CALCULATING ECONOMIC INDICATORS IN VALUE TERMS:

THE AUSTRALIAN ECONOMY AND INDUSTRIAL SECTORS, 1974-75 AND 1978-79.

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Loosely co-ordinated research into national patterns of accumulation is being undertaken in a number of advanced and underdeveloped capitalist countries. All research groups have in common the aim of developing a systematic empirical framework, based on explicitly Marxist categories, within which to conduct a range of theoretical investigations. Despite variations in theoretical orientation, there is agreement amongst working groups that it is essential and important to challenge the 'received' economic data upon which discussions of economic performance are based.[2]

One long range goal of this work is comparative research into the nature of different capitalist economies.[3] Another, which is just as important, is the refinement of alternative methods of approximating value categories

1 Research upon which this paper is based was funded partly by a University of Sydney Special Projects Grant. The authors are grateful for the competent research assistance of Peter McEvoy.

2 Members of these groups recently presented papers at the Conference on International Perspectives on Profitability and Accumulation organised by Edward Wolff at New York University in September, 1988.

3 Most researchers are, of course, aware of the importance of the internationalisation of capital in the recent period, and of the limitations a national focus places upon understanding the accumulation of capital on a global scale. In our case we are forced to assume, for example, that all productive industries in Australia are producing commodities using socially necessary labour time, whereas for many protected sectors the actual labour time inputs may not be globally socially necessary. At this point, however, our analyses are confined, by both the available data and appropriate theoretical development, to the national scale.

using data which is produced in non-Marxian (usually Keynesian) categories. This process of methodological refinement involves the theoretical concretisation of many components of value theory. What actually is the productive labour force? Which method of calculating profit rates best fits the theory of accumulation? How does social labour flow through the system once it has been produced in the sphere of production? These are some of the interesting theoretical issues that arise in the process of operationalising a value analysis.

In this paper we hope to further the goal of comparative national research by calculating, for the Australian economy, the magnitudes of theoretical categories relevant to the Marxian theory of accumulation. Given the preliminary stage of the research, our attention is primarily directed at the methods and data employed, rather than at the findings for the two years for which calculations have been made. The purpose of this paper is to contribute to the on-going discussion of how best to make Marxist accumulation theory operational through the selection, specification and refinement of appropriate categories and data.

Value Analysis: Critiques and Rejoinders

Within the Marxian tradition, empirical research employing value categories is rather underdeveloped. For many Marxists the use of value categories in empirical practice is obstructed by what are seen to be significant ontological, epistemological and practical problems. While the purpose of this paper is not to resolve or counter these objections (for such a discussion see Graham and Shakow, 1988), a brief comment concerning two of the objections to operationalising value categories is appropriate.

Value encompasses the simultaneous and interactive presence of three qualities--substance (social labour), form of appearance (exchange value) and magnitude (labour time). The dialectical, or over-determined, nature of value has often been distorted by an undue preoccupation with one or other of its aspects. Many Marxists, for example, have seized upon Marx's designation of price as the 'form' of value to argue that price is the only observable form of value. They argue that measurement can only be made of prices and not of value per se. 'Value refers to a foundation aspect, price to a phenomenal one' (De Vroey, 1981, p.189).

Such a critique conflates the magnitude of value with its 'form of appearance'. Moreover it endows certain theoretical concepts, value in this case, with a mystical quality of unknowability while designating the empirical identification of others, such as prices, as unproblematic. We prefer to regard value as a scientifically observable category which is hidden by the accounting procedures in which most economies are documented. While it is true that value data are not 'there' waiting to be uncovered, it is possible to construct such data. Of course most of the primary inputs into the calculation of values and value ratios are data compiled in prices, but this information can be employed in a variety of methods (one of which we outline here) which seek to approximate value relations to a greater or lesser extent.[4]

A second version of this argument claims there can be no a priori determination of abstract labour because it is the market which renders concrete labour abstract and homogeneous (Mohun, 1983). In this view any attempt to measure value as distinct from price must fail because abstract labour does not come into existence until value takes the price form. From this perspective, researchers attempting to calculate value magnitudes from Input-Output type production models are seen as engaged in a purely technical or engineering exercise, deriving 'embodied labour coefficients' with limited social content, wholly incongruent with Marx's conception of value.

This criticism again displays a one-sided approach to the concept and operationalisation of value. As an over-determined social entity, value is a product of both physical inputs and valorised outputs of an economy. All inputs into production-labour, circulating constant capital and fixed constant capital-must be realized in exchange in the act of becoming part

4 As with any research, the production of value indicators involves a social labour process in which judgements conceming theoretical coherence, empirical correspondence and practicality vie together to affect the outcome. From our perspective, while the final figures produced are instructive, it is the process of their creation around which most theoretical and political interest should be centred.

of the capitalist production process. As they enter production they are already part of the real social process by which labour is abstracted as social labour. To see inputs as only technical or physical coefficients is to ignore the over-determined nature of value in motion.[5]

Calculating values using an Input-Output model involves using inter-industry transactions tables which are merely aggregations of recorded purchases of (realised) commodities employed as inputs in capitalist production. Where such tables are normalised by total sectoral output, they show purchases per unit output by sector for all production sectors. This suggests an empirical method to derive the social average of labour input in a given branch from the actual realisation of production input commodities in the capitalist market. This arithmetic calculation of average labour input is taken to approximate socially necessary labour.

The process of doing empirical research in value categories is not, in our view, to 'test' for value or prove that it exists.[6] In studying the economy in value terms we are engaged in an intellectual labour process aimed at producing a social accounting of flows of value within a capitalist economy from a class perspective. There are many different methods of producing such an accounting. Some researchers use aggregate price data alone, for example, presented in a nation's National Income and Product Accounts, to calculate value ratios. Others use the disaggregated data presented in a nation's inter-industry transactions tables (Input-Output tables) to calculate a vector of unit values which can then be used to transform other price data into value magnitudes.[7] Various degrees of data transformation, intended to modify data compiled in conventional national accounting categories for use in Marxian analysis, are employed. In many cases the methods used are heavily constrained by the availability

5 This is not to argue that all commodities produced are themselves automatically valorised. As the production process evolves and markets oscillate, some commodities are never finally consumed and the labour embodied in them does not get 'socialized' in the capitalist sense. What is socially necessary labour in an economy is constantly being redefined. Input-Output tables provide the data to make measurements at certain points in time, but this type of value calculation need not negate the recognition that valorization takes place in a dynamic system.

6 That is, our objective is quite different to the work of Kuznecovs (1981), whose thesis represents one of the few forays into empirical value research in the Australian context.

7 The main advantage of this more complicated method, from our perspective, is that it allows sectoral as opposed to economy wide value calculations to be made.

of appropriate data. And in all cases they reflect the particular issues in value analysis the researchers are pursuing.

In this study, our particular focus is the computational issues associated with the transformation of Australian data into Marxian categories. We report magnitudes aggregated over the economy as a whole as well as magnitudes computed for individual industrial sectors. Our ultimate research objective is to investigate the value dynamics of individual industrial sectors and their relationship to flows of social labour in the economy as a whole. The concentration on sectoral magnitudes stems from our interest in the process of industrial restructuring. There appears to be a complex relationship between changes in industrial organisation (that is, in the nature of production, and the structure of competition) and sectoral value relations, which cannot be explained in the simple terms of action and reaction (falling profitability-structural response). The performance of groups of industrial sectors appears to be interconnected. One consequence of this is that industrial restructuring is not always an on-going, incremental process of change, but can take the form of conjunctural crisis for a number of sectors and widespread structural change.

In other research we have explored this type of conjunctural transition within manufacturing sectors in the United States economy (Graham et al., 1988) and its relationship to sectoral value dynamics (Shakow, Graham and Gibson, 1988); a preliminary attempt at identifying structural changes in Australian manufacturing sectors has also been made (Gibson and Horvath, 1983).

Data Availability

The collection of economic statistics in Australia has been influenced by the nation's particular economic history. The orientation of the economy towards primary exports, the rather late establishment of secondary industry based upon state protection, and the stunted development of an indigenous industrial capitalist class have all been important in determining what economic data are collected and how they are presented.

The most important sources of economic data are the Australian Bureau of Statistics (ABS), the Australian Bureaus of Agricultural Economics, and Industry Economics (BAE, BIE) and the Industries Assistance Com-

mission (IAC). The ABS provides relatively reliable primary data on the Australian labour force, the production, circulation and consumption of output, imports and exports. It collects detailed economic and labour statistics in its five-yearly population census, yearly manufacturing census, and irregular censi of other industries and industry and labour force surveys. Much of this data appears in the Australian National Accounts (ANA) published yearly. The BIE Industry Economics respectively produce irregular surveys of Australian industry. On the basis of information collected by the ABS, other governmental agencies and private surveys, economists within the IAC have produced data series on a range of economic indicators primarily for use in the ORANI general equilibrium model of the Australian economy developed by Dixon and others, who were originally part of the IAC's IMPACT Project. The IAC, which replaced the Tariff Review Board, is concerned with the international competitiveness of Australian industry. Its policy orientation is towards assessing the effectiveness of state assistance to industry. The data compiled and the econometric models constructed by the IAC reflect this interest in commodity trade rather than in the industrial structure of commodity production. In the absence of more suitable sources of information we have had to rely upon a number of estimated data series supplied by the IAC.

The Value Vector: Data Requirements and Calculation

The calculation of sectoral and economy-wide value ratios involves first of all the calculation of a vector of unit commodity values for each year under examination. Commodity values are constituted not merely of abstract socially necessary labour entering the production process directly, but also of the labour materialised in other commodity inputs into the production process. Thus, calculation of a vector of unit values requires collection of two primary sets of data: one associated with the direct or current labour inputs into production, and one associated with the indirect or past labour inputs, which appear in the current period as embodied in productive inputs.

Value = indirect labour + direct labour(1)

= constant capital + [variable capital + surplus value]

Data on direct labour inputs into production are relatively easily available from labour force surveys. But indirect labour materialised in constant capital inputs cannot be determined as easily as we must rely upon the algebraic manipulation of inter-industry matrices which map flows of constant and fixed capital inputs and outputs by sector in the economy.

Direct labour inputs

In this study the direct labour component was taken as the total hours worked in a year by the productive labour force in the productive sectors of the economy. The concept of productive labour is an important abstraction in Marxian economics which separates out from all the social labour necessary to the functioning of the capitalist economy, only that labour which creates use values under capitalist relations of production for the purpose of exchange. This category thus excludes the labour of the self-employed or petite bourgeoisie, but would include the labour of productive workers employed by the capitalist state and private industry. Productive labour is that which produces the fund of surplus value which supports the full range of unproductive activities as well as the expansion of capital in an economy.

The transformation of national economic data to reflect the distinction between productive and unproductive labour is clearly important to the calculation of value. The theoretical discussion of productive and unproductive labour does not, however, lead to crystal clear research guidelines. Added to the complex theoretical issues involved there are practical problems associated with disaggregating a productive sub-matrix from economic data collected in categories which are oblivious to this classical distinction. In our view, no one transformation procedure should be seen as final or 'right'. For example, in this study the health sector is left out of the productive sub-matrix on the rather traditional grounds that this industry does not produce clearly defined commodities for exchange. If, however, we take the view that the health industry produces the use value of healthier bodies under increasingly capitalist

conditions of production and exchange we must include it in our value calculations.

In this paper economy-wide and sectoral value ratios are calculated for the years 1974-75 and 1978-79.[8] The data used to calculate direct labour inputs into production in the years 1974-75 and 1978-79 were extracted from industry by occupation matrices supplied by the IAC, each showing person hours worked in millions. Documentation of the original construction of these matrices is scanty but can be partly found in Dixon et al., (1982). The vector of productive labour hours was produced by eliminating from these matrices (1) the unproductive sectors and (2) the hours worked by unproductive workers in the productive sectors.

In this study most input data was arranged according to the disaggregation of industry into 109, 113 or 115 sectors used in the Australian National Accounts with the 109 industry disaggregation being the preferred mode. From these 109 sectors we extracted a productive industry sub-matrix of 92 sectors. A list of the sectors which were excluded from the productive sub-matrix are shown in Table 1.

Table 1 Sectors excluded from the productive sub-matrix#

Sector Number	I-O code	Industry Description
93	47.01	Wholesale trade
94	47.02	Retail trade
95	61.01	Banking
96	61.02	Non-bank finance
97	61.03	Investment etc
98	61.04	Insurance etc
99	61.05	Other business services
100	61.06	Ownership of dwellings
101	71.01	Public administration
102	72.01	Defence
103	81.01	Health
104	82.01	Education, libraries etc
105	83.01	Welfare etc services
106	91.01	Entertainment etc*
107	92.01	Restaurants, hotels, clubs*
108	93.01	Personal services*
109	99.01	Business services

Those sectors marked by an * were excluded on grounds of data unavailability and not for theoretical reasons. The rest were designated unproductive in this study.

8 The choice of these two years was determined by the availability of conformable Input-Output tables for the Australian economy.

Some of the sectors excluded from the productive sub-matrix had to be excluded on practical rather than theoretical grounds. A preliminary review of the data for a number of productive sectors (such as entertainment, restaurants and personal services) revealed implausible magnitudes which confounded our calculations. It was resolved to pursue this data problem at a later date and exclude these sectors for the time being. The impact of excluding these clearly productive sectors from our calculations may well be to lower the estimated aggregate rate of profit as these 'service' sectors are more likely to have displayed a relatively high and growing rate of surplus value extraction over the period of study and rather low organic compositions of capital.

By international standards the Australian economy has a high degree of state ownership and control of sectors which are clearly productive (though the move towards privatisation is threatening to reduce significantly the state presence). Although we included as many of the state industries as was practically possible given the Input-Output data available, they create problems of data conformability. Some state industries, such as the railways, electricity, and water, sewerage and drainage sectors, are state monopolies which differentiate between their industrial and non-industrial consumers. It is likely that prices set for industrial users are deliberately undervalued on grounds of public policy thereby facilitating a transfer of the profits generated by state sectors to private sector consumers.[9]

Part of the labour performed in productive industries is unproductive labour concerned either with the circulation of commodities (for example, factory sales clerks) or the reproduction and maintenance of capitalist social relations (for example, certain managers and supervisors) or undertaken within non-capitalist relations of production (for example, self-employed). The division of the workforce of the productive sectors into productive and unproductive labour was based upon the occupational classification used in the 1976 Australian Bureau of Statistics Census of

9 Such claims have been made, for instance, with respect to the pricing of electricity sold to aluminium smelters in the Hunter Valley, (Dick, 1981; Falk and Larcombe, 1983). In order to test out such a proposition we could compare the ratios of direct price (that is, a dollar measure directly proportional to value that can be used in comparing values to actual prices [Shaikh, 1977]) for state and private sectors with ratios of market price for the same sectors to see in what way the transformation of values into prices may be skewed by state intervention.

Population and Housing. The Census classified persons into 504 industries and 370 occupations. This 370x504 occupation by industry matrix was reduced to a 10x112 occupation by industry matrix by the Industries Assistance Commission (IAC) IMPACT project for use in their ORANI model of the Australian economy. The 10 occupational groupings to emerge from the IAC classification are shown in Table 2. Unfortunately, each group is based upon skill and qualification criteria which are not easily translated into the productive/unproductive labour distinction. For the purposes of this study we excluded those workers employed in occupations 1 to 4 and 10 from the productive workforce.[10]

Table 2 Ten occupational groups defined by the IAC

1. Professional white collar	Scientists, engineers, medical, societal, university teachers, secondary and other teachers with tertiary qualifications
2. Paraprofessional	Primary teachers, other teachers, para-medical, creative.
3. Skilled white collar	Technicians, government, employers and own account workers.
4. Semiskilled and unskilled white collar	Clerical, sales, semiskilled medical, audio-visual.
5. Skilled blue collar, metal and electrical	Metal, electrical and instruments trades.
6. Skilled blue collar, building	Wood, brick, stone and glass trades, painters.
7. Skilled blue collar, other	Food, textile and printing trades.
8. Semiskilled and unskilled blue collar	Metal and electrical, building, miners, drivers, protective services, production and process, services, labourers.
9. Rural workers	Farmers, farm workers.
10. Armed Services	

10 Clearly the decision to exclude all of the workers in occupations 1 to 4 is one that needs to be carefully considered from a theoretical perspective. Our position is that many of these workers such as scientists, engineers and teachers are productive workers, but in this run we have operationalised a very traditional view of the productive workforce. The danger is that our estimation of productive hours worked in the economy will be lower than it should be.

Occupation group 9, rural workers, posed special problems for the agricultural, forestry and fishing sectors as it contains a sizeable proportion of self-employed people as well as employees. The numbers in this occupation group were reduced to reflect the proportion of farm workers and employees (census codes 317-337) to farmers and managers (census codes 300-316) using proportions calculated from information found in the 1976 Census of Population and Housing, and only the former group were included in the productive workforce.[11]

Indirect Labour Inputs

The indirect labour component comprises all past labour which is transferred from the raw materials and plant and equipment inputs into production to the new product. Indirect labour comprises both circulating constant capital and fixed constant capital.

Data on inter-industry circulating constant capital transactions was obtained from the 109 order Industry by Industry Flow Matrix (Table 8) of the Australian National Accounts: Input-Output Tables compiled for the years 1974-75 and 1978-79.[12] By using this table we were forced to assume that imported inputs which compete with Australian inputs into production have the same value as the domestically produced inputs. We were also forced to omit from our calculations the contribution of complementary imports[13] to the flow of circulating constant capital. For-

11 This decision sidesteps the important issue of the contribution of self-employed workers to value creation in capitalist societies. Although the traditional view is that the petite bourgeoisie exploits its own labour and perhaps that of family members and a few employees, but not enough to generate expanded accumulation, the exclusion of this class from value calculations may need to be reconsidered, especially in the light of the apparent growth of self-employment in recent years and the renewed importance of smaller decentralised capitals in the organisation of production.

12 The time span of the analysis presented here is clearly very short. We were initially limited to the selection of these two years by the unavailability of easily conformable Input-Output tables from earlier years. The final Input-Output tables produced by the ABS for 1962-63 and 1968-69, for example, use a very aggregated industry classification which was not conformable to that used in later years. In more recent times conformable Input-Output tables have been produced in 1977-78, 1978-80, 1980-81, but calculations for these years were not done as the additional data required for value calculation was unavailable.

13 That is, those imports for which no suitable substitute is produced locally, for example, natural rubber.

tunately, these imports represent a very small proportion of the total value of industry output.

A number of different data series was combined to provided information on flows of fixed constant capital. The depreciation vector is a vector of total fixed capital flows in each of the productive industries. This vector was calculated by multiplying the fixed capital stock vector by a set of depreciation rates estimated for 1977-78 by the IAC for use in the ORANI model (Cox, 1984).

The fixed capital stock coefficients were derived from two fixed capital stock matrices supplied by the IAC for the years 1974-75 and 1978-79 (Hourigan, 1980) under the assumption that the commodity composition of total capital stocks and flows (depreciation) are identical. From the fixed capital stock matrices we computed the fractional commodity composition of capital dividing each matrix column by the column sum. We then computed the scalar product of each column and a vector of estimated (annual) depreciation rates calculated for ORANI 1977-78, multiplying each fractional column for a given sector by its associated depreciation. The resulting matrix represents annual flows of fixed constant capital.

Vector Of Commodity Values

At this point we have three data sets in two different units; a vector of direct labour inputs measured in hours and two matrices, of constant capital and fixed capital inter-industry flows, measured in dollars. To calculate the vector of values per unit commodity both the direct labour inputs and indirect labour inputs into production must be specified in per unit commodity terms. To do this we divided each element in our labour vector by the total output of each sector to reflect the input of direct labour (in hours) per dollar unit of output (l'). We then divided both of the constant capital matrices by the total output of each sector to produce unitised direct requirements matrices of circulating constant capital (am) and fixed constant capital (af) per dollar unit of output. The total output vector is found in the ANA Input-Output Table 8 as row 'T2 Australian Production'.

Defining λ as the vector of values per dollar unit commodity, we can specify constant capital inputs per unit as '(am + af) and direct labour per

unit as l'. Their sum yields unit commodity values (that is, the value in hours of socially necessary labour of a dollar's worth of commodity i).

$N = (am + af) + l(2)$

A mathematical transformation which yields estimates of Marxian values on the basis of input-output tables was developed in the pioneering work of Sraffa (1960), Morishima and Seton (1961) and Morishima (1973). This mathematical formula allows us to combine data on direct labour inputs in a given time period and the indirect labour inputs into production which are made not only in one time period, but over an infinite series of production episodes. The vector of values per unit commodity was computed in the usual fashion as the vector product of the per unit productive labour input vector and the Leontief inverse of the sum of the direct requirements (productive) submatrices for fixed and circulating constant capital.

$$\lambda' = \mathbf{l}' [\mathbf{I}-\mathbf{a}]^{-1} \qquad (3)$$

where λ' = vector of unit values

$\mathbf{l}'$ = labour input coefficients

$\mathbf{a}$ = am + af (constant capital coefficients)

The prime (') indicates a row vector and bold notation indicates a matrix.

Constant Capital, Variable Capital and Surplus Value

Having calculated the vector of unit commodity values it was then used to transform the data needed to calculate value ratios from price into value magnitudes The inter-industry transactions matrix which represents the money form of circulating constant capital was transformed into labour hour units (values) by premultiplying by the (row) vector of unit values to yield the matrix of circulating constant capital values.

Similarly, the matrix of fixed constant capital expended (dollar depreciation) was transformed into values by premultiplying by the vector of unit values to yield the matrix of fixed constant capital values.

Variable capital was equated with the valorised annual personal consumption expenditures of productive workers under the assumption that these workers' net savings are zero. Annual private consumption by sector is found in column 'Q1 Private Final Consumption Expenditure' of the ANA

Input-Output Table 8. Valorised consumption is the vector product of the above vector and the vector of unit values. Capitalist consumption and consumption of unproductive workers was extracted by multiplying valorised consumption by the ratio of productive workers wages and total (dollar) consumption yielding aggregate variable capital. The wages of productive workers, by sector, in current dollars was extracted from a 109x10 industry by occupation wages bill matrix supplied by the IAC. This matrix had to be transformed to a vector of productive workers' wages on the same basis as that for productive worker hours. Variable capital by sector was then calculated multiplying aggregate variable capital by the ratio of sectoral to aggregate productive worker wages under the assumption that consumption patterns are uniform among workers regardless of the sector of employment.

Economy-wide surplus value was computed as a residual subtracting aggregate variable capital from total direct labour (the sum of productive worker hours). For each sector, variable capital was subtracted from sectoral direct labour.

Computing the Critical Ratios of Marxist Analysis

We now have described most of the ingredients necessary to compute the critical ratios that are central to the Marxian value analysis of capitalism:

- Vector of total productive hours worked in productive sectors
- Matrix of inter-industry circulating constant capital transactions
- Matrix of depreciation (fixed constant capital) flows
- Total output vector
- Vector of values per unit commodity
- Circulating constant capital values
- Valorised fixed constant capital expended
- Valorised annual personal consumption expenditures of productive workers

Economy-wide surplus value

The rate of surplus value encapsulates the struggle of capital and labour over the division of the working day between that portion returned to the productive worker in the form of wages and that retained by the capitalist. Since it refers to the division of value generated over an interval of time it is defined strictly in terms of flow categories. The rate of surplus value was thus calculated as the flow ratio of surplus value (in aggregate or by sector) to variable capital. Table 4 provides a summary of intermediate calculations performed in the computation of the economy-wide rate of surplus value.

Table 3 Intermediate calculations in the computation of the rate of surplus value

	1974-75	1978-79
(1) productive wages/total consumption	0.384	0.322
(2) direct labour*	4.096	3.822
(3) (valorized) consumption*	1.923	2.565
(4) total variable capital*	0.740	0.827 [(1) x (3)]
(5) total surplus value*	3.356	2.994 [(2) - (4)]

*in billions of person hours

Table 4 Intermediate calculations in the computation of the organic composition of capital (advanced)

	1974-75	1978-79
Fixed constant capital advanced*	5.421	4.816
Circulating constant capital expended*	3.506	4.973
Circulating constant capital advanced*	0.744	1.002
Total variable capital expended*	0.740	0.828
Total variable capital advanced*	0.186	0.213
Organic composition of capital	33.183	27.307

* billions of person hours

In computing the other ratios of interest, we were careful to distinguish flow categories from stock categories. Whereas flow categories are evaluated over an interval of time (such as a period of production, or a year), stock categories are evaluated at a particular point in time. Stock categories are used to assess the magnitude of capital required (tied up) in a given production period to set production in motion. The concept of turnover time enables an operational distinction between stocks and flows. Turnover time refers to the period or duration of the cycle of production and circulation. Variable and circulating constant capital advanced to sustain the production and realisation process (the stock concept) may be considerably less than annual expenditures of capital (the corresponding flow concept) because a commodity once produced may be realised in a relatively short period of time. In the course of a year, many production rounds can thus be sustained from an initial stock of capital.

Turnover time, t, is measured as the portion of a year necessary for a given quantum of money capital to generate 1) the purchase of labour power and means of production, 2) the production of a commodity by these means, and 3) the realisation of the commodity on the capitalist market once again as money. Though information on turnover times was not directly available, t was approximated using the ratio of sectoral inventory to annual output. Only one vector of turnover times was calculated and it contained figures pertaining to 1977-78 and 1978-79. For 71 industries turnover time was calculated as the ratio of inventory (as measured by the ABS in its various industry censi) to annual output as recorded in the ANA Input-Output Table 8. In the remaining industries a number of methods were used to estimate t.[14]

The stock of fixed capital is independent of turnover time since fixed capital abides through many production cycles in its original form, though reflecting progressively greater wear and tear. Fixed constant capital advanced is the entire stock of equipment and structures required to set production in motion. To compute this category we used the matrix employed in computing the flow of fixed constant capital above. This matrix records the dollar fraction of capital purchased from the various

14 For further documentation on the derivation of turnover times, and on any other of the data used in this study, see Gibson, (1988a).

Table 5 Sectoral value ratio.s for 92 industries in the Australian economy, 1974-75, 1978-79

	Organic composition		Rate of surplus value		Rate of profit	
	1974-75	1978-79	1974-75	1978-79	1974-75	1978-79
1 Sheep	23.279	28.773	5.269	3.248	0.623	0.313
2 Cereal	204.647	70.775	5.264	8.115	0.098	0.434
3 Meat cattle	49.763	96.759	18.651	10.110	1.092	0.307
4 Milk cattle/pigs	64.786	23.549	8.094	11.732	0.160	0.620
5 Poultry	289.140	70.414	5.845	4.317	0.791	2.373
6 Other agric	52.816	18.441	4.837	4.098	0.583	1.367
7 Services to Agric	43.175	82.172	0.931	0.784	0.156	0.070
8 Forestry/logging	29.483	19.189	1.854	1.694	0.206	0.284
9 Fishing/hunting	302.873	3389.098	3.118	9.320	0.177	0.047
10 Ferrous metals	133.511	229.339	2.766	2.204	0.163	0.076
11 Non-ferrous ores	84.462	61.579	3.078	2.260	0.243	0.244
12 Coal/oil/ gas	134.244	162.491	2.245	1.444	0.188	0.100
13 Other minerals	87.036	91.412	3.683	2.617	0.334	0.226
14 Services/mining	29.077	23.253	3.206	3.342	0.135	0.175
15 Meat products	54.022	30.916	4.607	3.214	2.116	2.545
16 Milk products	82.807	53.428	4.325	3.317	0.778	0.918
17 Fruit/vegies	18.117	11.418	4.487	3.345	0.825	0.947
18 Marg/oils/fats	66.521	42.399	3.931	2.546	0.421	0.424
19 Flour/cereals	34.316	23.947	4.754	3.251	0.858	0.831
20 Bread/cakes/bisc	64.234	36.506	5.379	3.859	2.088	2.606
21 Confectionery	14.448	10.444	5.178	3.808	2.022	2.008
22 Other food prods	85.010	44.087	4.247	3.324	0.631	0.943
23 Soft drinks	59.744	50.204	5.576	3.738	0.910	0.724
24 Beer and malt	100.230	41.762	3.200	2.291	0.423	0.717
25 Other alc bev	20.389	15.906	5.151	4.032	0.319	0.316
26 Tobacco prods	12.704	13.196	3.756	2.805	0.580	0.418
27 Cotton ginning	44.874	36.111	4.224	3.073	0.953	0.857
28 Man-made fibres	22.692	14.893	4.504	3.139	0.791	0.822
29 Cotton fabrics	23.105	12.112	5.357	3.792	1.165	1.517
30 Wool, worsted	9.735	6.605	5.634	4.107	2.395	2.465
31 Textile finishing	59.954	58.170	4.970	3.341	1.938	1.342
32 Floor coverings	21.789	12.881	5.194	3.511	1.015	1.126
33 Other textiles	20.446	10.060	5.951	4.176	1.611	2.192
34 Knitting mills	14.709	7.981	5.790	4.069	1.904	2.340
35 Clothing	11.382	6.990	6.808	4.723	3.628	3.901
36 Footwear	9.284	34.608	5.752	4.240	3.682	0.784
37 Sawmill products	24.715	18.343	5.688	4.197	1.271	1.247
38 Veneers	21.169	28.778	4.488	4.044	1.194	0.801
39 Joinery	37.596	17.029	5.637	4.568	1.209	2.098
40 Furniture/matt	13.473	10.994	5.583	4.463	2.967	2.862
41 Pulp/paper	25.092	19.847	3.126	2.280	0.650	0.594
42 Bags/containers	26.232	20.028	4.626	3.298	1.095	1.011
43 Paper prods nec	33.522	19.665	4.718	3.364	0.852	1.015
44 Publishing	34.741	18.345	4.405	2.987	1.360	1.705
45 Printing/station	27.103	13.779	4.951	3.654	1.507	2.114
46 Chemical fert	38.587	61.684	3.468	2.650	0.508	0.245
47 Other basic chem	58.811	85.445	3.413	2.662	0.318	0.171
48 Paints	23.348	16.867	5.266	3.409	1.138	1.004

Table 5 Continued.

	Organic composition		Rate of surplus value		Rate of profit	
	1974-75	1978-79	1974-75	1978-79	1974-75	1978-79
49 Pharmaceuticals	23.969	25.665	5.265	3.437	0.753	0.460
50 Soap/detergents	31.451	34.878	4.798	3.611	0.955	0.650
51 Cosmetics nec	14.043	13.073	5.514	3.210	1.560	0.971
52 Other chemical	19.383	15.683	4.751	3.331	1.156	0.990
53 Petroleum prods	306.340	398.959	2.506	1.475	0.288	0.130
54 Glass/glass prod	15.490	16.355	3.427	2.387	0.954	0.631
55 Clay prods/refact	15.925	11.131	4.170	3.071	1.108	1.139
56 Cement	37.184	24.150	3.584	2.383	0.562	0.568
57 Ready mix conc	351.444	406.747	4.248	3.335	1.038	0.705
58 Concrete prods	16.591	11.110	4.080	3.464	1.390	1.714
59 Non-met min prods	16.940	11.666	4.477	2.899	1.111	1.019
60 Basic iron/steel	28.129	10.993	3.692	2.635	0.496	0.859
61 Non-ferrous met	74.823	42.578	3.330	2.434	0.210	0.267
62 Struct/metal prod	16.363	11.742	5.013	3.680	1.892	1.893
63 Sheet metal prod	23.306	15.600	4.998	3.530	1.209	1.250
64 Other metal prod	13.621	8.999	4.925	3.748	1.775	1.975
65 Motor vehicles	17.344	5.904	4.406	3.336	1.161	2.337
66 Ships and boats	9.152	7.969	4.267	3.712	3.762	3.704
67 Railway rolling	5.803	10.107	4.328	3.632	7.062	3.630
68 Aircraft	30.742	35.042	3.355	2.849	0.271	0.203
69 Scientific equip	14.047	29.591	4.736	3.615	1.403	0.527
70 Electronic equip	14.159	20.428	5.046	3.901	1.095	0.599
71 Household appl	10.063	4.620	4.933	3.742	1.893	2.826
72 Other elect/equip	12.725	6.330	4.868	3.650	1.576	2.213
73 Agric equipment	7.792	25.016	4.139	3.746	1.325	0.405
74 Const machinery	8.776	4.611	4.257	3.233	1.467	1.941
75 Other machinery	11.764	5.632	4.514	3.467	1.569	2.319
76 Leather prods	44.396	209.722	6.114	4.312	0.887	0.135
77 Rubber prods	27.547	117.753	3.571	3.223	0.777	0.168
78 Plastic	28.787	37.905	4.823	3.660	2.118	1.230
79 Signs	28.903	134.602	5.981	4.402	1.321	0.214
80 Other manug	9.073	15.567	6.696	4.817	3.458	1.512
81 Electricity	426.421	318.861	3.574	3.330	0.111	0.138
82 Gas	203.275	233.954	4.080	3.336	0.214	0.152
83 Water/sew/drain	650.976	550.685	3.978	2.912	0.079	0.068
84 Res building	19.101	14.877	4.713	3.923	2.949	3.108
85 Other const	12.277	5.937	4.484	3.966	4.248	7.191
86 Motor veh/repair	53.022	28.747	7.486	5.484	5.964	7.934
87 Other repairs	23.815	11.618	7.272	4.909	0.779	1.035
88 Road transport	14.631	5.751	4.411	4.917	0.401	1.035
89 Rail transport	19.753	15.282	4.528	3.025	0.146	0.124
90 Water transport	31.134	29.391	3.427	1.674	0.167	0.086
91 Air transport	37.871	58.787	2.797	2.400	0.129	0.072
92 Communication	55.404	47.819	4.578	3.376	0.223	0.190

capital supplying industries. In this case, each fractional column was multiplied by the net capital stock of the corresponding sector. The columns were then normalised by output and the resulting matrix was then premultiplied by the (row) vector of unit values, yielding the valorise magnitude of fixed constant capital advanced per unit output.

Each of the other stock magnitudes, circulating constant capital advanced and variable capital advanced, was computed by multiplying the corresponding flow magnitude by turnover time. Circulating constant capital advanced per unit output was then obtained by premultiplying the standard direct requirements matrix from the Input-Output tables by the vector of unit values.

The organic composition of capital reflects the capacity of the current capital stock for self-expansion. This was computed as the ratio (in aggregate or by sector) of constant (fixed plus circulating) capital advanced to variable capital advanced. Table 5 summarises intermediate calculations performed in the computation of the economy-wide organic composition of capital.

The value rate of profit describes how much self-expansion is forthcoming from a unit of capital advanced. This identity was calculated as the ratio of the flow of surplus value to total (constant plus variable) capital advanced.

In anticipation of a structural analysis of Australian industry, we computed sectoral unit values, organic compositions of capital, rates of surplus value and rates of profit. These are reported in Table 6.

Economy-Wide Findings

The results of our value calculations for the Australian economy as a whole are found in Table 6. Clearly the short time span of the study creates problems of interpretation and in the following discussion we are careful not to overstate the significance of our findings.

Table 6 Aggregate value ratios for the Australian economy, 1974-75, 1978-79

	1974-75	1978-79
Rate of surplus value	4.533	3.617
Organic composition	33.183	27.307
Rate of profit	0.528	0.496

A decline in the organic composition of capital over the four year interval, 1974-75 to 1978-79, from 33.183 to 27.307, and in particular the decline in the economy-wide sum of fixed constant capital advanced from 5.421 to 4.816 billion person hours is particularly striking. This finding is consistent with the general downturn of investment in the capital stock of Australian industry, particularly manufacturing, during the 1970s (Bureau of Industry Economics, 1987).

Disinvestment in manufacturing was coupled with a marked decrease in the aggregate rate of surplus value from 4.533 to 3.617, related to the rise in total variable capital advanced from 0.186 to 0.213 billion person hours over the four year interval. These figures can be interpreted in the light of the macro-economic trends which occurred in the mid-1970s Australian economy. Between 1973 and 1974 Australia's annual rate of consumer price inflation (as calculated by the OECD) rose from 9.5 to 15.1 and in the years 1974 to 1979 the annual average rate was 12.2 (Hughes, 1980: 70). This inflation rate was way higher than the average for all OECD countries (and indeed Australia's inflation rate was exceeded only by the UK, Italy and New Zealand). High inflation rates were attributed to imported food price inflation and the so-called 1974 wage explosion (during which adult male earnings rose by 31 percent and female pay rates rose even more in response to the 1973 equal pay for women decision) which filtered through the cost pipeline as the decade proceeded (Hughes, 1980: 61, 69).

Given that the value vector is measured in hours per Australian dollar, the effect of rampant inflation during the 1970s was to reduce the value per unit output measured for industrial sectors over the period 1974-75 to 1978-79. But despite inflation, the magnitude of wage rises in the 1970s

meant that the valorised consumption of productive workers rose from 1.923 to 2.565 billion person hours. The small decline in the size of the productive workforce, measured in terms of the ratio of productive workers wages to total consumption, from 0.384 to 0.322 was not enough to counter the resulting increase in total variable capital from 0.740 to 0.827 billion person hours. A significant decline in the economy-wide rate of surplus value took place in this mid-1970s period as the first federal Labor government for 23 years under the leadership of Gough Whitlam rose and 'fell' from power.

While the organic composition of capital declined as a result of disinvestment and inflation, the rate of surplus value also fell. The relative combination of these factors were clearly unfavourable to the profit rate which fell from 0.528 to 0.496 over the period. A comparison with the US economy over the same interval (see Table 7) shows that the US witnessed a somewhat sharper fall in the rate of profit from 0.66 to 0.47. For each country the relative importance of the constituent ingredients of the profit rate appears to have differed.

Table 7 Comparison of the US and Australian Economies in the Mid 1970s

Category	US		Australia	
	1974-75	1978-79	1974-75	1978-79
Rate of surplus value	4.515	4.785	4.533	3.618
Organic composition	60.738	99.684	33.183	27.307
Rate of profit	0.66	0.47	0.528	0.496

US figures are from Shakow, et al.(1988)

A two point sample is clearly inadequate for making conclusive observations based on our empirical findings. It is nonetheless tempting to speculate. First we note that the rates of surplus value for the US and Australia are comparable in magnitude. The trend, however, is reversed. While the rate of surplus value rose slightly in the US during this period, in Australia, labour appears to have increased its strength vis a vis capital and engineered a decrease in the rate of surplus value. The permanency of this challenge to Marx's classical tendency for the rate of surplus value to rise can only be explored by the extension of the analysis into the 1980s, a task for future research.

We observe secondly that the devalorisation evident in the Australian economy during this period was not sufficient to offset the impact of a declining rate of surplus value on the profit rate. For the US we see evidence of the greater impact of a rising organic composition of capital, despite a slightly rising rate of surplus value, on the profit rate, i.e. support for Marx's classic 'tendency for the profit rate to fall' theory of crisis. In the case of Australia over this very short time interval, we see evidence of the greater impact of the declining rate of surplus value, despite a falling organic composition of capital, on the profit rate, i.e. support for the 'profit squeeze' view of capitalist crisis.

Clearly an empirical exploration of conflicting theories of capitalist crisis requires an analysis at additional time points over a much longer historical period. Research on the US economy using similar methods reported above, has produced trends for the period 1947-1979 (Graham, 1984; Shakow et al, 1988). For Australia, Input-Output tables exist for 1958-59, 1962-63 and 1968-69 as well as for 1979-80, 1980-81 and 1981-82. Annual control totals exist for the interval 1959-79 and would allow the development of intermediate tables. Thus, the calculation of twenty year annual time series for those ratios crucial to the theory of accumulation and the value rate of profit remains a distinct future possibility. We declined to extend our analysis at this stage because (1) the various Input-Output tables are not conformable; and (2) vectors of depreciation rates and turnover times and the matrix of capital stocks available at the outset of this research project were each available for one year only. We did not feel it appropriate to make the assumption that these variables remained constant or tracked with output over a twenty year span.

Sectoral Findings

If we examine the value ratios calculated on a sectoral basis, as shown in Table 6, it is clear that the general economy-wide picture does not reflect the experience of all industries. Individual industries display very different movements in sectoral organic composition, rate of surplus value and rate of profit over the time period studied.[15] In particular the mining sectors experienced trends in direct contrast to those of the economy as a whole (Bryan, 1988). The massive mining boom of the late 1960s tailed off in the mid 1970s and then was revived by a further boom, particularly in coal mining, in the late 1970s. Throughout this period there was strong investment in new mining equipment, technology and infrastructure. At the same time mining workers won major wage rises in return for productivity gains. These dual impacts can be seen in the value ratios for the mining sectors as shown in Table 8. The ferrous metal ore, coal and oil and other mining industries all experienced an increase in the organic composition of capital. Non-ferrous metal ore mining, which covers a broad range of mining activities (including bauxite, copper, gold, mineral sands, silver, lead, zinc, tin and uranium mining) showed a small decline in organic composition. Many of these sectors did not experience rapid development until the period after 1978-79, and those which did grow in the mid-1970s, e.g. bauxite and mineral sands mining, involved relatively more simple equipment and technology than that used in underground or deep open cut mining. All mining sectors showed a decrease in their respective rates of surplus value, with the highest percentage decrease (of 36 percent) experienced by the coal and oil industry. The sectoral profit rates show decline in three cases, and no change for the non-ferrous metal ores sector. This finding is consistent with our view, elaborated elsewhere (see Shakow, Graham and Gibson, 1988) that sectors which have experienced widespread restructuring of the forces and relations of produc-

15 While we are confident that the majority of the results shown in this table are reasonably correct given the input data available, for some sectors the results are clearly incorrect. For example, marked anomalies in the organic composition of capital for the two years appear for the cereal grains, poultry, and fishing and hunting sectors. At present it appears that these and other possible anomalies arise from incorrect input data on capital stocks. In the next phase of this research the data sets supplied by the IAC will be checked and possibly amended using other sources for certain sectors. In our estimation, these anomalies should have no significant qualitative impact upon the aggregate results.

tion and a resulting enhancement of their competitive capabilities, are likely to show a declining value rate of profit. In the short run such a decline is associated with high price rates of return, increasing market share and continued investment interest. In the longer term, unless other factors (such as political intervention) come into play, price rates of return are likely to begin to reflect this value sphere decline, as has occurred, for example, in the case of the Australian coal industry (Gibson, 1988b).

Table 8 Value ratios for Australian mining sectors, 1974-75/1978-79

Sectors	Organic Composition		Rate of surplus value		Rate of profit	
	1974-75	1978-79	1974-75	1978-79	1974-75	1978-79
Ferrous metal ores	133.51	228.67	2.77	2.19	0.16	0.08
Non-ferr metal ores	84.46	61.40	3.08	2.24	0.24	0.24
Coal and oil	134.24	162.02	2.24	1.44	0.19	0.10
Other mining	87.03	91.14	3.68	2.60	0.33	0.23

By contrast, the metals industries (basic iron and steel, non-ferrous metals, structural metal products, sheet metal products and other metal products) showed a uniform decline in sectoral organic compositions of capital and rates of surplus value and stable or slightly rising sectoral value rates of profit. These industries form the heart of an industrial economy, and during the 1970s it was clear that the investment necessary to keep abreast of international developments in capital goods and supplying industries was not taking place in Australia. While labour was gaining in power vis a vis capital (at least in terms of wage bargaining), capital did not undertake the restructuring necessary to maintain its competitive edge in these core areas of the economy.

While much more could be said about the details of these sectoral results, we feel it would be wiser to postpone such a discussion until the time frame of the analysis is extended to encompass a longer period.

Conclusion

This paper reports upon the methods and findings of a research project which is aimed at operationalising Marxian value categories in the empirical analysis of the Australian economy. The calculation of value ratios for the economy as a whole and for 92 industrial sectors have been completed for two years only. It is hoped that the account of the methods and data used in these calculations will be of interest to those concerned with the application of a value analysis to the interpretation of economic change. We have attempted to demonstrate one way, among the many possible ways, in which value categories can be approximated using economic data collected in the categories of non-Marxian theory.

While the findings reported at this stage may not appear particularly striking, it is useful to look at this exercise in terms of the doors it opens for a fully developed analysis of the Australian economy from a perspective grounded in Marxian value theory. The methods reported here allow a quantitative assessment of the exploitation of productive labour, of capitalist investment in labour-saving devices and of the uneven trajectories of sectoral value rates of profit. Many hypotheses of central interest to contemporary Marxian economic debate can potentially be explored using this data base and set of calculations, including the differential trajectories of economic indicators for Departments I and II, deviations between value and price magnitudes over time for individual sectors, the classical and neo-marxist theories of economic crisis and the relationship between value dynamics and the restructuring of capitalist industry. Clearly there are many other pressing issues of central interest to Marxists which cannot be addressed using such data and calculations. Nevertheless, the overall method demonstrated here of de-constructing bourgeois categories and data in order to reconstruct 'facts' relevant to a Marxian analysis is, we would argue, a method shared by many Marxists grappling with the interpretation of empirical material. In this paper we hope to contribute yet another strand to this growing literature. We would welcome the participation of others interested in the development of empirical value analyses in the Australian context.

References

Australian Bureau of Statistics, *Australian National Accounts: Input-Output Tables, 1974-75 and 1978-79* Canberra: Australian Government Publishing Service.

Australian Bureau of Statistics, *Census of Manufacturing Establishments, Details of Operations, 1977-78* Canberra: Australian Government Publishing Service.

Australian Bureau of Statistics, *Census of Mining Establishments, Details of Operations by States, Territories and Australia, 1977-78* Canberra: Australian Government Publishing Service.

Australian Bureau of Statistics, *Census of Population and Housing, 1976* Canberra: Australian Government Publishing Service.

Australian Bureau of Statistics, *Electricity and Gas Establishments, Details of Operations by States, Territories and Australia, 1974-75 and 1977-78* Canberra: Australian Government Publishing Service.

Australian Bureau of Statistics, *Private Sector Construction Establishments: Summary of Operations by Industry Class, Australia and States, 1978-79* Canberra: Australian Government Publishing Service.

Bryan, R. 1988 'After the long boom: the mining industry and capital restructuring' *Journal of Australian Political Economy* 22, February.

Bureau of Industry Economics, 1987 'Investment in the manufacturing sector 1959-60 to 1984-85' *BIE Occasional Paper 3* Canberra: Australian Government Publishing Service.

Cox, A. 1984 'GOS splits and investment parameters for the 1977-78 ORANI database' Research Memorandum ORANI Module Canberra: Industries Assistance Commission.

De Vroey, M. 1981 'Value, production and exchange' In *The Value Controversy* pp. 173-201. Edited by Ian Steedman et al. London: Verso.

Dick, H. 1981 *Aluminium Smelters and the Price of Electricity: Who Really Pays?* Newcastle: Hunter Valley Research Co-operative.

Dixon, P., Parmenter, B., Sutton, J. and Vincent, D. 1982 *ORANI: A Multisectoral Model of the Australian Economy* Amsterdam: North Holland Publishing.

Falk, J. and Larcombe, G. 1983 'NSW power and the on/off resources boom' *Journal of Australian Political Economy* 14, April.

Gibson, K. 1988a 'Documentation of data for the Australian Value Project' Unpublished manuscript, Department of Geography, University of Sydney.

Gibson, K. 1988b 'Internationalisation and crisis in the Australian coal industry' Unpublished manuscript, Department of Geography, University of Sydney.

Gibson, K. and Horvath, R. 1983 'Global capital and the restructuring crisis in Australian manufacturing' *Economic Geography* 59, 2.

Graham, J. 1984 'Economic restructuring in the US, 1958-1980: theory and identification' Unpublished PhD dissertation, Graduate School of Geography, Clark University.

Graham, J. and Shakow, D. 1988 'Value in theory and practice' Unpublished manuscript, Department of Geology and Geography, University of Massachussetts.

Graham, J., Gibson, K., Horvath, R. and Shakow, D. 1988 'Restructuring in US manufacturing: the decline of monopoly capitalism' *Annals of the Association of American Geographers* 78, 3.

Hourigan, M. 1980 'Estimation of Australian capital stock matrix for the IMPACT Project' *Impact Research Paper* 1-11 Melbourne: Industries Assistance Commission.

Hughes, B. 1980 *Exit Full Employment* Sydney: Angus and Robertson Publishers.

Kuznecovs, J. 1981 'An empirical test of the labour theory of value' Unpublished B.Ec (Honours) thesis, School of Social Sciences, Flinders University, South Australia.

Mohun, S. 1983 'Abstract labour' In *A Dictionary of Marxist Thought* Edited by T. Bottomore Cambridge: Harvard University Press.

Morishima, M. 1973 *Marx's Economics* London: Cambridge University Press.

Morishima, M. and Seton, F. 1961 'Aggregation in Leontief matrices and the labour theory of value' *Econometrica* 29, 4.

Shaikh, A. 1977 'Marx's theory of value and the transformation problem' In *The Subtle Anatomy of Capitalism* Edited by J. Schwartz. Santa Monica: Goodyear Publishing Company.

Shakow, D., Gibson, K., Graham, J. and Horvath, R. 1988 *Economic Statistics and Social Change: Empirical Research in the Marxist Tradition* Unpublished manuscript, Department of Economics, Clark University.

Shakow, D., Graham, J. and Gibson, K. 1988 'Industrial restructuring in the US economy: a value analysis' Unpublished manuscript, Department of Economics, Clark University.

Sraffa, P. 1960 *Production of Commodities by Means of Commodities* Cambridge: Cambridge University Press.