also, we chose to exclude one industry ("Milk Products" (ASIC Code 212)) as we felt its activities were regulated to an extent that would invalidate its appearance in our study, we excluded three more industries because the share of exports in total sales was deemed to be so large as to effect the results.

Other industries were excluded because it was difficult to identify with sufficient precision the number of, and data for, dominant firms. Other data deficiencies combined with a desire to define the industries to be included as narrowly as possible (and the exclusion of two 'simple' oligopolies (Beer and Tobacco)) have led us to deal with twelve industries (e.g. the twenty industries which were scrutinised in an earlier paper (Dixon & Gunther, 1986)). A list of the industries included in this study is given in Table 5. We assume, in what follows, that the elasticity of demand for the products of each industry is constant over time.

The dominant group of firms in each industry was identified from data for the cumulative turnover of groups of four firms reported in the statistics on Industry Concentration. We have defined the dominant group to be that number of firms to be found in "enterprise groups" (usually of four firms) which account for 50% (or more) of total industry turnover. Information on the total number of firms in each industry (N), number of firms in the dominant group (N_d), the large firm Herfindahl-Hirschman Index (H_d) and the share of industry turnover accounted for by the dominant group (i.e. the large firms as previously defined) (C_d) for 1982/3 is given in Table 6. In order to reduce the length of the paper I have not included here data for the earlier years. This may be obtained from the author.

In measuring gross margins, we must accept that data on fixed costs is unavailable. We use as our measure of margins for each group of large firms the ratio of gross operating surplus (value added minus wages and salaries) to the value of turnover. This data is obtained from the censuses of manufacturing for the years 1968/9, 1972/3, 1977/8 and 1982/3, and is reported in Table 7.

### Table 5

<table>
<thead>
<tr>
<th>Industry</th>
<th>ASIC 69</th>
<th>ASIC 78</th>
<th>Demand Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margarine, oils and fats</td>
<td>214</td>
<td>214</td>
<td>.230</td>
</tr>
<tr>
<td>Biscuits</td>
<td>2163</td>
<td>2163</td>
<td>.072(b)</td>
</tr>
<tr>
<td>Confectionary &amp; Cocoa Products</td>
<td>2181</td>
<td>2173</td>
<td>.217</td>
</tr>
<tr>
<td>Soft drinks, cordial &amp; syrups</td>
<td>2191</td>
<td>2185</td>
<td>.215</td>
</tr>
<tr>
<td>Wine and brandy</td>
<td>2194</td>
<td>2188</td>
<td>.666(c)</td>
</tr>
<tr>
<td>Textile floor covering</td>
<td>2331</td>
<td>2345</td>
<td>.771(d)</td>
</tr>
<tr>
<td>Hosiery</td>
<td>2411</td>
<td>2414</td>
<td>.144(e)</td>
</tr>
<tr>
<td>Rubber Footwear</td>
<td>2431</td>
<td>-</td>
<td>.144(f)</td>
</tr>
<tr>
<td>Pharmaceutical &amp; Veterinary products</td>
<td>2723</td>
<td>2763</td>
<td>.737(g)</td>
</tr>
<tr>
<td>Soap and other detergents</td>
<td>2725</td>
<td>2765</td>
<td>.236</td>
</tr>
<tr>
<td>Cosmetics and toilet preparations</td>
<td>2726</td>
<td>2766</td>
<td>.211</td>
</tr>
<tr>
<td>Refrigerators &amp; household appliances</td>
<td>3322</td>
<td>3353</td>
<td>.774(h)</td>
</tr>
</tbody>
</table>

Notes:

(a) Beer and Tobacco, which were included in the Dixon and Gunther (1986) study have been excluded as it was felt that, as simple oligopolies, they should be treated separately.

(b) Demand elasticity refers to Bread, cakes and biscuits.

(c) Demand elasticity refers to Wine and Brandy and Alcoholic Beverages, n.e.c.

(d) Demand elasticity refers to Textile floor covering, felt and felt products

(e) Demand elasticity refers to all Knitting Mills.

(f) Demand elasticity refers to all Footwear.

(g) Demand elasticity refers to Pharmaceutical and Veterinary products together with agricultural chemicals

(h) Demand elasticity refers to Refrigerators, household appliances and water heating systems combined.
### TABLE 6
Data on Number of Firms and Concentration 1982/83

<table>
<thead>
<tr>
<th>INDUSTRY</th>
<th>N</th>
<th>NL</th>
<th>CCL</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margarine, oil and fats</td>
<td>18</td>
<td>4</td>
<td>.67</td>
<td>.250</td>
</tr>
<tr>
<td>Biscuits</td>
<td>23</td>
<td>4</td>
<td>.96</td>
<td>.250</td>
</tr>
<tr>
<td>Confectionary and Cocoa Products</td>
<td>75</td>
<td>4</td>
<td>.63</td>
<td>.250</td>
</tr>
<tr>
<td>Soft drinks, cordials and syrups</td>
<td>140</td>
<td>4</td>
<td>.56</td>
<td>.250</td>
</tr>
<tr>
<td>Wine and brandy</td>
<td>151</td>
<td>8</td>
<td>.52</td>
<td>.137</td>
</tr>
<tr>
<td>Textile floor covering</td>
<td>36</td>
<td>8</td>
<td>.72</td>
<td>.137</td>
</tr>
<tr>
<td>Hosiery</td>
<td>31</td>
<td>4</td>
<td>.51</td>
<td>.250</td>
</tr>
<tr>
<td>Rubber Footwear</td>
<td>112</td>
<td>12</td>
<td>.48</td>
<td>.088</td>
</tr>
<tr>
<td>Pharmaceutical and Veterinary products</td>
<td>114</td>
<td>8</td>
<td>.49</td>
<td>.250</td>
</tr>
<tr>
<td>Soap and other detergents</td>
<td>114</td>
<td>8</td>
<td>.49</td>
<td>.250</td>
</tr>
<tr>
<td>Cosmetics and toilet preparations</td>
<td>156</td>
<td>8</td>
<td>.51</td>
<td>.157</td>
</tr>
</tbody>
</table>

- Indicates data not available in sufficient detail.

### TABLE 7
Margin of "Large Firms"

<table>
<thead>
<tr>
<th>INDUSTRY</th>
<th>68/9</th>
<th>72/3</th>
<th>77/8</th>
<th>82/3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margarine, oil and fats</td>
<td>.198</td>
<td>.176</td>
<td>.138</td>
<td>.212</td>
</tr>
<tr>
<td>Biscuits</td>
<td>.229</td>
<td>.216</td>
<td>.216</td>
<td>.231</td>
</tr>
<tr>
<td>Confectionary and Cocoa Products</td>
<td>.171</td>
<td>.271</td>
<td>.238</td>
<td>.190</td>
</tr>
<tr>
<td>Soft drinks, cordials and syrups</td>
<td>.176</td>
<td>.176</td>
<td>.193</td>
<td>.262</td>
</tr>
<tr>
<td>Wine and brandy</td>
<td>.216</td>
<td>.270</td>
<td>.246</td>
<td>.268</td>
</tr>
<tr>
<td>Textile floor covering</td>
<td>.184</td>
<td>.161</td>
<td>.177</td>
<td>.135</td>
</tr>
<tr>
<td>Hosiery</td>
<td>.150</td>
<td>.209</td>
<td>.140</td>
<td>.217</td>
</tr>
<tr>
<td>Rubber Footwear</td>
<td>.216</td>
<td>.216</td>
<td>.216</td>
<td>.216</td>
</tr>
<tr>
<td>Pharmaceutical and Veterinary products</td>
<td>.322</td>
<td>.322</td>
<td>.322</td>
<td>.322</td>
</tr>
<tr>
<td>Soap and other detergents</td>
<td>.322</td>
<td>.322</td>
<td>.322</td>
<td>.322</td>
</tr>
<tr>
<td>Cosmetics and toilet preparations</td>
<td>.460</td>
<td>.958</td>
<td>.610</td>
<td>.468</td>
</tr>
<tr>
<td>Refrigerators and household appliances</td>
<td>.173</td>
<td>.165</td>
<td>.177</td>
<td>.117</td>
</tr>
</tbody>
</table>

Our model also identifies the share of imports in total sales as a relevant variable. This data is reported in Table 8 below.

### TABLE 8
Import Shares

<table>
<thead>
<tr>
<th>INDUSTRY</th>
<th>68/9</th>
<th>72/3</th>
<th>77/8</th>
<th>82/3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margarine, oil and fats</td>
<td>.225</td>
<td>.125</td>
<td>.187</td>
<td>.181</td>
</tr>
<tr>
<td>Biscuits</td>
<td>.097</td>
<td>.041</td>
<td>.037</td>
<td>.043</td>
</tr>
<tr>
<td>Confectionary and Cocoa Products</td>
<td>.066</td>
<td>.055</td>
<td>.101</td>
<td>.109</td>
</tr>
<tr>
<td>Soft drinks, cordials and syrups</td>
<td>.002</td>
<td>.002</td>
<td>.005</td>
<td>.006</td>
</tr>
<tr>
<td>Wine and brandy</td>
<td>.067</td>
<td>.071</td>
<td>.087</td>
<td>.092</td>
</tr>
<tr>
<td>Textile floor covering</td>
<td>.374</td>
<td>.188</td>
<td>.203</td>
<td>.203</td>
</tr>
<tr>
<td>Hosiery</td>
<td>.040</td>
<td>.021</td>
<td>.071</td>
<td>.071</td>
</tr>
<tr>
<td>Rubber Footwear</td>
<td>.091</td>
<td>.151</td>
<td>.248</td>
<td>.313</td>
</tr>
<tr>
<td>Pharmaceutical and Veterinary products</td>
<td>.215</td>
<td>.214</td>
<td>.187</td>
<td>.168</td>
</tr>
<tr>
<td>Soap and other detergents</td>
<td>.027</td>
<td>.031</td>
<td>.040</td>
<td>.087</td>
</tr>
<tr>
<td>Cosmetics and toilet preparations</td>
<td>.068</td>
<td>.062</td>
<td>.090</td>
<td>.071</td>
</tr>
<tr>
<td>Refrigerators and household appliances</td>
<td>.104</td>
<td>.156</td>
<td>.260</td>
<td>.316</td>
</tr>
</tbody>
</table>

Source: 68/9, 72/3 and 77/8 - Industries Assistance Commission.
- 82/3 - calculated by author from ABS data on imports, exports and re-exports by ASIC class.

Information on the proportion of the output of domestic producers which goes to final consumption is taken from the Australian Input-Output Tables.
(I have used the data for 1977/8 for 1982/3 and I have estimated the proportions for 1972/3 by interpolation).

I have found data on advertising very hard to come by. I have been able to find some highly aggregated data for 1974/5 and these proportions of advertising expenditure to turnover are reported in Table 9. For want of anything better I have used the same ratio in each of our years.

Apart from the obvious limitations on the data I would like to mention a few specific difficulties. First, we have comparable data on structure and margins for only four years (1968/9, 72/3, 77/8 and 82/3). In an attempt to gain degrees of freedom and to take account of lagged adjustment I have pooled the data for the purposes of estimation, so that the dependent variable in each equation consists of the values of the variable across our twelve industries in each of the years 1972/3, 77/8 and 82/3. Any difficulties which may accompany pooling are compounded by the changes in ASIC which occurred in 1978.37 Secondly, I have neglected the obvious fact that some industries and especially most small firms in most industries are selling in spatially differentiated markets. Thirdly, because of the level of aggregation at which
we are working, our data is not that of homogeneous oligopoly, rather the
level of industrial classification encompasses a range of commodity
classifications, and each commodity classification is comprised of a number of
(often markedly) differentiated products. Against these last two difficulties
(product and spatial differentiation) it may be argued that although small
firms may have a specialised product and market "niche", the large firms which
are the focus of our attention, typically produce a common product mix which
is marketed nationally. 38

| Table 9 |
| Advertising as a Percentage of Turnover |
| (1974/5) |

<table>
<thead>
<tr>
<th>Product Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margarine, oils and fats</td>
<td>1.0</td>
</tr>
<tr>
<td>Biscuits</td>
<td>3.0(a)</td>
</tr>
<tr>
<td>Confectionary and cocoa products</td>
<td>5.0(b)</td>
</tr>
<tr>
<td>Soft drinks, cordials and syrups</td>
<td>2.0(c)</td>
</tr>
<tr>
<td>Wine and brandy</td>
<td>2.0(a)</td>
</tr>
<tr>
<td>Textile floor covering</td>
<td>1.0(d)</td>
</tr>
<tr>
<td>Nonferrous metals</td>
<td>1.0(e)</td>
</tr>
<tr>
<td>Rubber Footwear</td>
<td>1.0(f)</td>
</tr>
<tr>
<td>Pharmaceutical and veterinary products</td>
<td>3.6(g)</td>
</tr>
<tr>
<td>Soap and other detergents</td>
<td>3.6(h)</td>
</tr>
<tr>
<td>Cosmetics and toiletries</td>
<td>3.6(g)</td>
</tr>
<tr>
<td>Refrigerators and household appliances</td>
<td>0.6(h)</td>
</tr>
</tbody>
</table>

(a) data refer to all bread, cakes and biscuits (ASIC 216)
(b) data refer to all other food products (ASIC 218)
(c) data refer to all beverages and malt (ASIC 219)
(d) data refer to all other textiles (ASIC 233)
(e) data refer to all knitting mills (ASIC 241)
(f) data refer to all footwear (ASIC 243)
(g) data refer to all other chemicals (ASIC 272)
(h) data refer to all household appliances etc. (ASIC 332)


Clearly in estimating the model there is a need to allow both for
simultaneity and for the possibility that disturbances are correlated, and
thus the coefficients have been estimated using Three-Stage Least Squares.
The results are reported in Table 10. The equation for margins is less than
satisfactory and the estimates are sensitive to the presence or absence of the
lagged dependent variable. Sensitivity to specification is, I am afraid, one
of the features of three stage least squares.

The results appear a little disappointing, but are rather similar to
those obtained in other studies. All of the coefficients in the equation for
ARE in the three stage least squares estimation have the expected sign,
although it does appear that economies of scale are the most important
determinant of industry structure.

We turn now to a more detailed examination of the determination of the
H-index.

5 Modelling the Hirschman-Herfindahl Index

Whilst most models of industry concentration, margins, advertising or
whatever are specified in terms of the (say) four-firm concentration ratio,
our model indicates that both the (large-firm) share in total industry
turnover and the H-index for the large firms are important. With respect to
the former variable (CR4), there is a reasonable amount of overseas literature
which is very well summarised in Currie and George's (1983) and Waterman
(1984). Indeed, this variable was the subject of the previous essay in this
paper. There would seem to be a consensus of opinion that concentration
ratios evolve slowly over time in a distributed lag fashion. It also appears
to be the case that high margins or profit rates act as inducements for the
fringe to expand whilst entry barriers assist to protect the large firms from
these intrusions. Although there has been a good deal of work on levels of
concentration (as measured by the proportion of total turnovers in an industry
which is accounted for by the largest firms) there has been little work on
modelling the relative size of firms which make up such a group.

Clarke and Davies (1982) argue that the H-index will be related, inter
alia, to the relative variability in marginal costs between firms. With
respect to cost-variability, two explanatory variables suggest themselves.
First, I will use the ratio of value added per worker in the largest four
firms to value added per worker in the second largest group of firms.
TABLE 10  
Results of Three-Stage Least Squares Estimation  
(t-values in Parentheses)

<table>
<thead>
<tr>
<th></th>
<th>ADV</th>
<th>ARL</th>
<th>MARL</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-1.776</td>
<td>.008</td>
<td>.120</td>
</tr>
<tr>
<td></td>
<td>(.52)</td>
<td>(.68)</td>
<td>(2.31)</td>
</tr>
<tr>
<td>ARL</td>
<td>7.173</td>
<td>-.511</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.72)</td>
<td>(1.40)</td>
<td></td>
</tr>
<tr>
<td>MARL</td>
<td>13.019</td>
<td>-.064</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.45)</td>
<td>(.84)</td>
<td></td>
</tr>
<tr>
<td>ETA</td>
<td>-.389</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.29)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSC</td>
<td>.457</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.64)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALPS</td>
<td>.520</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.45)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAR</td>
<td>.004</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.61)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADV</td>
<td>.006</td>
<td>.054</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.01)</td>
<td>(2.02)</td>
<td></td>
</tr>
<tr>
<td>LAHL</td>
<td>.324</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LMARL</td>
<td>.212</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.73)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comanor and Wilson (1967 and 1974, p. 135), this is estimated as the mean value added of the large firms (i.e. the firms which account for approximately fifty percent of total industry value added). If I divide this number into the total value added actually contributed by large firms I will have an estimate of the maximum number of firms which could operate at m.e.s. If I then express the actual number of large firms as a ratio to the "optimal" number I have an indicator of the relative importance of the sub-optimal size of firms. 39

The model with a lagged dependent variable to allow for slow adjustment was estimated by O.L.S. as:

$$
HL = 0.013 + 0.252(\text{VAR}) + 0.370(\text{SOS}) + 0.477HL_{-1}
$$

(1.09)  (3.20)  (2.82)  (4.64)

$$(t-values in parenthesis) R^2 = .920

where: \text{VAR} = \text{value added per worker ratio of top four firms}
\text{SOS} = \text{an index of sub-optimal size}

This result would support the view that the size distribution of firms in Australian industry predominantly reflects the prevailing economies (or diseconomies) of firm and plant size in relation to the size of the market. 40 Notice also that the adjustment coefficient here is relatively high, especially compared with many of the estimates in the preceding part of this paper.

6 Determinants of Structure and the Rate of Structural Change

Our results in this part of the paper are consistent with the view that "... there can be little doubt that technical factors, as reflected in optimal plant sizes, do play an important part in explaining inter-industry differences in the level of concentration". (Curry and George, 1983, p.222). Richard Caves, in his discussion of 'Scale, Openness and Productivity' in the Australian Economy (Caves, 1984, p.316) writes: "What deters efficient scale production ... is a combination of substantial scale economies, differentiation of domestic from foreign producers, and (artificial or natural) protection of domestic producers". Our estimates support his view
that public policy can influence structure, and through encouraging the fragmentation of industry, is likely to have given rise to a structure which is inimical to fast productivity growth and product innovation. At the same time, our results do show a faster rate of adaptation of market shares than may have been expected.

Consider the basic form of a stock adjustment model, namely:

\[ Y_t = Y_{t-1} + \lambda (Y_t^* - Y_{t-1}) \]

The above may be rewritten with \( Y_t \) on the L.H.S. and with both \( Y_t^* \) and \( Y_{t-1} \) on the R.H.S. as follows:

\[ Y_t = \lambda Y_{t-1}^* + (1-\lambda) Y_{t-1} \]

It is clear therefore that the coefficients on the lagged dependent variables in the expressions for \( ALH \) (given in Table 10) and for \( HL \) (given on the previous page) must be interpreted as unity minus the adjustment coefficient. If we subtract the coefficient on the lagged dependent variable (in each case) from unity we obtain an estimate of the rate of adjustment. If we do this the adjustment rate for \( ALH \) is 0.676 and for \( HL \) is 0.523, both referring to a (roughly) five year period. These estimates are very much higher than the rates of adjustment obtained in the preceding essay of this paper for the 4-firm concentration ratio and probably reflect two things: first, the role of import variability in the case of \( ALH \) and secondly, the fact that we are dealing with only a few, relatively large firms in consumer goods industries. Indeed it is surprising that the number of "large" firms has changed hardly at all over the sample period (1968/9-1982/3) in most industries and yet their shares both of the total market, and the market for domestic products is subject to relatively rapid adjustment. Clearly, the burden of the adjustment is being borne by movements in the import share and in the degree of capacity created and utilised by the domestic producers.

APPENDIX
A MODEL OF OLIGOPOLY

Consider an industry which consists of a number of domestic firms (some large, many small) producing a homogeneous commodity which is sold in a market in which some sales originate from foreign sellers. We will assume that local products and imports are perfect substitutes so that there will be a single price prevailing in the market. Total sales of the commodity in the domestic market (S) will therefore equal the sum of the output of domestic producers in the industry (X) together with the amount imported (M). That is, total sales in the market will equal:

1) \[ S = X + M \]

Domestic output originates from one or other of two sources: First, it may come from one of the large firms in the industry, denoted by the subscript \( i \) (i=1,2,...,n). Secondly, it may come from one of the (relatively) numerous small firms in the industry. These firms are assumed to be price takers.

Total sales may therefore be said to equal:

2) \[ S = X_L + X_S + M \]

where:
\[ X_L \] = output of small firms
\[ X_S \] = output of large firms, with \[ X_S = \sum_{i=1}^{n} X_{Li} \]

We will proceed to model the gross margin of an individual large firm, and then by aggregation to derive an expression for the price-cost margin of all large firms as a group. The firm's marginal revenue function may be expressed in terms of price (p) and its perceived elasticity of demand. We will assume profits maximisation such that:

3) \[ MR = p \left( \frac{dS}{dx} \right) = \frac{C}{\eta} \]

where: \( MR \) is marginal revenue, 
\( \eta \) is the (assumed constant) market elasticity of demand (\( \eta = -\frac{dS}{dp}/(dp/p) \)),
\( C \) is marginal cost.
The firm's gross profit, that is, output multiplied by the difference between price and average variable cost (where average variable cost is assumed to equal marginal cost), will therefore equal:

\[(p - \sigma)X_L - X_Lp(x_n = \frac{dX_L}{dx_n})\]

Given (2), we may approximate the growth in total sales as:

\[\frac{dS}{S} = \frac{X_b}{x_b} \frac{dx_b}{S} + \frac{M}{S} + \frac{\varphi}{S} \cdot \frac{dx_L}{x_L}\]

Now if the small firms are a price-taking competitive fringe, their growth in sales may be modelled in terms of their elasticity of supply (efn) and the rate of change in market price. This latter variable may be expressed in terms of the ratio of the growth in total market sales \((dS/S)\) to the market elasticity of demand \((n)\), so that we may write:

\[\frac{dx_b}{x_b} = -\frac{efn}{n} \frac{dS}{S}\]

For the large firms, it is convenient to proceed as follows:

Define:

\[X_L = X_{L1} + \sum X_{Lj}, \text{ where } 1 \neq j.\]

It follows from the above that:

\[\frac{dX_L}{X_L} = \frac{X_{L1}}{X_L} \frac{dx_{L1}}{x_{L1}} + \left(1 - \frac{X_{L1}}{X_L}\right) \frac{dX_{Lj}}{x_{Lj}}\]

If we substitute (6) and (7) into (5), collect like-terms and re-arrange the expression, we obtain:

\[\frac{dS}{S} = \left[1 + \frac{efn}{n} \frac{x_n}{S}\right] \left[M \frac{X_L}{x_L} \frac{dx_{L1}}{x_{L1}} + \frac{X_L}{x_L} \left(1 - \frac{X_{L1}}{X_L}\right) \frac{dX_{Lj}}{x_{Lj}}\right]\]

Let us define \(\phi_1\) to be the (conjectural) elasticity of 'other large domestic producer's output' with respect to the output of the 1'th firm (i.e., \(\phi_1 = \frac{dX_{L1}}{dx_{L1}}/X_{L1}/X_{L1}\)), and \(\varphi\) to be the (conjectural) elasticity of the supply of imports with respect to the output of the 1'th firm (i.e.,

\[\psi_1 = \frac{dX_{L1}}{dx_{L1}}/X_{L1}/X_{L1}\]). Dividing (8) through by \((dX_{L1}/X_{L1})\) will give:

\[\frac{dS}{S} = \left[1 + \frac{efn}{n} \frac{x_n}{S}\right] \left[M \frac{X_L}{x_L} \frac{X_{L1}}{x_{L1}} + \frac{X_L}{x_L} \left(1 - \frac{X_{L1}}{X_L}\right) \phi_1\right]\]

Substitution of (9) into (4) yields, after some rearrangement, an expression for the gross margin of the 1'th (large) firm as:

\[\frac{(p - \sigma)X_{L1} - p_n \sigma \frac{x_n}{S}}{x_n} = \left[X_{L1} \frac{X_L}{x_L} \frac{M}{S} + \frac{X_L}{x_L} \frac{X_{L1}}{x_{L1}} + \frac{X_L}{x_L} \left(1 - \frac{X_{L1}}{X_L}\right) \phi_1\right]\]

It is possible at this point to model either the price-cost margins of the group of large firms or the ratio of the gross margins of large firms to the total sales by domestic producers.

We now divide both sides of (1) by the total value of sales by all large firms \((pX_L)\). This yields:

\[\frac{(p - \sigma)X_{L1}}{pX_L} = \left[\frac{X_{L1}}{X_L} \frac{M}{S} + \frac{X_L}{x_L} \frac{X_{L1}}{x_{L1}} + \frac{X_L}{x_L} \left(1 - \frac{X_{L1}}{X_L}\right) \phi_1\right]\]

Next we sum over all the large firms in an industry to give an expression for the ratio of the gross margins of the large firms \((H_L)\) to the total value of sales by large firms. In so-doing we will also make the simplifying assumptions that \(\psi_1\), and \(\phi_1\) are the same for all (large) firms.

\[\frac{X_{L1}}{pX_L} = \left[\frac{X_{L1}}{X_L} \frac{M}{S} + \frac{X_L}{x_L} \left(1 - H_L\right) \phi_1\right]\]

where \(H_L\) is the "large firm" Hirschman-Herfindahl index

\[H_L = \sum_{i=1}^{n} \left(\frac{X_{L1}}{X_L}\right)^2.\]

It is possible to rewrite the above given that

\[(1) \quad \frac{X_{L1}}{X_L} = C_{L1}, \text{ the } n \text{ (large) firm concentration ratio}\]

\[(2) \quad (X_{L1}/S) = H_L (1-m), \text{ where } m = (M/S), \text{ and}\]

\[(3) \quad (X_0/S) = (1-C_{L1})(1-m).\]
We thus obtain:

\[
\frac{S_L}{P_L} = \left[ \eta + e \alpha (1-CR_L) (1-m) \right]^{-1} \left[ mv + CR_L (1-m)H_L + CR_L (1-m) (1-H_L) \right]
\]

All of which is to say that margins depend neither on the concentration ratio \((CR_L)\) alone nor upon the Hirschman-Herfindahl index alone, but upon both of these indices, together with the import share.

FOOTNOTES

1. I have measured private consumption expenditure, OGE and GDP all net of the gross operating surplus from the ownership of dwellings.

2. The sources of information are: ABS (various years), BIE (1979) and Boehm (1979).

3. Both Haig and the NIEIR are concerned to account for the relative growth rates of employment.

4. Using the IMF model. For a description see Brain (1986).

5. For a similar conclusion, albeit from a Marxist perspective, see Dixon (1984).

6. A copy of the flow table and the matrix of direct requirements coefficients may be obtained from the author.


8. Where I have experimented with more disaggregated data the main features of the series are present no matter what the level of aggregation, although the mean level of compositional change is greater, the greater the level of disaggregation used. I have also generated a series based on employment in the whole economy by occupation over the period 1966-1986. (This data is obtained from the ABS publication, The Labour Force: Australia). This series displays almost identical movements over time as the manufacturing series reported here.


11. If a quadratic is estimated the coefficient on \(G\) is insignificant. The equation as estimated is

\[
COCC = 0.749 - 0.019G + 0.009G^2
\]

\[
(9.35) \quad (1.10) \quad (2.31)
\]

\[R^2 = .167\]

12. If we allow for \(G\) as well as \(G^2\), we find,

\[
COCC = 0.679 - 0.005G + 0.009G^2 + 0.918D1 + 0.926D2
\]

\[
(10.59) \quad (0.34) \quad (3.04) \quad (3.31) \quad (3.27)
\]

\[R^2 = .500\]

Again, the coefficient on \(G\) is insignificant.
13. By "pressure of structural adjustment" I simply mean the relationship between the proportion of the workforce involved in (net) re-locations between industries (COCG) and the proportional number of (net) additions to, or subtractions from, the level of aggregate employment (O). By comparing the two it may be possible to obtain an idea of the relative strengths of these two impulses or sources of change in the activity in the labour market.

14. An excellent summary of recent research may be found in Curry and George (1983).

15. There is one study for France which uses a partial adjustment model (Jenny & Weber (1978)). Unfortunately I have been unable to construct a similar set of explanatory variables to those used in that study and so I will not comment on their paper at any length. They estimate a rate of adjustment parameter of 0.06 for all the industries in their sample over the period 1961-1969.

16. I shall discuss Wright's alternative measure of the change in the concentration ratio in section 2 below.

17. This is out of a total number of 174 4-digit manufacturing industries identified by the Australian Bureau of Statistics. Curry and George (1983, p.222) note that: "An important constraint in the analysis of concentration changes is that each industry included in the analysis must be comparable over time; i.e. each industry must be the same, or broadly the same, in terms of product mix at the beginning and end of the period being studied. This leads immediately to the problem that the experience of the industries being studied may not be similar to those that have to be excluded. For the excluded industries are liable to be those that are, for instance, the most technologically progressive and where, therefore, the products produced may have changed substantially over time. Bearing in mind also that the number of comparable industries is often a relatively small proportion of the total number of manufacturing industries, the results of cross-section analysis must clearly be treated with considerable caution".

18. In fact this was the only significant variable in the equation. The full results were (t-values in parenthesis):

C62-C68 = 13.05 + 0.62 ADVERT - 8.33 SIZE = 1.52 GROWTH = 0.12 C68
(3.61) (0.68) (0.98) (1.09) (2.46)

19. Also the Australian adjustment coefficient is greater than that estimated for France in the study by Jenny and Weber (1978). However, their explanatory variables for C* are quite different to ours.

20. N.B. All of the studies, including my own, discussed in the previous section dealt with the sales (or turnover) concentration ratio.

21. The data was obtained from ABS (1974) and (1980a).

22. This is measured using the same procedure as in Comanor & Wilson (1967). A more extensive discussion of this measure is given in the essay which follows.

23. The equation as estimated is:

\[
\begin{align*}
\text{DLLOGC} & = 0.583 + 0.106 \text{DLLOGMES} + 0.003 \text{DLLOGSIZE} \\
& = (4.21) (3.97) (0.07)
\end{align*}
\]

\[
\begin{align*}
+ 0.007 \text{ LOGA} - 0.143 \text{ LOGC}_1 \\
& = (0.35) (4.55)
\end{align*}
\]

\[R^2 = .352\]

where:

\begin{itemize}
  \item \text{DLLOGC} = \text{difference in the logarithms of the concentration ratio.}
  \item \text{DLLOGMES} = \text{difference in the logarithms of minimum efficient scale}
  \item \text{DLLOGSIZE} = \text{difference in the logarithms of industry value added}
  \item \text{LOGA} = \text{logarithms of the ratio of advertising to sales}
  \item \text{LOGC}_1 = \text{logarithm of the initial (1968/69) concentration ratio.}
\end{itemize}

24. In the studies of Wright (1978) and Levy (1985) the dependent variable is calculated as:

\[
\{(C_t-C_{t-1})/(50-150-C_t)^{1/2}(50-150-C_{t-1})^{1/2}\}
\]


26. Our findings are consistent with Shepherds (1972, p.46) estimates which show the rate of adjustment to be slower in the U.S. than in Britain.

27. Our focus will be on adjusting the model presented in Dixon & Gunther (1986) to allow for the presence of imports and tariffs. We will continue to neglect exportation for two reasons, first only three of the industries included in the original study exported a significant (by which we mean in excess of 10%) proportion of their output [although one of these, Meat Products, exports over 50% of its output] and secondly, to model the price-cost relation with a significant export component of output would entail obtaining reasonable data on the revenue per unit accruing to the domestic producer on account of export sales. Given data limitations, it seemed safer to disregard these industries.

28. By "large" I mean of sufficient size to be aware both that variations in firm output affect the market price and that other large firms will know of this and will no doubt discuss this aspect.

29. For the theoretical argument behind this assertion see the paper by Neumann et al (1982) and Dixon (1986).
30. Our measure could also be expressed in terms of "firm-equivalents." See Grossack (1965) and Adelman (1969).

31. I have estimated this as the average firm size amongst the largest firms which account for (approximately) 50% of industry value added.

32. In the light of earlier studies (eg. Strickland and Weiles, 1976) it may be wise to allow for a non-linear relationship between advertising and concentration as higher levels of concentration may facilitate collusion, and this in turn may (I stress, may) offset the need to advertise.

33. The procedure used is described in detail in Fitzgibbon (1983). The data on the calculated own-price elasticities is reported in Blimpied (1985).

34. Screening was achieved with the aid of the 1968/9 Input-Output tables. Industries included in the study are (i) those industries (twenty in all) where the ratio of consumption demand to gross output exceeds fifty per cent, and (ii) industries which are not eligible under (i) above, but where consumption demand is the single most important destination for gross output (only one industry, Household Appliances n.e.c., qualified under this heading).

35. In a few industries the dominant group was defined to account for slightly less than 50%. In each of these cases to include the next group of 4 firms would lead to a proportion of turnover which would exceed 50% by far more than the extent to which our preferred groups are less than 50%.

36. It is possible to calculate (minimum) values of the Hirschman-Herfindahl index from data given in the Australian Bureau of Statistics publications on industrial concentration using Schamsalee’s (1977) method. These bulletins give estimates of the share in industry turnover (amongst other things) of each of the top five groups of four firms and on the share taken up by the remainder. We are able, using this data, to calculate the Hirschman-Herfindahl indices for the years 1968/9, 1972/3, 1977/8 and 1982/3. In calculating the index for any industry we assume that within each group the shares of the firms are equal and so we can only establish a minimum value (or lower bound) for the Hirschman-Herfindahl index for that industry. We use the approximation:

\[ H_i = \sum_2^{k} \left( \frac{X_i}{X_j} \right)^2 / H_j \]

where \( j \) = class (i.e. 4-firm group), \( 1, 2, \ldots, k \).

37. I believe these to be minor.

38. I am grateful to Peter Lloyd for this suggestion.

39. Again, the index is standardised for the number of large firms as suggested by Clarke and Davian (1982). See also Dixon (1986) for further discussion.

Caves

40. Caves (1985) has expressed concern at the treatment of minimum efficient scale as exogenous.

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The industry concentration issue sits neatly within the structural change theme if it is thought of as the attempt to account for the influence on industries' performances of new entrants. The paper addresses the issue of whether Australia's relatively slow rate of structural change is linked to industry concentration. Dixon compares the standard deviations of output growth rates for six countries in nine industrial sectors. His test is implicitly of a simple model in which lots of variability in prices would be associated with greater than average structural change, or, as measured here, greater variability in output growth rates across industries.

These remarks are focussed on the introduction and the second and third sections. Evidence in the remaining sections suggests similar patterns of change in industry concentration in Australia and the United States but that the adjustments in Australia occur more slowly than in
the United Kingdom. Dixon finds that structural differences across industries are related to technical factors especially plant size, and that while public policy can weaken concentration, the resulting structure may not be conducive to rapid growth.

In the second section Dixon summarises recent changes in the structure of the Australian economy and in the principal elements of expenditure. However he does not tease out the connection between changes in inter-industry linkages and the changes in private and government consumption patterns and other macroeconomic variables he identifies.

The most interesting part of this section (especially in the longer version presented at the conference) is his analysis of inter-industry flow data based on input-output tables. Dixon is interested in what happens to industry outputs when final demand for commodities increases. He identifies increased specialisation as a reduction in the backward linkages between sectors. He checks to see whether the industries he earlier identified as the growth sectors (in Australia, mining and services) changed their relationships with other industries in the economy in supplying final demand for their outputs between 1968/9 and 1978/9. He shows that for these sectors (2 and 9 in Table 2) there were greater than average declines in their backward linkages to the rest of the economy. What is absent is a discussion of the apparent increase in the backward linkages of the construction industry and of the factors which made it the only sector to have increased its backward linkages to the rest of the economy.

Speculative remarks could have been offered on the role of the changes in the macroeconomic variables identified with respect to the backward linkages of industries.

A major theme of the paper is that change and growth are linked. What needs to be identified are the barriers to growth. Is it that changes in consumption, investment or the activities of government are the barriers to growth? Or, is it simpler, perhaps more to do with the ease or difficulty of transferring factor services across sectors?

In the third section, Dixon is concerned with the transfer of labour services across the manufacturing sector, or more specifically shifts in the composition of employment within manufacturing. He notes that his simple measure of dispersion, the coefficient of compositional change, does not discriminate between the reorganisation of the existing labour force and the effects of unbalanced sectoral employment growth rates. However he notes that this is where he uses 'redistribution' and 'differential deployment' rates to both introduce an interesting idea, and to produce a relationship between growth and compositional change. These rates are not estimated but his computations yield some solid conclusions.

The most striking result from his estimation is that his constant term, which is interpreted as the occurrence of structural change.
change in the absence of growth in the economy, is well
determined. He is able to conclude that about two-thirds of one
percent of the manufacturing workforce is reallocated annually in
a non-growth economy. This amounts to a bit less than 6,000
workers. Is this a large or small number? From the paper we can
estimate that if growth in the economy were two percent per annum,
the coefficient of compositional change would increase from 0.67
to 0.71. Thus growth is estimated to account for only six percent
of the change in overall structural change. It seems that while
underlying structural change itself is slight, growth would need
to be very rapid to make very much difference to (the measure of)
total structural change.

Some insight on the relative magnitudes might be obtained
from comparisons with other countries. It is clear that in Dixon's
estimating equations two things stand out: the constant; and the
small coefficient on the growth term. It is a strength of the paper
that many very interesting research avenues are suggested in this paper.

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