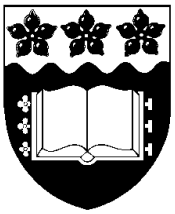

University of Wollongong
Department of Economics
Working Paper Series 1998

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WP 98-3

AN INTEGRATIVE ANALYSIS OF BUSINESS BANKRUPTCY IN AUSTRALIA

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University of Wollongong
Working Paper Series WP 98-3

ISSN 1321-9774
ISBN 0 86418 569 3

ABSTRACT

This paper proposes an integrative and dynamic approach for analyzing business failure. The simultaneous estimation results obtained with Australian data indicate significant associations between bankruptcy rates in different industries. Most of these associations are positive and hence implying that bankruptcy in one industry can inflict a 'domino' effect on other industries. The estimated significant negative association between current and lagged bankruptcy rates in the industries under consideration lend support to the survival of the fittest hypothesis. The estimation results also highlight the important effects of industry, domestic and international economic conditions on bankruptcy rates.

(*JEL* Classification G33)

* The authors are listed in alphabetical order. They share equal responsibility for remaining errors. They are grateful for the financial support received from the Australian Research Council and the Applied Economic Modelling Program.

INTRODUCTION

Despite the large research interest and effort invested in the area of business bankruptcy, the financial and economic literature has not paid sufficient attention to the possibility of interrelationships between bankruptcy rates in various industries. A large portion of this literature has focused on the ability of financial ratios to explain and predict business failure. This trend originated with Beaver's univariate method (1966) and continued through Altman's (1968) Multiple Discriminant Analysis (MDA) to Ohlson's (1980) conditional logit analysis (CLA). Modifications of the MDA have been provided by Deakin (1972), Blum (1974) and, more recently, by Sheppard (1994). A major study of Australian business failure with the MDA approach has been conducted by Castagna and Matolcsy (1981).

Another strand of insolvency and bankruptcy studies has focused on providing microeconomic foundations to the effect of capital structure on the prospects of corporate survival. Pioneering works in this area include the studies of Stiglitz (1972, 1975) and Stapleton (1975) on the relationship between firms' valuation and their debt-equity ratio and Bulow and Shoven (1978) on the conflict of interests between bondholders, bank lenders and equity holders and the gain from immediate liquidation of an insolvent firm to a coalition of claimants with negotiating power. These works have generated an interest in comprehending bankruptcy-liquidation decisions that led to the important contributions of White (1980, 1989, 1994), Ang and Chua (1980), Baldwin and Mason (1983), Culter and Summers (1988), Gilson (1989,1990), Chamberlain (1990), Aghion, Hart and Moore (1992), Opler and Titman (1994) and Denis and Denis (1995), to mention a few.

Following Altman's (1971) seminal paper, more attention has been paid to the relationship between corporate bankruptcy and macroeconomic conditions. Working on this theme, Levy and

Bar-Niv (1987) have provided a macroeconomic framework and Levy (1992, 1995) has combined micro and macro economic aspects into an integrated insolvency and bankruptcy model. Other works on the effects of macroeconomic conditions on business failure include Melicher and Hearth (1988), Post and Moon (1988), Lane and Schary (1991), Goudie and Meeks (1991), Hudson and Cuthbertson (1993), Platt and Platt (1994), Platt, Platt and Pedersen (1994) and Bandopadhyaya (1994).

In addition to the effect of financial factors, capital structure and macroeconomic conditions on bankruptcy, it is possible that a business failure in one industry affects the well being of firms in other industries. The underlying rationale is that industries are integrated by producer-user relationships as goods produced in one industry serve as production inputs in other industries. Thus, in a non-perfectly competitive market environment, an interruption in the supply of intermediate goods caused by bankruptcy of a supplying firm might adversely affect the well-being of the user firm. Similarly, the decline in the demand for intermediate goods caused by bankruptcy of a user firm can destabilize the producers of those goods.

These inter-industry linkages of business failures are the focus of the present study. They have been partially recognized by Platt (1989), whose simultaneous-equation estimation results with data on industries in the United States for the period 1950-1981 have indicated that vertically associated industry failure rates are related and that the failure rate in the supplying industry is positively affected by the failure rate in the buying industry.

In a country like Australia where small businesses and partnerships comprise a considerable portion of the business sector, incidence of bankruptcy is a wide-spread phenomenon. The number of business bankruptcy cases filed in Australia has been rising throughout the last two decades. Our preliminary cointegration and Granger causality tests with nation-wide data have lent support for a long-run relationship between bankruptcy rates in the primary production and the manufacturing

industries. They have also suggested the presence of significant short-run dynamic effects of the bankruptcy rates in the building and construction industry, the transport, storage and communication industry and the finance and property industry on the bankruptcy rate in the mining and quarrying industry. (Cheung and Levy, 1997)

The main objective of this paper is to test for, and estimate, inter-industry linkages in bankruptcy rates in Australia. The simultaneous and dynamic equation system designed for this purpose also facilitates the testing and estimation of the effects of intervening factors such as industry-specific and domestic and international economic conditions on current bankruptcy rates in major Australian industries. The industries included in the analysis are: 1. primary production, 2. mining and quarrying, 3. manufacturing, 4. building and construction, 5. transport, storage and communication, and 6. finance and property, for which bankruptcy data are available for the period 1978-1992.

The paper is organized as follows. The second section presents a dynamic and simultaneous-equation system for estimating and testing the relationships between bankruptcy rates in various industries as well as the role of intervening economic factors. The definitions of the explanatory variables and their expected effects on the industries' bankruptcy rates are given in the third section. The general estimation results of the simultaneous and dynamic equation system obtained with cross-state/territory and time-series data are summarized and interpreted in the fourth section. The implications of changes in government policy instruments, industry and domestic economic conditions, and international economic conditions on business stability in Australia are then discussed.

INTEGRATIVE AND DYNAMIC APPROACH TO BUSINESS FAILURE

Our proposed structural form of the integrative and dynamic business-failure system comprises a set of six linear equations

incorporating the effects of inter-industry linkages, industry-specific characteristics, domestic economic conditions and international economic factors on the current industries' bankruptcy rates. The construction of this structural form takes into account that a considerable amount of time is involved in processing business bankruptcies. In the case of Australia, about three to twelve months elapse from submitting an application to the acceptance of the bankruptcy notice. Thus, the data obtained for a particular year might not necessarily represent business failures within that year, and the inclusion of one-year lags of all explanatory variables is necessary. The proposed structural form also includes lagged dependent variables in order to test for inertia or, alternatively, the survival of the fittest hypothesis. Lagged bankruptcy rates in other industries are also incorporated in order to assess the accumulated effects of inter-industry linkages.

More specifically, the structural equations for the six industries under consideration are expressed as follows:

$$\begin{aligned} br_{1t} &= \mu_1 + \alpha_2 br_{1t-1} + \sum_{j\neq 1}^{6}\sum_{s=0}^{1}\beta_{1j} BR_{jt-s} \\ &+ \delta_{11} CR_{1t-1} + \phi_{11} SY_{t-1} + \phi_{12} OY_{t-1} + \phi_{13} G_{t-1} + \phi_{14} T_{t-1} + \phi_{15} R_{t-1} \\ &+ \phi_{16} M_{t-1} + \gamma_{11} ER_{t-1} + \gamma_{12} JGDP_{t-1} + \gamma_{13} WP_{t-1} + \varepsilon_{1t} \end{aligned} \qquad (1)$$

$$\begin{aligned} br_{2t} &= \mu_2 + \alpha_2 br_{2t-1} + \sum_{j\neq 2}^{6}\sum_{s=0}^{1}\beta_{2j} BR_{jt-s} + \delta_{21} CR_{2t-1} + \delta_{22} DIS_{2t-1} \\ &+ \phi_{21} SY_{t-1} + \phi_{22} OY_{t-1} + \phi_{23} G_{t-1} + \phi_{24} T_{t-1} \\ &+ \phi_{25} R_{t-1} + \phi_{26} M_{t-1} + \gamma_{21} ER_{t-1} + \gamma_{22} JGDP_{t-1} + \gamma_{23} CP_{t-1} + \varepsilon_{2t} \end{aligned} \qquad (2)$$

$$br_{3t} = \mu_3 + \alpha_3 br_{3t-1} + \sum_{j\neq 3}^{6}\sum_{s=0}^{1} \beta_{3j} BR_{jt-s} + \delta_{31} CR_{3t-1}$$
$$+ \delta_{32} DIS_{3t-1} + \delta_{33} MW_{t-1} + \phi_{31} SY_{t-1} + \phi_{32} OY_{t-1} + \phi_{33} G_{t-1}$$
$$+ \phi_{34} T_{t-1} + \phi_{35} R_{t-1} + \phi_{36} M_{t-1} + \gamma_{31} ER_{t-1} + \gamma_{32} NZGDP_{t-1} + \varepsilon_{3t} \qquad (3)$$

$$br_{4t} = \mu_4 + \alpha_4 br_{4t-1} + \sum_{j\neq 4}^{6}\sum_{s=0}^{1} \beta_{4j} BR_{jt-s} + \delta_{41} CR_{4t-1}$$
$$+ \delta_{42} DIS_{4t-1} + \delta_{43} HP_{t-1} + \phi_{41} SY_{t-1} + \phi_{42} OY_{t-1} + \phi_{43} G_{t-1}$$
$$+ \phi_{44} T_{t-1} + \phi_{45} R_{t-1} + \phi_{46} M_{t-1} + \gamma_{41} ER_{t-1} + \gamma_{42} JGDP_{t-1} + \varepsilon_{4t} \qquad (4)$$

$$br_{5t} = \mu_5 + \alpha_5 br_{5t-1} + \sum_{j\neq 5}^{6}\sum_{s=0}^{1} \beta_{5j} BR_{jt-s} + \delta_{51} CR_{5t-1}$$
$$+ \delta_{52} DIS_{5t-1} + \phi_{51} SY_{t-1} + \phi_{52} OY_{t-1} + \phi_{53} G_{t-1} + \phi_{54} T_{t-1}$$
$$+ \phi_{55} R_{t-1} + \phi_{56} M_{t-1} + \varepsilon_{5t} \qquad (5)$$

$$br_{6t} = \mu_6 + \alpha_6 br_{6t-1} + \sum_{j\neq 6}^{6}\sum_{s=0}^{1} \beta_{6j} BR_{jt-s} + \delta_{61} CR_{6t-1}$$
$$+ \delta_{63} HP_{t-1} + \phi_{61} SY_{t-1} + \phi_{62} OY_{t-1} + \phi_{63} G_{t-1} + \phi_{64} T_{t-1}$$
$$+ \phi_{65} R_{t-1} + \phi_{66} M_{t-1} + \gamma_{61} ER_{t-1} + \gamma_{62} JGDP_{t-1} + \varepsilon_{6t} \qquad (6)$$

where, BR_1 to BR_6 denote the bankruptcy rates in the primary production industry, the mining and quarrying industry, the manufacturing industry, the construction industry, the transport, storage and communication industry and the finance and property industry, and ε_{1t} to ε_{6t} are autocorrelated and contemporaneously correlated disturbances having zero means and finite variances and covariances, respectively. In addition, CR is a concentration ratio, DIS indicates industrial disputes, MW

the average manufacturing real wage per employee per annum, HP housing prices, SY per-capita income within a state, OY per-capita income in other states and territories, G government spending, T personal income tax rate, R annual interest rate, M money supply, ER exchange rate, JGDP Japan's gross domestic product, NZGDP New Zealand's GDP, AP agricultural prices and MP mineral prices. The rest of the symbols denote parameters.

In all of the above equations, lagged dependent variables, inter-industry effects and government policy variables are included. The inclusion of other economic variables are tailored for each individual industry. Generally, the proposed regression equations for all industries contain variables of industry-specific characteristics as well as domestic and international economic conditions. However, irregularities exist in some equations. The regression equation associated with the transport, storage and communication industry excludes international economic conditions, as this sector has relatively lower export capabilities and attracts an insignificant level of foreign investment. Due to the unavailability of data on the number of industrial disputes in the primary production and the finance and property sectors, this variable is not included in the regression equations associated with these sectors. As the primary production and the mining and quarrying sectors are heavily dependent on exports of their products, world commodity prices as well as the GDP of Japan, which is the largest importer of these two industries' products, they are incorporated into these sectors' equations. Since Japanese investors play an important role in Australia's financial and property market, Japan's GDP is also included in the finance and property industry's as well as in the construction industry's regression equations. The annual average manufacturing real wage rate is included in the manufacturing industry's regression equation due to the relatively labor-intensive nature of this industry. The manufacturing industry's regression equation also includes the GDP of New Zealand which is the largest importer

of Australia's elaborately transformed manufactures. Housing prices are included in the construction and the finance and property industry's regression equations as these two industries are highly dependent on the demand for housing.

Due to a lack of degrees of freedom it is impossible to estimate the above system of six simultaneous equations as a whole. Instead, sub-sets of two to three industries' regression equations, that exhaust all possible combinations, are estimated separately using the three-stage-least-squares (3SLS) procedure. Cross-state and time-series observations are used because the national sample is not sufficiently large for obtaining reliable results. The states and territories are New South Wales, Australian Capital Territory, Victoria, Queensland, South Australia, Western Australia, Northern Territories and Tasmania. The data for New South Wales and Australian Capital territory are combined as the observations on the number of bankruptcy cases filed for these two states are not available separately. Since the states and territories are different, the rates of bankruptcy in different states and the associated explanatory variables are weighted by the shares of the states' aggregate output in Australia's GDP. Thus, the greater the aggregate output share of a state, the higher the weight assigned to the observed endogenous and exogenous variables associated with the regression equations for that state. Finally, all of the variables are taken in their first differences in order to control for multicollinearity.

EXPLANATORY VARIABLES AND THEIR EXPECTED EFFECTS

The explanatory variables included in the simultaneous equation analysis are classified into three categories: 1. industry-specific variables, 2. domestic economic conditions and 3. international economic conditions. The definitions of these variables and their expected effects on the bankruptcy rate of the various industries are given in this section.

Industry-specific conditions

This category includes lagged bankruptcy rates in the industry under consideration, business bankruptcy rates in other industries, concentration ratio, industrial disputes, housing prices and annual average manufacturing real wage rate.

The rate of bankruptcy (BR) in an industry is defined as the ratio of the number of business bankruptcies to the total number of businesses in that industry in a financial year. The number of business bankruptcy by industry is obtained from the issues of 'The Bankruptcy Act 1966 Annual Report' for the income years 1972-73 to 1991-92, where 'business bankruptcy' refers to the bankrupt individuals having been employed on their own account in some trade, business or profession. The number of businesses in an industry is given by the total number of business taxpayers extracted from the annual issues of the 'Taxation Statistics', which are published by the Australian Department of Taxation. As user-supplier relationships are likely to exist between industries, both positive and negative associations between bankruptcy rates in different industries can be expected. A positive association between the current bankruptcy rate and its lag may indicate a dominant inertia effect, whereas a negative association may reveal a dominant survival of the fittest phenomenon.

Data on the commonly used measure of concentration ratio (CR) such as the four-firm concentration ratio is not available for the classification of industry used above. Hence, a relatively crude measure has been used -- the reciprocal of the total number of firms in an industry. The drawback of this measure is that it does not take into account that firms in a given industry can be of different sizes. The total number of firms in an industry is proxied by the documented total number of business taxpayers in that industry. We expect that the mere small number of firms operating in highly concentrated industries may contribute to high rates of bankruptcy in those industries. In such industries, even a small number of cases of bankruptcies implies a relatively

high rate of bankruptcy. However, in industries with lower concentration ratio the more competitive environment may contribute to the likelihood of firms being forced out of business. The relationship between bankruptcy rates and concentration ratio can, therefore, be positive or negative.

Industrial disputes (ID) are defined by the Australian Bureau of Statistics as a withdrawal from work by employees, or a refusal by employers to permit some or all of the employees to work. The recorded figures are concerned only with disputes involving stoppages of work of ten days or more. The ID used in our analysis are measured as the number of working days lost per one thousand employees. Harmonious industrial relations are important to the smooth and efficient operation of a firm. This is of a particular importance in industries using labor-intensive production processes. Prolonged and/or frequent industrial disputes can cause delays in production and supply, loss of reputation and contracts and, consequently, business failure and bankruptcy. However, a positive association may not always be revealed. In many cases, workers refrain from industrial disputes in periods of recession and business instability and postpone industrial disputes to periods of more secure business stability and employment prospects.

Housing prices (HP) are an important indicator of the performance of the property market. Hence, housing prices are included in the construction and the finance and property industries' regression equations. The excess capacity of construction production in Australia implies that changes in housing prices are predominantly the result of fluctuations in demand. It is, therefore, expected that a rise in housing prices is associated with a decline in bankruptcy rates in those industries. A weighted average of the housing prices of the eight capital cities of Australia's states and territories is provided by the Australian Bureau of Statistics.

The annual average manufacturing real wage rate (MW) is incorporated into the bankruptcy-rate regression equations for

the manufacturing industry. The figures are obtained by computing the ratio of the annual total wages in the manufacturing sector to the total number of employees in that sector. The implicit price deflator of GDP has been applied to convert nominal figures to constant 1990 prices. Many of the manufacturing processes are relatively labor-intensive, and hence a rise in the wage rate would increase the costs of production in that industry substantially. If the demand for manufactured goods remains the same, an increase in the wage rate in the manufacturing sector would reduce the mark-up for manufacturers, and thereby lead to a rise in the bankruptcy rate in that sector. On the other hand, it is possible that workers are willing to accept wage cuts when the company is in financial distress. Therefore, the relationship between the rate of bankruptcy and wage rate is not necessarily positive.

2. Domestic economic conditions

This category contains per-capita income within the state under consideration, per-capita income in other states, and government policy variables such as government spending, personal income tax rate, interest rate and money supply.

Per-capita income within a state, or a territory, (SY) is defined as the state contribution to Australia's GDP at factor cost divided by the state population. Since GDP figures are available in current prices, the implicit price deflator of GDP has been applied to represent the GDP figures at constant 1990 prices. Per-capita state income is expected to be associated with a lower bankruptcy rate for industries specializing in normal goods. For such industries, the higher the per-capita income, the greater the demand for their products. However, a positive correlation between the rate of bankruptcy and per-capita income within a state, or territory, cannot be ruled out a priori for the following reasons. An increase in demand for goods during an economic growth period can lead to a rise in the cost of credit and in the cost of purchasing some

production inputs, and consequently, may lead to an increase in the operational costs of firms. Moreover, periods of strong income growth are accompanied by mushroom and cobweb phenomena where many of the new business initiatives are lacking in technological knowledge and managerial skills.

Since a state is linked to the rest of the country via trade, the per-capita income of the rest of Australia (OY) is included in the regression analysis in addition to the state and territory per capita income. This variable is measured as a ratio of the GDP at constant 1990 prices for Australia, excluding the state under consideration, divided by the population of the rest of Australia. It is expected that the effect of this variable is similar in direction to the aforementioned effect of the state's per-capita income.

An increase in state-government spending (SG) and / or federal (commonwealth) government spending (CG) can, on the one hand, raise the aggregate demand for goods and services and, in turn, the earnings of firms and their prospects of survival. On the other hand, there can be a crowding-out effect. Namely, an increase in government spending may lead to a rise in the interest rate. The rise in interest rate, in turn, can lead to a decline in household spending on goods and services and higher debt-servicing costs for firms which, subsequently, reduce their profit margins. Therefore, the combined effect of government spending on the rates of bankruptcy of various industries can be negative if the former effect dominates the latter, and nil, or even positive, otherwise. An implicit price deflator on total government expenditure is used to convert the figures to 1990 prices.

A rise in tax rates (T) reduces the net operating profits of firms directly. It also reduces profits indirectly through a decline in consumer disposable income. Although these effects lend support to a positive association between bankruptcy rates and income tax rates, a negative association between bankruptcy rates and income tax rate cannot be ruled out a priori. This is because governments tend to have a higher propensity to spend than households and their spending is directed, in part, to buying

goods or services from domestic industries. Since most of the bankrupt firms in our study are partnerships, and since the taxes on income for partnerships are often paid as individual income tax, it is likely that the maximum marginal personal income tax rate is mostly suitable for our regression analysis.

As mentioned earlier, a rise in interest rate (R) may adversely affect the well-being of firms directly and indirectly. Such a rise can increase the debt-servicing cost for firms and can discourage investment. The rise in the cost of credit can also reduce households' demand for goods and services and, thus, indirectly and adversely affect firms' profits. Moreover, a rise in the interest rate, in a country enjoying a relatively high degree of capital mobility such as Australia, can lead to an appreciation of the Australian dollar, and thereby to a deterioration of the competitive edge of domestic industries. Interest rates in Australia have been considerably responsive to the changes in the prime rate set by the Reserve Bank of Australia, and can be perceived as major monetary-policy instruments. They are proxied in our regression analysis by the ninety-day bank accepted bill figures as in June of each year.

The overall effect of money supply (M) on bankruptcy rates is not clear a priori. On the one hand, expansionary monetary policy can lead to inflation, worsen a country's terms of trade and lower the ability of its producers to compete in domestic and foreign markets. On the other hand, an expansion in money supply can lower the interest rate and, thereby, generate the various effects discussed earlier. A relatively broad definition of money supply, M3, is used in the regression analysis. This variable is expressed in real terms by using the Australian GDP deflator.

International economic conditions

International economic conditions include the exchange rate, wool prices, coal prices as well as the GDP of Japan and New Zealand.

It is important to note that our analysis does not employ the common definition of exchange rate (ER) but rather the definition used in the International Financial Statistics. A depreciation of the Australian dollar (i.e., a rise of the above-mentioned exchange rate) improves the competitive edge of Australian products. Therefore, the exchange rate is expected to be negatively correlated with bankruptcy rates, in particular for industries with high export volume, (e.g. the primary production and mining and quarrying industries) and for industries highly exposed to foreign competition (e.g. the manufacturing industry). Moreover, some other industries can be indirectly affected by exchange-rate movements. In view of the high level of dependency of the Australian GNP on export of primary and mining goods, it is expected that the rates of bankruptcy in other industries would rise with an appreciation of the Australian dollar (i.e., a decline of ER). This is because a decline in the demand for Australia's traditional export goods can significantly lower the aggregate national income and, subsequently, consumer demand. It is also important to note that the finance and property industry can be very sensitive to exchange-rate movements. A rise in the exchange rate as defined above, may motivate foreign investors to materialize capital gains and sell their Australian asset holdings. This in turn, can cause excess supply in the property market, a decline in property prices, and a downturn in the property industry as well as the construction industry. The exchange rate employed in this paper is given in terms of the Australian dollar per U.S. dollar. The Australian dollar-U.S. dollar exchange rate provides a broad indication of Australia's terms of trade.

The prices of major agricultural produce (AP) are used as an indicator of the well-being of the primary sector. A decline in agricultural prices can be accompanied by a higher bankruptcy rate in this sector. The bankruptcy-rate regression equation for primary industry includes the agricultural price index with 1985 as the base year. The agricultural price index is a weighted average of the price indices of sugar, wheat and wool, where the

weights are equal to the proportions of these commodities in their aggregate sale value.

Mineral prices (MP) are used in this analysis as an indicator of the well-being of the mining and quarrying sector. A decline in the world prices for minerals can lead to bankruptcies in the mining and quarrying industry. The bankruptcy-rate regression equation for the mining and quarrying industry takes this factor into account by employing the mineral price index with 1985 as the base year. The mineral price index is computed by a weighted average of the price indices of aluminium, bauxite, coal, iron ore, copper and lead, where the weights are the shares of these commodities in their aggregate sale value. Since the value of production of minerals in monetary terms is not available, the value of production of a commodity in dollars is calculated by the product of its price index and its volume of production in physical units of that commodity.

Being the largest importer of Australia's primary and mining products, Japan's gross domestic product (JGDP) is incorporated into the bankruptcy-rate regression equations for the primary production sector and the mining and quarrying sector. Moreover, JGDP is included in the bankruptcy-rate regression equations for the construction and the finance and property sectors, as Japanese investors hold a significant share of Australia's real estates (about 18 per cent of the foreign investment in this sector in 1992). A recession in Japan can lead to a decline in Japanese investment in those industries, and even to repatriation of Japanese capital. GDP figures of Japan in billions of 1985 U.S. dollars are incorporated into the bankruptcy regression equations of the construction and the finance and property industries.

New Zealand's gross domestic product (NZGD) in billions of 1985 US dollars is included in the manufacturing industry's bankruptcy-rate regression equation, as New Zealand is the largest importer of Australia's elaborately transformed manufacturing exports. A rise of NZGD is expected to increase

the demand for manufacturing exports and thereby to reduce the bankruptcy rates in the manufacturing industry

GENERAL ESTIMATION RESULTS

As indicated earlier the effects of the explanatory variables on the various industries' bankruptcy rates are estimated within sub sets of regression equations because of a limited number of degrees of freedom. Variables are taken in their first differences because of multicollinearity problems. Since the means of the differences of variables can have negative values, the estimated elasticities associated with the explanatory variables are obtained by multiplying the product of the estimated coefficient by the ratio of the mean of the explanatory variable to the mean of the dependent variables in absolute levels. Table 1 summarizes the estimated elasticities of the significant associations between differences of dependent and explanatory variables obtained with the 3SLS estimation method for the various sub sets of regression equations. Elasticities are reported only when estimation results are significant at the 5 per cent level. A plus/minus sign is shown when significant associations have been found in either direction. A detailed summary of the estimated coefficients of the variables in their first differences is given in Table A1 in the Appendix.

In general, the estimation results indicate that there is a consistency in all significant estimated coefficients across the various sets of bankruptcy-rate regression equations. In other words, the signs of the significant estimated coefficients with respect to a given exogenous variable have remained the same when estimated in equation systems with different specifications. This reflects the robustness of the effects of differences in these exogenous variables on changes in the bankruptcy rates. The empirical evidence obtained by the estimation with variables in their first differences also exhibits general consistency in most of the associations between changes in current and lagged

bankruptcy rates in the industries under consideration; between the change in current bankruptcy rate in one industry and that in another; as well as the association between the change in current bankruptcy rate in one industry and the change in lagged bankruptcy rate in another industry. The exceptions for such findings occur in the association between the current bankruptcy rates in the manufacturing industry and the construction industry and the association between the current bankruptcy rate in the manufacturing industry and the lagged bankruptcy rate in the construction industry.

The estimation results lend support to the presence of inter-industry linkages among the six Australian industries studied. That is, the bankruptcy rate in any given industry is found to be dependent on the bankruptcy rates in most, and in some cases, all of the other industries. They also support the survival of the fittest hypothesis. Namely, the current bankruptcy rate is negatively associated with the bankruptcy rate in the previous year in the industry under consideration for all industries.

GOVERNMENT POLICY INSTRUMENTS AND THEIR IMPLICATIONS FOR BUSINESS STABILITY

While the estimation results indicate no significant association between the industry bankruptcy rates and the state-government spending, the rates of bankruptcy in the primary production, manufacturing, building and construction and transport, storage and communication industries are found to be significantly associated with the federal-government spending. The rates of bankruptcy in the former two industries are positively associated with the federal-government spending and, in recalling the discussion of the expected effect of federal spending, the dominance of the crowding-out effect is evident. In contrast, the rates of bankruptcy in the latter two industries are negatively associated with the federal-government spending, indicating perhaps a dominant demand expansion effect. In view of these

findings, the Australian federal government should be aware of the possible trade-off associated with its fiscal policy: while a cut in the federal government spending may improve business stability in the construction and the transport, storage and communication industries, it may increase instability in the primary production and manufacturing industries.

Personal income tax rates were found to have significant associations with the bankruptcy rates in all of the industries studied. With the exception of the rates of bankruptcy in the primary production and manufacturing industries, bankruptcy rates in all the other industries studied are negatively associated with personal income tax rates. As indicated earlier a possible explanation to this negative association is that governments have a higher propensity to spend than the private sector and part of their spending is directed to purchasing goods and services from industries. In contrast, the positive association of the rates of bankruptcy in the primary production and manufacturing industries with personal income tax rates may suggest that a rise in income tax rates reduces significantly the firms' net profits and consumers' disposable income and, in turn, decreases the firms' derived demand and consumers' demand for goods produced by those industries more than the possible rise in the government demand.

To a certain extent, the effect of interest rate on bankruptcy rates is captured by the aforementioned fiscal policy instruments as well as by the money supply. Despite having insignificant effects on the bankruptcy rates in most of the industries studied, a rise in the interest rate is associated with a reduced bankruptcy rate in the finance and property industry. This finding is partially consistent with Melicher's and Hearth's (1988) finding of a negative relationship between business failures and the ninety-day Treasury Bill yield and with Post's and Moon's (1988) results of negative association between business failures and the prime lending rate in the United States. This finding differs from the results obtained by Platt (1989), Hudson and Cuthbertson (1993),

Platt, Platt and Pedersen (1994), and Bandopadhyaya (1994). This negative association suggests, perhaps, that high interest rates reflect an increase in the demand for financial services. Yet, it can also be explained by the responsiveness of capital inflow to changes in the interest rate, which can be beneficial to the finance and property industries. As you remember, it was expected that the rise in the cost of credit and the appreciation of the Australian dollar accompanying a hike in the interest rate would adversely affect the stability of the rest of the industries. This expectation has not been supported by the estimation results.

The estimation results indicate that the stability of the building and construction industry is adversely affected by increases in the money supply. This finding is consistent with the results obtained by Altman (1980), and may suggest that the negative effects of the inflationary pressure have dominated the positive effect of money supply on the cost of credit for contractors and the cost of servicing mortgages for investors during the observed period. In contrast, the stability of the primary production and the manufacturing industries is not hampered by increases in the money supply. This seemingly surprising result can be explained by other intervening factors which are not included in the analysis such as the degree of protection (e.g. tariffs and subsidies) enjoyed by the latter industries during periods of less restrictive monetary policy.

INDUSTRY-SPECIFIC AND DOMESTIC ECONOMIC FACTORS AND BUSINESS STABILITY

The industry concentration ratio does not have significant effects on bankruptcy rates in all the industries studied except the building and construction industry. The positive association between the rate of bankruptcy in the building and construction industry and the industry concentration ratio may merely be arithmetic and indicating the large effect of a bankruptcy incident on bankruptcy rate as this industry becomes more concentrated.

Industrial disputes are positively associated with the rate of bankruptcy in the mining and quarrying industry, but negatively associated with the rate of bankruptcy in the building and construction industry. The former positive association may suggest that the mining and quarrying industry is susceptible to the adverse effects of industrial disputes. In contrast, the latter negative association may reflect the increased probability of industrial disputes in periods of economic upturns rather than in periods of recession in which employees refrain from striking and risking their employment.

Housing prices are negatively associated with the rates of bankruptcy in the building and construction industry and the finance and property industry. These negative associations can possibly be a reflection of the considerable effect of demand fluctuations on housing prices.

The average real wage rate in the manufacturing industry is negatively associated with the rate of bankruptcy in this industry. This finding is different from the results obtained by Platt and Platt (1994) with U.S. data. It is possible that the significant negative association reflects employees' acceptance of real wage cuts when a company is experiencing financial distress in order to protect their jobs.

It is interesting to note that per-capita income within a state is generally positively associated with industry bankruptcy rates in that state, whereas per-capita incomes in other states have negative association with industry bankruptcy rates that indicate, perhaps, significant spill-over effects. The adverse effects of a rise in per-capita income within a state on its industry bankruptcy rates may be explained by the aforementioned mushroom and cobweb phenomena.

INTERNATIONAL ECONOMIC FACTORS AND BUSINESS STABILITY

The estimation results indicate that over the observed period a depreciation of the Australian dollar has improved the stability of

the mining and quarrying industry and the financial and property industry. These results are consistent with our expectations and the findings of Goudie and Meeks (1991) with U.K. data.

As expected, world prices of agricultural and mineral products are negatively and significantly associated with the rates of bankruptcy in the primary production and the mining and quarrying industries, respectively. The former association suggests that the decline in primary products' prices stemming from the expansion of production capacity raises the probability of business failure in the primary production industry. The latter finding can be explained by the strong export-orientation of the Australian mining and quarrying industry.

Japan's GDP is significantly and positively associated with the rate of bankruptcy in the primary production industry, and significantly and negatively associated with the bankruptcy rates in the mining and quarrying and the building and construction industries. Moreover, the estimated associations are substantial. A possible explanation for the former association is that Japanese consumer spending shifts in favor of primary products produced by Australia's rivals and in favor of non-primary products as consumer income rises. The latter associations suggest the dependence of Australia's mining and quarrying industry on the Japanese demand as well as the dependence of the building and construction industry on Japanese investment in Australian real estates. In contrast, no significant association is found between New Zealand's GDP and the rate of bankruptcy in the manufacturing industry.

CONCLUSION

This paper proposes an integrative and dynamic approach to business failure which incorporates the effects of inter-industry linkages, lagged bankruptcy rates, industry-specific factors and domestic and international economic conditions on industry

bankruptcy rates. The empirical findings suggest that previous year's bankruptcy rate, bankruptcy rates in other industries and domestic and international economic conditions are important determinants of business failures in Australia. The statistically significant associations between industry bankruptcy rates suggest the existence of interdependence among the industries studied. Most of these associations are found to be positive and, therefore, indicate that bankruptcy in one industry can inflict a 'domino' impact on other industries.

In addition, the estimation results of the simultaneous-equation system support the survival of the fittest hypothesis. There is strong evidence for a significant negative association between current and lagged bankruptcy rates in any given industry. Bankruptcy is, therefore, an issue which is not only important in its current effect, but also in its extended implication for subsequent years.

A number of economic variables are found to be significantly associated with business bankruptcy rates. They include industry-specific variables such as the number of industrial disputes, housing prices and manufacturing wage rate; domestic economic variables such as state per-capita income, federal government spending, personal income tax rate, interest rate and money supply; and international economic factors such as exchange rate, world prices and Japan's GDP. Among these variables, government policy instruments are found to have relatively large effects on the rates of bankruptcy.

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APPENDIX

Data Definition and Sources

Business Bankruptcy Rate (BR): BR is computed as the ratio of the number of business bankruptcies to the total number of firms in the industry. The latter is proxied by the total number of business taxpayers in that industry.

Source: The data for the number of business bankruptcies are obtained from the Commonwealth Government, Annual Report on the Operation of the Bankruptcy Act 1966, AGPS, Canberra, 1969-1993, administered by the Attorney General (1966-74, 1981-89), Minister for Business and Consumer Affairs (1975-80) and Inspector General in Bankruptcy (1990-93). Data for the total number of business taxpayers are obtained from the annual issues of Taxation Statistics, published by the Department of Taxation.

Concentration Ratio (CR): CR is the reciprocal of the total number of firms in an industry. The total number of firms in an industry is proxied by the total number of business taxpayers in that industry.

Source: Data for the total number of business taxpayers are obtained from the annual issues of Taxation Statistics, published by the Department of Taxation.

Industrial Disputes (DIS): DIS is defined as the total working days lost per one thousand workers.

Source: Australian Economic Statistics, 1949-1989 and Reserve Bank of Australia Bulletins, Reserve Bank of Australia (RBA).

Housing Prices (HP): HP is the weighted average of the housing prices of the Australian eight capital cities.

Source: DX Data, ABS Time Series Service.

Annual Average Manufacturing Real Wage Rate (MW): MW is the annual total salaries and wages in the manufacturing industry divided by the total number of employees in that industry and deflated by the implicit price deflator of GDP. Expressed in constant 1990 prices.

Source: The data for annual total manufacturing salaries and wages are obtained from the United Nations Industrial Development Organisation (UNIDO) Industrial Statistics 1994 (3-digit level of ISIC code on diskette), UNIDO. The total number of employed persons in the manufacturing industry is extracted from The Labour Force, Australia, ABS (Cat. No. 6203.0).

Per-Capita Income within a State (SY): SY is defined as the state contribution to Australia's GDP at factor cost divided by the state population. Since GDP figures are available in current prices, the implicit price deflator of GDP has been applied to represent the GDP figures at constant 1990 prices.

Source: The data for state contribution to GDP in current prices are extracted from Australian National Accounts: State Accounts, Australian Bureau of Statistics (ABS) (Cat. No. 5220.0). State population data are obtained from Monthly Summary of Statistics, ABS (Cat. No. 1304.0). The implicit price deflator of GDP is extracted from Australian National Accounts: National Income and Expenditure, ABS (Cat. No. 5204.0).

Per-Capita Income in other States (OY): OY is measured as a ratio of the GDP at constant 1990 prices for Australia, excluding the state under consideration, divided by the population of Australia.

Source: As for per-capita income within a state (SY).

State Government Spending (SG): SG is the implicit price deflator of total government expenditure used to convert current values into 1990 prices.

Source: Data for state government spending in current prices are obtained from Australian National Accounts: State Accounts, ABS (Cat. No. 5220.0). The implicit price deflator of total government expenditure is extracted from Australian National Accounts: National Income and Expenditure, ABS (Cat. No. 5204.0).

Federal/ Commonwealth Government Spending (CG): CG is the implicit price deflator of total government expenditure used to convert current values into 1990 prices.

Source: Data for state government spending in current prices are obtained from Government Financial Estimates, ABS (Cat. No. 5501.0).

Personal Income Tax Rate (T): T is the maximum marginal personal income tax rate.

Source: Australian Economic Statistics, 1949-1989, and Reserve Bank of Australia Bulletins, RBA.

Interest Rate (R): R is the ninety-day bank-accepted bill yield.

Source: Reserve Bank of Australia Bulletins, RBA.

Money Supply (M): M is represented by M3 which is currency plus all bank deposits of the private non-bank sector. An implicit price deflator of GDP is used to convert the figures into 1990 prices.

Source: Reserve Bank of Australia Bulletins, RBA.

Exchange Rate (ER): ER is given in terms of Australian dollar vis-à-vis U.S. dollar.

Source: International Financial Statistics Yearbook 1993, International Monetary Fund (IMF).

Agricultural Prices (AP): AP is a weighted average of the price indices of sugar, wheat and wool which are weighted by the proportion of the commodities' production in the total value of production of all three commodities, and is given in 1985 prices.

Source: World price indices of major agricultural commodities are obtained from International Financial Statistics Yearbook 1993, IMF. The value of production of the commodities is extracted from Australian Economic Statistics 1949-1989, and Reserve Bank of Australia Bulletins, RBA.

Mineral Prices (MP): MP is a weighted average of the price indices of aluminium, bauxite, coal, iron ore, copper and lead where the weights are the proportion of these commodities' production in the total value of production of all six commodities, and is given in 1985 prices.

Source: World price indices of major agricultural commodities are obtained from International Financial Statistics Yearbook 1993, IMF. The prices and volume of production of the commodities are extracted from Commodity Statistical Bulletin 1994, Australian Bureau of Agricultural and Resources Economics (ABARE).

Japan's Gross Domestic Product (JGDP): JGDP is represented in billion of US dollars at 1985 prices.

Source: International Financial Statistics Yearbook 1993, IMF.

New Zealand's Gross Domestic Product (NZGDP): NZGDP is represented in billion of US dollars at 1985 prices.

Source: International Financial Statistics Yearbook 1993, IMF.

Table 1: Estimated bankruptcy rate elasticities

Explanatory Variable	Dependent Variable					
	br_{1t}	br_{2t}	br_{3t}	br_{4t}	br_{5t}	br_{6t}
BR_{1t}		1.491 to 2.409	0.625 to 0.741	±	0.434	1.481 to 2.181
BR_{2t}	0.223 to 0.401		-0.270			0.368
BR_{3t}				±	0.734 to 0.864	1.846 to 2.077
BR_{4t}	0.540	0.643	±		0.423 to 0.671	0.904 to 1.574
BR_{5t}	0.734 to 1.193		0.653 to 1.232	1.429		-3.052 to -3.166
BR_{6t}	0.484 to 0.730	1.599	0.536 to 1.342	1.193		

Explanatory Variable	Dependent Variable					
	br_{1t}	br_{2t}	br_{3t}	br_{4t}	br_{5t}	br_{6t}
BR_{1t-1}	-0.301 to -0.453	0.622 to 0.879	0.320	0.315		0.909
BR_{2t-1}		-0.309 to -0.790				0.256
BR_{3t-1}	-0.475		-0.272 to -1.495	0.661	0.251 to 0.384	0.648 to 0.802
BR_{4t-1}		0.537 to 0.542	±	-0.234 to -0.871	0.268 to 0.593	
BR_{5t-1}		0.812 to 1.324	0.362 to 0.863	0.928	-0.219 to -0.668	
BR_{6t-1}	0.213	0.494 to 0.654	0.190	0.325	0.204 to 0.268	-0.250 to -0.360
CR_{t-1}				0.616 to 0.922		
DIS_{t-1}		0.491 to 0.739		-0.196 to -0.402		
HP_{t-1}				-2.785 to -11.509		-4.529 to -5.160
MW_{t-1}			-2.846 to -4.715			
SY_{t-1}	-0.159		0.092 to 0.205	0.178 to 0.352	0.135 to 0.189	0.546
OY_{t-1}	-0.667 to -1.167			-1.300	-0.524 to -1.222	-1.729 to -2.299
HP_{t-1}				-2.785 to -11.509		-4.529 to -5.160
MW_{t-1}			-2.846 to -4.715			
SG_{t-1}						
CG_{t-1}	5.239 to 8.723		6.022 to 9.393	-10.141	-3.943 to -6.845	
T_{t-1}	6.215 to 15.147	-11.733 to -35.2	6.994	-5.116 to -10.839	-3.633 to -4.552	-23.000
R_{t-1}						-1.319
M_{t-1}	-4.423		-3.143 to -3.809	7.044		
ER_{t-1}		-3.926 to -9.513				-4.636
AP_{t-1}	-0.721 to -1.803					
MP_{t-1}		-1.373 to -1.872				
$JGDP_{t-1}$	1.469 to 3.664	-3.435 to -8.436		-1.584 to -2.473		
$NZGDP_{t-1}$						