4. Method

The data set which will be analysed to address the research questions introduced in Chapter 1 consists of all of the qualifying firms listed in UBD Directories as carrying on business in Armidale, NSW during the period 1953 - 1988. Counting each firm, each year as an observation, there are almost 11,000 firms in the population.

This data set allows us to gain an understanding of the differences between different kinds of businesses by holding the context in which the firms operate constant. That is, in any given year, all businesses face the same local environmental and macro-environmental factors. Their relative success or failure depends on individual and industry variations only.

This chapter addresses methodological issues beginning with how data was collected and interpreted, then describing the calculation of the index of managerial competence, and finally discussing statistical topics: the overall analytical strategy, the choice of statistical methods, and data transformations required to better fit statistical methods.

4.1 Data Collection and Interpretation Issues

4.1.1 Use of a Directory

There are obviously a wide range of data collection approaches available for studies of small business failures.

When the analytical approach being used is cross-sectional (i.e. when observations are to be made at one specific point in time), a survey methodology is appropriate. The researcher would obtain current information about a sample of firms in whatever

universe had been chosen, and would apply MDA or regression techniques to find "causes" of failure. Much of the work aimed at predicting individual firm failures uses this sort of survey-based, cross-sectional approach.

Other cross-sectional studies such as those of Sorby-Adams and Kiel (1981) and Peacock (1985a) use lists of failures (bankruptcies) provided by the court system.

The characteristic of using lists as a data source is that the researcher is usually unable to readily obtain firm-specific information other than what is provided on the specific list used. When a current list is used for cross-sectional work it might be possible to approach companies on the list for additional information. When the list is a specialised one, as was the list used by Williams for his longitudinal study (1982a), the developer of the list may have additional information. Williams had access to bank records of insolvent companies, for example. In general, however, the researcher must work with the data in the list alone.

This drawback, and those described by Mansfield (1962), are offset by at least two advantages of using lists. The first is that information covering a long period of time is available. The previously cited work of Hutchinson, Hutchinson and Newcomer (1938), for example, covered ninety years of business births and deaths in one city in New York state, while Baum and Mezias (1992) studied ninety-two years of the hotel industry in New York City, and Delacroix *et al.* (1989) studied 45 years of the California wine industry. The longitudinal nature of this sort of study allows conclusions to be drawn about the impact of items such as, for example, interest rates which would not vary (and hence could not be used as explanatory variables) in a cross-sectional study.

Secondly, the lists cover all of the population of firms in a given universe. Thus the studies are not subject to sampling fluctuations. When multiple regression is being used as an analytical tool, the stochastic interference term is a surrogate for missing variables alone, not for missing variables and sampling fluctuations.

The advantages and disadvantages of using what amounts to a saturation sample provided by a time series of directories is well-summarised by Swaminathan and Delacroix (1991):

> Ecological research pays for the temporal extensiveness of its coverage with a shortage of detailed data on the individual organizations in the population it studies. The sheer number of organizations considered alone tends to make it prohibitively onerous to collect data on any but a few features of each organization. The extinct status of many of these organizations further limits data gathering . . . Few of the compilers of the archival sources on which [we] rely have had the forethought and the good taste to anticipate what our requirements will be.

Carroll (1988) provides a list of ecological studies of business foundings and disappearances.

4.1.2 Choice of UBD

United Business Directories (UBD) of North Ryde, NSW began compiling directories of businesses in New South Wales after the Second World War. The first directory which included Armidale was published in 1953. The directory has been published annually ever since.

The only other directory which provides continuous coverage for the same period is the telephone directory published by Telecom. Telecom Yellow Pages provide much of the same information available in UBD directories, that is, for each year they show a list of companies divided into business categories. Yellow Pages directories have been used by a number of researchers including, for example, Kalleberg and Leicht (1991). Three reasons make UBD the preferred source, however.

First, the coverage of firms is likely to be better in the UBD directories. The UBD employees who compiled the directories were paid for each entry. Thus they had (and

have) an incentive to include as many businesses as possible in the directory. This means that the UBD directories for Armidale list all (or almost all) Armidale businesses. Yellow Pages for Armidale include all business telephone subscribers in Armidale. The incidence of having a telephone has undoubtedly increased over the years, which implied that there were some businesses in the early part of the 1953 - 1988 period which did not have phones. Thus use of Yellow Pages would understate the population of businesses early in the period. Moreover, to the extent that having a business telephone line rather than a residential line costs more, there is an incentive for businesses to operate from residential lines rather than business lines if they can get away with it. This means that the Yellow Pages likely do not include all businesses even later in the period when the use of telephones was close to universal.

Second, the Yellow Pages provide marginally less information than UBD. Although the Yellow Pages uses almost 1400 different business categories and the UBD directories just over 700, the telephone subscriber must pay extra for listings in more than one category whereas the business listed in UBD does not. So the UBD listings tend to include a given business in more categories than the Yellow Pages. The number of categories in which a firm is listed is an important measurement of the degree to which the business has worked to diversify its activities.

Third, it proved possible to track down UBD Directories for each of the years 1953 - 1988. Some were located in the University of New England, others at the State Library of New South Wales, and one at the UBD Head Office. It was not possible to find a complete set of Yellow Pages for the same period.

4.1.3 Multiple Entries for One Firm

As noted above, many firms chose to be listed in more than one category in the UBD Directory. Thus a firm like I.W. Burgess (which is a general merchant serving, primarily, the pastoral community) might be listed under "China and Glassware Dealer", "Electrical Supplies Retailer", "Furniture", "Garden Supplies", "Grocer",

"Hardware and Building Supplies", "Kitchenware Retailer", "Painters' Supplies", "Plumbers' Supplies", "Solid Fuel Heaters and Fireplaces", etc. Or a firm such as K.G. Motors might be engaged in activities as diverse as "New Car Sales", "Used Car Sales", "Motor Repairs", and "Insurance Sales".

For purposes of analysis, the firm must be placed into a single category. So an attempt was made to characterise the predominant nature of the business being conducted. For L.W. Burgess, the predominant business was supply of construction material. For K.G. Motors it was automotive sales. This process was required for most of the firms in the population. Few were very difficult decisions, although some did end up being debatable.

The difficulty increased as the level of diversification of the firms increased. Thus, for example, when a car dealer also sells insurance it is easy to characterise the business as selling cars. But when the firm is engaged in ten different businesses, the characterisation is less certain.

A by-product of the characterisation exercise is a measure of the degree to which the firm has sought to spread its risk (or better serve its customers) through diversification. This measure is used as a variable bearing on managerial competence.

4.1.4 Discontinuities

In a relatively few instances the data from the UBD directories showed discontinuities. That is, a firm with a fixed address over a few years disappeared for a year and then reappeared at the same address. This seemed more likely to be a data entry error or a data collection mistake than a genuine "disappearance". Accordingly, in the dozen or so instances in which a discontinuity was observed, the apparently missing data was interpolated.

4.2 Index of Managerial Competence

DiPietro and Sawhney (1977) argued that managerial competence could be thought of in two ways. In a static world, managerial competence is ". . . management's ability to adjust to a given situation" (197', 5). Dynamic managerial competence is the firm's ability to adjust to changes in the situation. To test for static managerial competence, they used data on listed U.S. firms for the period 1920 through 1975. They regressed failure rate on time and found the following result:

$$FR = 92.98 - 1.20485T$$

where FR is failure rate per 10,000 firms and T is time. They concluded that as each year went by, the static managerial competency increased so as to reduce the failure rate by 1.2 per 10,000.

To test for dynamic managerial competency, they then partitioned the data and ran two regressions of failure rate on GNP. The results are shown with the Cochrane-Orcutt (1949) adjustment used for serial correlation:

Improvements in GNP reduce failure rates in both periods, but the impact of GNP is lower in the second period which suggests that dynamic managerial competence had increased from the first period to the second (1977, 13). There is no ready way to incorporate this insight into statistical analysis of Armidale small business failures because the time periods of the two studies are different. What can be used is an index of static managerial competence for Armidale in the period 1954 - 1986 calculated using the DiPietro and Sawhney method (with GDP rather than GNP used). The resulting figure for change in static managerial competence is +.036% per year, and the index was constructed accordingly.

Exhibit 4

DiPietro and Sawhney Analysis of Dynamic Managerial Competence

1920 - 1945

FR = 124.218 - .943882GNP R^2 = .3274
(1.93169) (-3.24589) n = 25
D-W = 1.2855

1945 - 1975

FR = 29.3260 - .15674GNP R^2 = .1893
(2.29166) (-2.55693) n = 30
D-W = .9090

Source: DiPietro and Sawhney (1977 13)

4.3 Statistical Issues

Statistical issues will be discussed under three headings: The overall statistical strategy, choice of statistical methods, and required data transformations.

4.3.1 Statistical Strategy

Three different types of analysis will be carried out.

In the first, descriptive statistics will relate failure rates to a variety of single, firm-specific factors such as business age, type of business, degree of diversification, and level of competition. This will serve to provide the reader with an overview of the data

and will allow certain conclusions to be drawn about which variables are most likely to impact on the probability of failure of individual firms.

In the second, failure rate by year will be related to year-specific variables such as population, Gross Domestic Product (GDP), and share prices. This is some test of the contribution of local environmental and macro-economic variables to rates of failure even if it says little about the failure of individual firms.

Finally, all of the available and appropriate independent variables will be used to inquire into influences on the failure of individual firms.

4.3.2 Statistical Methods

4.3.2.1 For descriptive statistics Two criteria were used to choose the descriptive measures to be used. First, it was felt desirable to use the same statistical measure to describe all of the non-firm-specific variables. This would allow some comparability. Second, the statistical measure used must be valid. Given that some of the variable items are nominal or ordinal scaled, this has meant choice of a non-parametric measure.

Among the best known non-parametric tests is χ^2 which tests whether an observed distribution of values varies from what might be expected to occur by chance. Among the conditions for valid use of χ^2 are:

> The sample observations are independent of each other, sample data are drawn at random, data are in original units rather than percentages or ratios, there are at least 50 observations, and there are at least 5 observations in each cell. (Leabo 1972, 523)

The 10,000+ sample observations substantially meet all of these requirements. Accordingly, χ^2 will be used to provide descriptive statistics.

By way of adding to the descriptive statistics and confirming the χ^2 findings, a two sample *t* test (assuming unequal variances) will be performed on each of the independent variables. To further refine the analysis, the issue of failure rate by age will be investigated using Multiple Discriminant Analysis. That is, the findings on failure rate by age of the business will be tested to see whether the clusters of failures have different characteristics.

4.3.2.2 For analysis of failure rates Failure rates for each year from 1954 to 1986 can be calculated and related to year-specific variables such as economic measurements, population, and presence/absence of a local member in the State government. Although these variables represent a mix of categorical and numerical items, the dependent variable, failure rate, is numerical so a standard regression analysis will be carried out.

4.3.2.3 For analysis of probability of individual firm failure The nature of the variables to be analysed is a major determinant of the analytical method to be used. The independent variables are a mix of categorical items (e.g. presence or absence of drought, party in power nationally) and numerical items (e.g. number of franchised competitors, age of the business). The dependent variable is a bi-variate, fail/don't fail.

This mix rules out ordinary regression, which is restricted to numerical dependent variables. It also rules out discriminant analysis which demands numerical independent variables. Log-linear analysis is not appropriate because it demands that all independent variables be categorical (Darlington 1990, 84).

This leaves logistic regression (logit and probit) and survival analysis as appropriate analytical methods.

Survival analysis is most useful in modelling the conditional probability that an event will occur given that some other event has occurred. Logistic regression, on the other hand, models the unconditional probability of the event occurring. Thus, for predicting the likelihood of an event, logistic regression is the preferred methodology; for

predicting the likelihood of the event given some contingent event, use survival analysis (Morita *et al.* 1993).

For the current study, logistic regression is most appropriate (Keasey and McGuinness 1990). Indeed, this approach was suggested by Tippett (1982) as a useful way of analysing longitudinal data on failures in Australia.

Logit analysis generally requires that independent variables be normally distributed and this cannot be assured for the data being considered here. Probit analysis, on the other hand, can use a mix of numerical and categorical regressors (Darlington 1990, 455 *et seq.*). Accordingly, probit will be used to analyse the failure probability of individual firms.

In probit analysis, a least squares regression is carried out to obtain starting values. Then maximum likelihood estimates are developed using Newton method multiple iterations (Greene 1992, 429). The test of overall fit with the model is to compare log likelihood estimates from the model with those derived from using no variables (or, more correctly, from variables with no slope) using a χ^2 test. This can be expressed as

χ^2 = 2 (absolute differences in log likelihood estimates)
with *df* = number of independent variables - 1

4.3.3 Data Transformations

The categorical data which has been collected presents little in the way of analytical problem (beyond its impact on statistical methodology).

The numerical independent variables do, however, present some difficulties. Two areas of difficulty arise from collinearity concerns.

First, the numerical regressors are time series, a number of which are expressed in current dollars. To the extent that there has been inflation over the study period, the regressors would have appeared to grow even if no real growth had taken place. It is important to transform these data by adjusting for inflation. This has been done using the inflation rates shown in Appendix D.4 Inflation Rates in Australia (Wittink 1988, 260)

The second problem arises from the fact that other regressors grow with growth in the economy (Gross Domestic Product, even if expressed in constant dollars, is one example) and would thus be autocorrelated (Leabo 1972, 446). The solution here is to express the regressor in terms of change rather than as an absolute value. Accordingly, such independent variables have been transformed into percentage changes year to year (Wittink 1988, 261).

Closely related is another concern which relates to the use of indices rather than absolute numbers. Arguably, the impact of, say, wool prices on business survival lies less in the level of the price index and more in changes in that level. This may arise because spending patterns depend not on "how well we are doing financially" in some absolute sense (as measured by an index), but "how well we are doing" compared to last year. Thus we are led to transform indices to percentage changes year to year.

Some of the independent variables can be expected to change with changes in population. If the population of Armidale doubles we might expect the number of, say, newsagencies to double. Or, at least, we would not be prepared to say that the level of competition doubled if the number of newsagencies doubled over the same period that population was doubling. To adjust for this phenomenon, measures of competition have been transformed by dividing by the population of Armidale (Wittink 1988, 261).

Finally, in order that all variables be of roughly the same order of magnitude (Greene 1992, 75) the scale of some variables (such as population of Armidale) has been reduced by dividing by a factor of ten, or one hundred, or one thousand, or one million (as appropriate).

* * * * *

The methods to be employed in analysing the data for fit with the model (see Chapter 3) have been described in Chapter 4.

In the next chapter, the results of the analysis are set out.

5. Findings

5.1 Descriptive statistics

The study comprises 10,764 observations where each year in which a business operates constitutes one observation. The time period of the observations is 1954 to 1986. Of the 10,764 observations, 807 or 7.50% were of businesses in their final year before disappearance.

By way of describing the observations in greater detail, each of the categorical independent variables was related to failure rate to determine the degree to which the variable was associated with the average failure rate of 7.50%. These descriptive statistics were tested using χ^2. That is, the probability of the observed failure rates arising as a random variation from the average rate of 7.50% was calculated. These results are described below.

5.1.1 Failure Rates by Type of Business

Table 5.1 shows the proportion of businesses that survived or died in each of the industries being studied.

Table 5.1

Failure Rates by Type of Business

Industry	Survived	Died	Failure Rate
Agricultural Supplies and Services	511	42	7.60%
Automotive	1276	103	7.47%
Consumer Goods	1813	137	7.03%
Construction	1813	164	8.30%
Financial Services	392	27	6.44%
Food Suppliers	1521	141	8.48%
Hospitality	913	39	4.10%
Office and Other Supplies and Services	962	89	8.47%
Transportation	756	65	7.92%
Total	9957	807	7.50%

χ^2 $p = 0.004245$

The chance that the actual failure rates by type of business arose by chance is about 250 to 1 against. We conclude that there are significant differences in failure rates among different kinds of business. More specifically, the hospitality industry has a lower than average failure rate. This perhaps reflects the difficulty of achieving insolvency in an Australian hotel situation when the principal business of the hotel is selling beverage alcohol. The financial services industry also has a somewhat lower than average failure rate.

5.1.2 Failure Rates by Level of Diversification

There is an extremely low probability that the differential failure rates shown in Table 5.2 arose by chance. It appears that the likelihood of failure declined considerably as the diversity of the firm increased. This may, however, be as much a function of the size of the firm as of its diversity, since the more diversified firms tend to be larger than those engaged in only one line of activity.

Table 5.2

Failure Rates by Level of Diversification

Number of Businesses*	Survived	Died	Failure Rate
One	5851	593	9.20%
Two to Six	3597	205	5.39%
Seven or More	499	9	1.77%
Total	9957	807	7.50%

χ^2 p = 4.54E-17

* Number of businesses in which the individual firms reported being engaged

5.1.3 Failure Rates by Level of Competition

The next three tables show the failure rates of firms based on the level of competition which they must meet in the market. Table 5.3 relates failure rates to total number of competitors, Table 5.4 considers competition from chains or branches of larger firms. Table 5.5 looks at competition from franchises.

There is a probability of about one in six that the actual distribution of failure rates by level of overall competition arose by chance. Accordingly, no conclusions can be drawn with any great confidence. Note, however, that failure rates do seem to increase modestly with increases in the level of overall competition.

Table 5.3

Failure Rates by Level of Overall Competition

Number of Competitors	Survived	Died	Failure Rate
0 - 4	1819	130	6.67%
5 - 9	2509	186	6.90%
10 - 14	1640	142	7.97%
15 - 19	1095	88	7.44%
20 or More	2894	261	8.27%
Total	9957	807	7.50%

χ^2 p = 0.157827

Table 5.4

Failure Rates by Level of Chain/Branch Competition

Number of Competitors	Survived	Died	Failure Rate
None	7579	632	7.70%
One	1748	142	7.51%
Two or More	630	33	4.98%
Total	9957	807	7.50%

χ^2 p = 0.037941

The probability that this distribution arose by chance is about one in twenty-five, which suggests that at least tentative conclusions can be drawn. It appears that failure rate declines as the level of competition from branches or chains increases. On the face of it,

this is counter-intuitive and contrary to the hypothesis set out earlier. It may reflect the fact that such competition is not randomly distributed across industries. For example, banks would qualify as branch competitors of locally-owned credit unions which one would expect to have a low failure rate.

Table 5.5

Failure Rates by Level of Franchised Competition

Number of Competitors	Survived	Died	Failure Rate
None	7723	608	7.71%
One	1123	72	6.03%
Two	326	31	8.68%
Three	212	15	6.61%
Four or More	1023	81	7.34%
Total	9957	807	7.50%

χ^2 $p = 0.258243$

The χ^2 probability is too high to allow any sensible conclusions to be reached about the impact of franchised competition on failure rate.

5.1.4 Failure Rates by Age of Business

Table 5.6 sets out the relationship between failure rate and age of the business.

The probability of this distribution occurring by chance is very small.

Table 5.6

Failure Rates by Age of Business

Age of the Business	Survived	Died	Failure Rate
1	923	96	9.42%
2	976	96	8.96%
3	840	75	8.20%
4	754	47	5.87%
5	676	57	7.78%
6	604	68	10.12%
7	529	59	10.03%
8	490	38	7.20%
9	469	30	6.01%
10	396	40	9.17%
11	347	39	10.10%
12	289	20	6.47%
13 or More	2664	142	5.06%
Total	9957	807	7.50%

χ^2 p = 1.04 E-7

There appears to be a tri-modal distribution of failures, with peaks occurring in the very early years, at age six and seven, and again in years ten and eleven. This is a very interesting finding, because it appears to support all of the researchers who have investigated the field and arrived at contradictory conclusions.

Stinchcombe (1965) hypothesised a "liability of newness" which would explain a higher failure rate among newly established businesses. He has been supported by a long list of investigators including Carroll (1983), Freeman, Carroll, and Hannan (1983), Singh *et al.* (1986), Hannan and Freeman (1989), Churchill (1955), and Ganguly (1983). The data from Armidale reveal a higher than average failure rate at age one, with progressively decreasing rates at ages 2, 3, and 4.

Bruderl and Schussler (1990) argued a "liability of adolescence" rather than newness. Singh *et al.* (1986) found maximum failure rates in a Canadian sample at age 6. The Armidale data show higher failure rates at ages 6 and 7 than at start-up.

Aldrich and Auster (1986) suggest that there may be a "liability of age". The Armidale data show a third peak in failure rates at age 11.

Multiple Discriminant Analysis was used to attempt to understand why there where three modes in age at failure: years 1,2 and 3; years 6 and 7; years 10 and 11. Table 5.7 shows the resulting structure matrix

Of the two canonical discriminant functions, the first, which had Change in Sheep Price Index, Change in GDP, having a local member in the State government, Change in Lamb Price Index, Change in Liquidity, and having a local member in the State cabinet, as its most important discriminating variables was effective in discriminating between early age failures (years 1, 2 and 3) and failures in later modal periods (years 6 and 7; years 10 and 11). The group centroids were .46326, -.58293, and -.62857 respectively for the three periods.

The second canonical discriminant function, which had Change in Wool Price Index, Liquidity, Stock Price Index, Population, the Index of Managerial Competence, and GDP as its most important discriminating variables, was about equally effective in discriminating among the three periods. Group centroids were .01093, -.54987, and .84701 respectively.

The percentage of grouped cases correctly identified was 60.5%, producing a Cohen's Coefficient of Agreement ($K = \Sigma f_0 - \Sigma f_e / n - \Sigma f_e$) of .377. This indicates a modest level of difference among the three time periods.

Table 5.7

Structure Matrix

(Pooled with-in groups correlations between discriminating variables and canonical discriminant functions)

Variable	Function 1	Function 2
Location	-	-
Number of Divisions	-	-
Competitors	-	-
Franchised Competitors	-	-
Chain Competitors	-	-
Competitors/Population	-	-
Franchised Comp./Population	-	-
Chains/Population	-	-
Population	.315	-
Wool Price Index	-	-
Sheep Price Index	-	-
Lamb Price Index	-	-
Cattle Price Index	-	-
Drought/No Drought	-	-
Member in State Cabinet	.243	-
Member in State Government	.305	-
GDP	-	.299
Liquidity	-	.337
Stock Exchange Index	-	.327
Inflation Rate	-	-
Interest Rate	-	-
Party in Power Nationally	-	-
Δ Stock Price Index	-	-
Δ Wool Price Index	-	.349
Δ Sheep Price Index	.333	-
Δ Lamb Price Index	.292	-
Δ Cattle Price Index	-	-
Index of Managerial Competence	-	-.315
Δ Population	-	-
Δ Liquidity	-.284	-
Δ GDP	-.324	-

Comparing the average levels of the variables in each of the three periods suggests that early disappearances are characterised by a macro-environment which in many respects

is less friendly than for later disappearances (the stock index is lower, GDP is lower, there is less liquidity), and by a local environment which in some ways is more challenging

Table 5.8

Average Value of Variables for Different Disappearance Ages

Variable	Ages 1, 2, & 3 (n = 267)	Ages 6 & 7 (n = 127)	Ages 10 & 11 (n = 79)
Location	.102	.096	.063
Number of Divisions	1.56	1.50	1.67
Competitors	17.4	18.3	19.5
Franchised Competitors	1.03	.837	1.29
Chain Competitors	.257	.295	.418
Competitors/Population	.096	.097	.099
Franchised Comp./Population	.005	.005	.007
Chains/Population	.001	.002	.002
Population	18129	18337	19614
Wool Price Index	61.4	64.2	72.4
Sheep Price Index	38.7	40.4	45.9
Lamb Price Index	45.1	47.1	52.5
Cattle Price Index	48.2	50.8	57.9
Drought/No Drought	.253	.279	.342
Member in State Cabinet	.182	.160	.190
Member in State Government	.438	.424	.532
GDP	122	127	140
Liquidity	4309	4452	4907
Stock Exchange Index	340	374	441
Inflation Rate	4.85	5.02	5.35
Interest Rate	7.24	7.41	8.08
Party in Power Nationally	.51	.22	.30
Δ Stock Price Index	7.65	8.30	8.86
Δ Wool Price Index	-5.89	-.09	2.08
Δ Sheep Price Index	-10.96	-8.82	-7.91
Δ Lamb Price Index	-8.14	-8.00	-6.79
Δ Cattle Price Index	3.89	3.49	3.73
Index of Managerial Competence	7.42	7.21	7.45
Δ Population	2.27	2.08	1.91
Δ Liquidity	3.86	4.51	5.13
Δ GDP	4.84	4.69	5.12

(wool, sheep and lamb price indices all moving downwards more quickly than for later disappearances). Those firms that exhibit a terminal disability of old age (i.e. those that disappear at ages 10 or 11) have more competition from chains, are more likely to be in a drought when they fail, and to be in a period of higher inflation, higher interest rates, and more volatile liquidity and GDP. On most of the variables, firms that failed during adolescence were intermediate between early and late failures. An exception is that adolescent failures were much less likely to have failed with a Labor government in power nationally. Early failing firms were over-represented in the Hospitality industry and in Office & Other (twice as high a proportion as late failing firms). Twice as many adolescent firms than young or old firms proportionally failed in Agricultural Goods and Services, and 50% more than young firms failed in Transportation. Old age failures were over-represented in Financial Services (three times as many as average) and in Consumer Goods (one-third more than expected).

Table 5.9

Canonical Discriminant Functions

Function	#1	#2
Eigenvalue	.28015	.20236
Percent of Variance	58.06	41.94
Cannonical Correlation	.467802	.410245
Wilkes' lambda	.649691	.831699
Chi-squared	196.22245	83.84947
P	< .0001	< .0001

Table 5.9 shows other information on the two functions. Appendix E shows the territorial map for the two functions.

Overall, the survival rate shown below is significantly lower than that reported by Litvak and Maule (1980) for their small sample of Canadian businesses. They found that, of a sample of 47 small businesses that they tracked for ten years, all survived at least five years and 62% survived for the full ten years.

Table 5.10

Survival Rates of Armidale Small Businesses

Age	% Surviving
0	100.0
1	90.6
2	82.5
3	75.7
4	71.3
5	65.8
6	59.9
7	53.9
8	50.0
9	47.0
10	43.7

5.1.5 Failure Rates by Location of Business

It was hypothesised that the quality of the location of a business would have an impact on its chance of failure. Table 5.11 shows that there was no significant relationship between location and failure rates.

Table 5.11

Failure Rates by Location of Business

Location of the Business	Survived	Died	Failure Rate
Desirable Location	8799	707	7.44%
Less Desirable Location	1156	100	7.95%
Total	9957	807	7.50%

χ^2 p = 0.517197

There is a one-in-two probability that the distribution of failures based on location arose by chance, so conclusions about the effect of location on failure cannot be drawn. For what little it is worth, the very small difference between the failure rates for desirable and less desirable locations is in the hypothesised direction. That is, better locations seem to be associated with lower chances of failure (although the difference is minimal if it exists at all).

5.1.6 Failure Rate by Year

Table 5.12 shows the relationship of failure rate and year for each of the years 1954 to 1986. Note that for 1974 and 1979 the data violate the requirement for χ^2 analysis that each cell contain at least 5 observations (Leabo 1972, 523). One approach to handling this problem is to apply the Yates Correction (Yates 1960) which involves changing the observed frequency in each cell by 0.5 in accordance with:

$$\chi^2 = \Sigma \frac{(|f_o - f_e| - 0.5)^2}{f_e}$$

where $|f_0 - f_e|$ is the absolute difference between observed and expected frequencies. This correction was not used because, while it has the effect of understating the value of

χ^2 and hence the attractiveness of the null hypothesis, the χ^2 value (as calculated without adjustment) is so large that the Yates Correction is unlikely to have any substantive impact on the probability that the distribution is random.

Table 5.12

Failure Rates by Year

Year	Survived	Died	Failure Rate
1954	254	13	5.04%
1955	235	15	6.00%
1956	267	12	4.30%
1957	283	12	4.07%
1958	287	37	11.42%
1959	297	41	12.13%
1960	322	12	3.59%
1961	310	20	6.06%
1962	282	44	13.50%
1963	279	38	11.99%
1964	285	29	9.24%
1965	272	28	9.33%
1966	257	34	11.68%
1967	283	8	2.75%
1968	273	27	9.00%
1969	294	12	3.92%
1970	277	43	13.44%
1971	276	28	9.21%
1972	276	29	9.51%
1973	297	15	4.81%
1974	313	2	0.63%
1975	275	40	12.70%
1976	311	46	12.89%
1977	327	20	5.76%
1978	343	16	4.46%
1979	357	3	0.83%
1980	332	27	7.52%
1981	347	15	4.14%
1982	349	6	1.69%
1983	326	41	11.17%
1984	331	36	9.81%
1985	385	13	3.27%
1986	364	45	11.00%

χ^2 $p = 4.84$ E-34

As shown in Table 5.12, there is a significant difference among annual failure rates over the period 1954 to 1986. This contradicts the findings of Kirchoff and Phillips (1987) who argue that exit rates are relatively stable over time.

5.1.7 Failure Rates by Drought/No Drought

Table 5.13 shows the relationship between failure and the presence or absence of drought in Armidale.

Table 5.13

Failure Rates by Drought / No Drought

Drought	Survived	Died	Failure Rate
Yes	2449	229	8.55%
No	7508	578	7.15%
Total	9957	807	7.50%

χ^2 p = 0.016869

There is about a one in sixty probability that the distribution shown in the table arose by chance. The presence of drought appears to be related to higher than average levels of failure among firms in Armidale. This suggests that the hypothesis concerning drought was correct.

5.1.8 Failure Rates by Party in Power Nationally

Table 5.14 shows failure rates of Armidale businesses during years in which the Labor Party formed the Commonwealth government.

The high p of 0.61 suggests that there is no significant difference in failure rate whatever party forms the national government.

Table 5.14

Failure Rates by Party in Power Nationally

Party in Power Nationally	Survived	Died	Failure Rate
Labor	2291	192	7.73%
Other	7666	615	7.43%
Total	9957	807	7.50%

χ^2 p = 0.611624

5.1.9 Failure Rates by Local Member of Government

Table 5.15 relates failure rates to whether or not the State member from Armidale represents the party which forms the state government.

It had been hypothesised that having a local member from the party forming the State government would tend to reduce failure rates due to the member's purported ability to bring advantages to her or his constituency. The data for Armidale, 1954 to 1986 appear to support this hypothesis.

Table 5.15

Failure Rates by State Member in Government

State Member Government Party	Survived	Died	Failure Rate
Yes	6386	466	6.80%
No	3571	341	8.72%
Total	9957	807	7.50%

χ^2 p = 0.000283

5.1.10 Failure Rates by Cabinet Member

Table 5.16 shows failure rates for firms during periods when the member for Armidale has been in the State Cabinet.

Table 5.16

Failure Rates by State Member in Cabinet

State Member in Cabinet	Survived	Died	Failure Rate
Yes	2210	209	8.64%
No	7747	598	7.17%
Total	9957	807	7.50%

χ^2 p = 0.015357

The result of this analysis is counter-intuitive, showing as it does that failure rates are higher when the local member is a state cabinet member. It had been hypothesised that

having a local member in cabinet would advantage the business community in Armidale.

5.1.11 t *tests*

A *t* test was applied to a number of the independent variables to confirm the findings of the χ^2 analysis and to allow non-categorical independent variables to be described. The only variable not tested was industry (because no mean can be calculated for the many industry categories). The results are set out in Table 5.17.

Table 5.17

Two sample *t* test (assuming unequal variances)
(Variance shown in parenthesis)

Variable	No-fail Mean	Fail Mean	*t* statistic*	P(T<=*t*)**
Diversification	2.16744 (5.77297)	1.6464 (2.47481)	8.62383	1.1 E-17
Competition	15.7051 (133.383)	16.8139 (150.524)	-2.4785	.00669
Comp./Pop.	.08337 (.00383)	.09047 (.00462)	-2.8692	.0021
Chains/Branches	.33561 (.52921)	.27792 (.37981)	2.51947	.00595
Chains/Pop.	.00173 (1.4 E-7)	.00145 (1 E-7)	2.33929	.00976
Franchises	1.101195 (5.92541)	.94417 (5.41427)	.79268	.21408
Franch./Pop.	.00508 (.00015)	.00489 (.00015)	.4408	.32973
Age	9.19395 (58.5214)	7.69107 (43.6498)	6.13377	6.2 E-10

Table 5.17 (cont'd)

Variable	No-fail Mean	Fail Mean	*t* statistic*	P(T<=*t*)**
Location	.11631 (.10279)	.12407 (.10881)	-.6435	.26002
Drought/No Drought	.24598 (.18549)	.28412 (.20365)	-2.3154	.0104
Party Nationally	.23011 (.17718)	.23821 (.18169)	-.5194	.30179
Local Member	.64132 (.23005)	.57692 (.24439)	3.56499	.00014
Local Cab. Min.	.22178 (.17261)	.25931 (.1923)	-2.3459	.0096
Population	19199.6 (1.1 E+7)	19021.7 (1.0 E+7)	1.5064	.06615
Change in Pop.	1.69275 (3.02401)	1.95311 (2.84293)	-4.2089	1.4 E-5
Wool Index	68.2877 (1166.94)	65.536 (1249.97)	2.13057	.01669
Change in Wool In.	-.9695 (506.59)	-3.9228 (426.311)	3.88084	5.6 E-5
Sheep Index	47.1429 (646.509)	43.0856 (536.578)	4.74634	1.2 E-6
Change in Sheep In.	2.0782 (904.305)	5.9329 (830.669)	7.56929	4.4 E-14
Lamb Index	52.9149 (613.614)	49.17 (566.946)	4.28158	1 E-5
Change in Lamb In.	-1.9796 (292.512)	-5.7545 (245.74)	6.53302	5.2 E-11
Cattle Index	55.4274 (1247.45)	52.5546 (1244.43)	2.22353	.01321
Change in Cattle In.	4.46611 (543.335)	2.17107 (382.226)	3.15783	.00082

Table 5.17 (cont'd)

Variable	No-fail Mean	Fail Mean	*t* statistic*	P(T<=*t*)**
GDP	137.829 (2455.51)	134.2 (2378.87)	2.02916	.02136
Change in GDP	3.89199 (4.55862)	4.4697 (3.69994)	-8.1354	6.2 E-16
Liquidity	4779.57 (2150791)	4686.8 (2127579)	1.73603	.04144
Change in Liquid.	3.33672 (14.6142)	3.55249 (11.8633)	-1.6969	.04501
Stocks Index	379.05 (61290.3)	378.464 (69795.9)	.06084	.47575
Change in St. In.	4.26594 (440.527)	6.76577 (367.432)	-3.5369	.00021
Inflation Rate	6.26972 (18.3832)	5.73499 (19.9687)	3.27731	.00054
Interest Rate	8.21684 (13.6032)	7.86985 (12.6053)	2.66083	.00396

* Critical t statistic is 1.646 (one tailed) or 1.960 (two tailed) at 0.05 level.

** Figure shown is for one tailed test, double this for two tailed.

5.1.11.1 *t* tests parallelling χ^2 tests Degree of diversification was found to be highly significant, with very low probabilities (on either a one- or two-tailed basis) of the difference in mean values occurring by chance. This confirms the χ^2 finding.

Level of overall competition yielded probabilities of .00669 (one-tailed) and .01337 (two-tailed) which is somewhat more significant than the χ^2 p of 0.157827. Competitors per thousand of population showed even lower probabilities.

Level of branch/chain competition yielded probabilities of .00595 and .01191 and branch/chain competitors per thousand of population probabilities were in the same range, which confirms the χ^2 finding.

Level of franchised competition and number of franchised competitors per thousand of population probabilities confirm the χ^2 finding which was that no sensible conclusions could be reached about the impact of franchised competition on failure rate.

Age of the businesses yielded a highly significant *t* statistic, confirming the χ^2 finding.

Location showed a low *t* statistic, confirming the χ^2 finding.

The drought / no drought *t* statistic was -2.3154 which confirms the χ^2 finding.

The *t* statistic for party in power nationally confirms that there is no significant difference in failure rates regardless of who forms the national government.

The χ^2 findings on state member in government and state member in cabinet are both confirmed by the *t* tests.

5.1.11.2 Other *t* tests The *t* test for population showed moderate probabilities (.06615 and .1323) while that of change in population was highly significant at (1.4E-5 and 2.8E-5). The mean % change in population of failed firms was significantly higher than that of non-failed firms. That is, the chances of failure were greater when population was rising more quickly. This finding is counter-intuitive if we are to believe that business is better off, on average, if its market is larger.

The wool price index and the change in wool price index *t* statistics were both highly significant at 2.13057 and 3.88034 respectively. Indeed, the price indices and change in price indices *t* statistics of sheep and lambs and cattle were all highly significant. For index changes in the prices of wool, sheep, and lambs, failed businesses had a higher

mean, which suggests that volatility in prices of important commodities is not conducive to small business success. For cattle price index changes, the mean is lower for failed companies which appears to contradict the conclusion about volatility which was based on lambs, sheep, and wool.

Both Gross Domestic Product and changes in GDP have significant *t* statistics. Higher changes in GDP appear to be associated with failures, which tends to confirm the volatility conclusion.

The *t* statistics for money supply (1.73603) and changes in money supply (-1.6969) just fit within the p = .05 limit set for the one-tailed test. The mean change in money supply is higher for failures which may be another confirmation of the volatility conclusion.

The *t* statistic for the stock price index is not significant, but when changes in the index was tested the t value was -3.5369. Once again, the mean change of the failed category was larger than the mean for non-failures.

Inflation rates showed a significantly higher mean for non-failed businesses than for failed. This finding is somewhat at odds with the finding that volatility in commodity prices is more associated with failures. Perhaps inflation rates bear more on confidence and economic buoyancy which encourages buying, while commodity price moves suggest or induce uncertainty about the future. Certainly the variability of commodity prices is much greater and there have tended to be about as many down as up moves. By contrast, there was only one deflationary year during the study period.

Interest rates show a *t* statistic of 2.66083 which is significant. Failure seems to be associated with lower interest rates although this appearance may reflect the fact that interest rates have tended to go up over the study period while failure rates have trended downwards modestly.

The means for the DiPietro and Sawhney index of static managerial competence (which is really a fitted line showing expected failure rate by year) had a *t* statistic of 1.6054 which is just under the *t* critical value of 1.646 (at the .05 level).

5.2 Analysis of failure rates

The annual failure rates were regressed against the various annual statistics such as change in GDP, change in population, and drought / no drought. The results are shown in Table 5.18. In this regression. the most important variables which influence failure rates are shown to be Change in Population (P value of .0303) and Gross Domestic Product Change (P value of .0162).

Population change is positively correlated with failure rates (i.e. an increasing rate of change increases failure rates). This counter-intuitive finding from the regression is similar to the conclusion reached from the *t* tests described above.

Change in GDP is also positively correlated with failure rates. This finding confirms the results of the *t* tests.

Table 5.18

Regression of All Annual Variables against Failure Rates
Armidale 1954 - 1986

n = 33
R^2 = .6544308 Adjusted R^2 = .3495167
Amemiya Prediction Criteria* = 5.4743
Akaike Information Criteria** = 15.2614
Durbin-Watson Statistic = 2.4715

ANOVA	*df*	Variable	Mean Square	F
Regression	15	330.8946	22.0596	2.1046
Residual	17	174.7274	10.2781	

Variable	Coefficient	Std. Error	*t* - ratio	Prob |*t*| => x
Constant	69.7589	71.1576	.0980	.3407
Population Change	1.3823	.5850	2.3627	.0303
Cattle Index Change	-.0263	.0392	-.6717	.5108
Sheep Index Change	.0279	.0648	.4307	.6721
Lamb Index Change	-.0589	.0716	-.8217	.4226
Wool Index Change	-.0220	.0606	-.3626	.7214
Stocks Index Change	.0371	.0472	.7854	.4430
Liquidity Index Ch.	-.3778	.3898	-.9693	.3460
GDP Change	1.4127	.5297	2.6669	.0162
Party in Office Nat.	-2.1149	2.3957	-.8828	.3897
Local Cabinet Min.	-.2587	2.9227	-.0855	.9305
Local Gov't.Member	-1.7873	1.8541	-.9639	.3486
Drought/No Drought	2.5302	1.9350	1.3076	.2084
Index of Mgrl Comp.	-8.9620	8.4423	-1.0616	.3033
Inflation	-.1758	.4089	-.4299	.6726
Interest Rates	-.0015	.7314	-.0021	.9984

* [e'e/(N-K)](1+K/N) where e'e = sum of squared residuals
N = number of variables
.K = model degrees of freedom

** 2(logL-K)N

5.3 Analysis of probability of individual firm failure

Probit analysis was carried out to assess the impact of the various independent variables on the probability of an individual firm failing. The details of findings are set out in Tables 5.19 through 5.29.

The probit analysis has four components.

5.3.1 The total data set

In the first, the total set of data (1954 - 1986) is analysed using all appropriate independent variables. Table 5.19 shows the results.

There is a significant difference between the log likelihoods with and without the regressor variables, which suggests that, although no individual firms are predicted to fail, the independent variables are useful in understanding small business failure.

Table 5.19

Probit Analysis - All Firms, All Years

Log likelihood	- 2744.865
Restricted (Slope = 0) log likelihood	- 2866.609
χ^2 (21)	243.4868
Significance level	.0000000

Variable	Coefficient	Std. Error	t ratio	Prob.|t|≥x	Mean x	Std.Dev. x
Constant	5.4135	2.4360	2.222	.0263		
Diversification	-.0641	.0166	-5.517	.0000	2.128	2.355
Age	-.0131	.0029	-4.478	.0000	9.080	7.597
Competition	.4300	.2985	1.440	.1497	.084	.062
Franch. Comp.	-.2680	1.5810	-.170	.8654	.005	.012
Chain Comp.	-5.3055	5.4330	-.976	.3290	.002	.004
Drought	.1830	.0602	3.037	.0024	.249	.432
Local Cab. Min.	-.0073	.0969	-.076	.9398	.225	.417
Local Member	-.1433	.0693	-2.068	.0387	.637	.481
Inflation	-.0230	.0138	-1.667	.0956	6.299	4.304
Interest Rate	-.0098	.0242	-.405	.6854	8.190	3.679
Pty in Pow Nat.	-.1413	.0828	-1.706	.0879	.231	.421
Δ Stock Index	.0019	.0014	1.391	.1643	4.453	20.867

Table 5.19 (cont'd)

Variable	Coefficient	Std. Error	t ratio	Prob.|t|≥x	Mean x	Std.Dev. x
Δ Wool Index	-.0011	.0021	- .515	.6065	-1.191	22.386
Δ Sheep Index	.0004	.0021	.189	.8500	1.478	30.053
Δ Lamb Index	-.0032	.0025	-1.287	.1980	-2.263	17.029
Δ Cattle Index	-.0019	.0014	-1.376	.1690	4.294	23.056
Ind Man Comp	-.9158	.2896	-3.162	.0016	7.486	.312
Δ Population	.0949	.0191	4.961	.0000	1.712	1.736
Δ Liquidity	-.0276	.0133	-2.075	.0380	3.353	3.796
Δ GDP	.0994	.0174	5.714	.0000	3.935	2.125
Location	.0032	.0584	.006	.9557	.117	.321

The following variables show a probability of $|t| \geq x$ of .001 or better (which is to say, lower):

level of diversification
age
change in population
change in GDP

The following variables show a probability of $|t| \geq x$ of .005 or better:

drought
index of managerial competence

The signs of the coefficients are as expected for three of these variables. For the other three, signs were not as expected.

Change in price adjusted GDP is positively associated with failure (probability of $|t| \geq x$ is .0000). This is not as hypothesised, but does correspond to the *t* test results reported above. Population change is also positively associated with failure (probability of $|t| \geq x$ is .0000). This counter-intuitive finding is not as hypothesised. Finally, the Index of Managerial Competence, which should suggest lower chances of failure at lower values (since it is an index of expected annual failure rates given a gradually increasing level of static managerial competence), in fact is negative.

5.3.2 Split between two time periods

To assess whether the importance of individual variables changed over time, the sample was divided approximately in half (years 1954 - 1969 and years 1970 - 1986) and separate probits were run on the two time periods. For the early period, Party in Power Nationally was not used because it showed no variation during the period.

The results of this segment of the analysis are shown in Tables 5.20 and 5.21.

Table 5.20

Probit Analysis - All Firms (1954 - 1969)

Log likelihood	-1269.343
Restricted (Slope = 0) log likelihood	-1337.573
χ^2 (20)	136.4593
Significance level	.0000000

Variable	Coefficient	Std. Error	t ratio	Prob.|t|≥x	Mean x	Std.Dev. x
Constant	10.1100	5.9080	1.686	.0919		
Diversification	-.0521	.0155	-4.001	.0001	2.236	2.670
Age	-.0250	.0080	-3.114	.0019	6.211	4.242
Competition	.3927	.4111	.955	.3394	.092	.067
Franch. Comp.	3.5075	2.4050	1.459	.1447	.004	.011
Chain Comp.	-10.9970	8.1040	-1.357	.1748	.002	.004
Drought	-.1513	.2101	-.720	.4714	.253	.435
Local Cab. Min.	-.0854	.3001	-.284	.7761	.307	.461
Local Member	.2335	.1728	1.352	.1762	.469	.499
Inflation	-.1414	.0495	-2.858	.0043	2.457	1.518
Interest Rate	.4887	.2964	1.648	.0993	4.949	.305
Δ Stock Index	.0032	.0027	1.207	.2273	8.123	19.144
Δ Wool Index	-.0108	.0034	-3.168	.0015	-3.727	14.582
Δ Sheep Index	.0018	.0047	.389	.6971	-.845	13.056
Δ Lamb Index	-.0038	.0052	-.736	.4616	-2.722	11.207
Δ Cattle Index	-.0077	.0055	-1.395	.1632	6.346	10.523
Ind Man Comp	-1.8792	.7017	-2.678	.0074	7.787	.146
Δ Population	.3913	.0812	4.819	.0000	2.152	1.027
Δ Liquidity	.0085	.0243	.351	.7254	3.882	3.588

Table 5.20 (cont'd)

Variable	Coefficient	Std. Error	t ratio	Prob.|t|≥x	Mean x	Std.Dev. x
Δ GDP	.0535	.0282	1.894	.0582	4.936	2.133
Location	.1033	.0890	1.151	.2497	.095	.293

In the early period, the variables most obviously associated with failure or success were (with probability of $|t| \geq x$ shown in parenthesis):

change in population (.0000)
level of diversification (.0001)
change in wool price index (.0015)
age (.0019)
inflation rate (.0043)
index of managerial competence (.0074)

Table 5.21

Probit Analysis - All Firms (1970-1986)

Log likelihood -1419.182

Restricted (Slope = 0) log likelihood -1528.146

χ^2 (21) 217.9277

Significance level .0000000

Variable	Coefficient	Std. Error	t ratio	Prob.|t|≥x	Mean x	Std.Dev. x
Constant	-18.2280	8.9790	-2.030	.0423		
Diversification	- .0696	.0184	-3.784	.0002	2.039	2.056
Age	- .0117	.0032	-3.653	.0003	11.435	8.817
Competition	.3732	.4575	.816	.4146	.077	.057
Franch. Comp.	- 3.5852	2.1900	-1.637	.1016	.006	.013
Chain Comp.	- 2.0085	7.5620	-.266	.7906	.002	.004
Drought	.1481	.1008	1.470	.1416	.245	.430
Local Cab. Min.	-1.0463	.3839	-2.725	.0064	.157	.364
Local Member	- .9856	.1888	-5.221	.0000	.774	.418
Inflation	- .2351	.0595	-3.955	.0000	9.325	3.251
Interest Rate	- .0323	.0441	-.732	.4642	10.851	2.978

Table 5.21 (cont'd)

Variable	Coefficient	Std. Error	t ratio	Prob.|t|≥x	Mean x	Std.Dev. x
Pty in Pow Nat.	.4039	.1926	2.097	.0360	.420	.494
Δ Stock Index	.0092	.0038	2.431	.0150	1.441	21.725
Δ Wool Index	.0235	.0058	4.021	.0001	.892	26.990
Δ Sheep Index	-.0163	.0058	-2.828	.0047	3.384	38.688
Δ Lamb Index	-.0069	.0054	-1.282	.2000	-1.885	20.607
Δ Cattle Index	-.0008	.0028	-.284	.7761	2.609	29.511
Ind Man Comp	2.8836	1.2430	2.321	.0203	7.240	.160
Δ Population	-.1078	.0351	-3.075	.0021	1.351	2.082
Δ Liquidity	-.0697	.0308	-2.265	.0235	2.918	3.906
Δ GDP	-.1086	.0710	-1.530	.1260	3.113	1.730
Location	-.0827	.0790	-1.046	.2956	.135	.342

In the later period, the variables of most importance were:

local member in state government (.0000)
inflation rate (.0000)
change in wool price index (.0001)
level of diversification (.0002)
age (.0003)
change in population (.0021)
change in sheep price index (.0047)
local member in state cabinet (.0064)

The Index of Managerial Competence drops from the early list, and the political situation and a sheep price index are added.

As Table 5.22 shows, the signs of the coefficients were as hypothesised, with three exceptions.

Table 5.22

Signs as Hypothesised?

	1954 - 1969	1970 - 1986
age	yes	yes
change in population	no	yes
change in sheep price index	N/A	yes
change in wool price index	yes	no
Index of Managerial Competence	no	N/A
inflation rate	yes	yes
level of diversification	yes	yes
local member in state cabinet	N/A	yes
local member in state government	N/A	yes

The change in population sign is as expected in the later period which may reflect an enhanced ability in the Armidale economy to weather the turbulence of growth. The counter-intuitive sign for change in wool price index in the later period suggests, perhaps, that wool has become a less important commodity in the local economy over time (see Stayner and Reeve 1990, Stayner 1990, and Stayner and Jackson 1994), but this conclusion is belied by the fact that changes in the wool price index are weighted more heavily in the later period and has a somewhat better probability of $|t| \geq x$.

It should be noted that in both periods, the significance of the χ^2 was very strong.

5.3.3 Managerial, local environmental, and macro-economic variables

Third, estimates are made using sub-sets of the independent variables, specifically those identified as managerial, local environmental, and macro-economic variables. The results are shown in Tables 5.23, 5.24, and 5.25. In addition, the significance of the difference in log likelihoods for the three probits of the sub-sets compared to the total data set are calculated using the method described by Darlington (1990, 449).

Among the managerial variables, age and degree of diversification had significant probabilities of $|t| \geq x$ (both .0000). Beyond these, only number of competitors per thousand of population was better than .10 (at .0336). The signs of all three were as hypothesised.

Five of the eight local environmental variables were associated with success and failure at the .01 level or better: change in index of sheep prices (.0022), a local member in the state cabinet (.0025), a local member in the state government (.0046), change in index of cattle prices (.0054), and drought (.0093). Of these five, the sheep index, having a local member in the government and drought showed the expected coefficient sign. Having a local member in the state cabinet appears to be negatively associated with business success. Changes in the cattle price index also seem to be associated more with failure than success.

Table 5.23

Probit Analysis - All Firms, All Years
Managerial Variables Only

Log likelihood	-2828.781
Restricted (Slope = 0) log likelihood	-2866.609
χ^2 (7)	75.65493
Significance level	.0000001

Variable	Coefficient	Std. Error	t ratio	Prob.|t|≥x	Mean x	Std.Dev. x
Constant	-1.0652	.4820	-2.210	.0271		
Diversification	-.0589	.0114	-5.149	.0000	2.128	2.355
Age	-.0112	.0028	-3.940	.0000	9.080	7.587
Competition	.6266	.2948	2.125	.0336	.084	.062
Franch. Comp.	-.9016	1.5450	-.584	.5596	.005	.012
Chain Comp.	-7.5238	5.3510	-1.406	.1597	.002	.004
Ind Man Comp	-.0278	.0632	-.439	.6606	7.486	.312
Location	.0224	.0572	.391	.6958	.012	.321

Table 5.24

Probit Analysis - All Firms, All Years
Local Environmental Variables Only

Log likelihood	-2818.488
Restricted (Slope = 0) log likelihood	-2866.609
χ^2 (7)	96.24146
Significance level	.0000000

Variable	Coefficient	Std. Error	t ratio	Prob.|t|≥x	Mean x	Std.Dev. x
Constant	-.15056	.0560	-26.889	.0000		
Drought	.1190	.0458	2.600	.0093	.249	.432
Local Cab. Min.	.1502	.0497	3.022	.0025	.225	.417
Local Member	-.1509	.0532	-2.837	.0046	.637	.481
Δ Wool Index	.0017	.0012	1.407	.1594	-1.191	22.386
Δ Sheep Index	-.0042	.0014	-3.060	.0022	1.478	30.053
Δ Lamb Index	-.0035	.0020	-1.721	.0853	-2.263	17.029
Δ Cattle Index	.0029	.0010	2.784	.0054	4.294	23.056
Δ Population	.0369	.0149	2.482	.0131	1.712	1.736

Only two of the macro-economic variables were highly significant, both at the .0000 level. Change in liquidity (money supply) had the hypothesised sign, change in GDP did not.

Table 5.25

Probit Analysis - All Firms, All Years
Macro-Economic Variables Only

Log likelihood	-2826.429
Restricted (Slope = 0) log likelihood	-2866.609
χ^2 (6)	80.35906
Significance level	.0000001

Variable	Coefficient	Std. Error	t ratio	Prob.|t|≥x	Mean x	Std.Dev. x
Constant	-1.7903	.10 8	-17.585	.0000		
Inflation	.0047	.00''3	.646	.5184	6.229	4.304
Interest Rate	- .0036	.0088 4	-.429	.6680	8.190	3.679
Pty in Pow Nat.	.1254	.06-17	1.939	.0525	.231	.421
Δ Stock Index	.0008	.00 0	.751	.4527	4.453	20.867
Δ Liquidity	- .0290	.0068	-4.242	.0000	3.353	3.796
Δ GDP	.1006	.01-13	7.034	.0000	3.935	2.125

The significance of the improvement in predictive power between using sub-sets of the variables and the full set of variables was tested using the technique described by Darlington (1990 449). That is, a χ^2 was calculated as follows:

χ^2 = 2 x (difference in NLL from one model to the next)
with *df* = difference in number of regressors in the two models
where NLL = - (log likelihood of the model)

For the models the inputs are as set out in Table 5.26.

Table 5.26

Improvement in Predictive Power

Model	NLL	# of regressors
All variables	2744.865	21
Managerial variables only	2828.781	7
Local environmental variables only	2818.488	8
Macro-economic variables only	2826.429	6

The χ^2 and *df* associated with moving from sub-set models to the model using all variables are shown in Table 5.27 below.

Table 5.27

χ^2 of Adding Variables

Movement	χ^2	*df*
Managerial to All	167.832	14
Local environmental to All	147.246	13
Macro-economic to All	163.128	15

Since the significance of even $\chi^2 = 37.7$ with $df = 15$ is .001, all of the movements described above are significant well beyond the .001 level.

What this analysis demonstrates is that although managerial competence variables have some power to explain failures, the addition of local environmental and macro-economic variables significantly increases the explanatory power. This finding confirms the central hypothesis of the current study.

5.3.4 Industry groups

Finally, a separate probit analysis is carried out for each of the industry groups described above and enumerated in Table 5.1. The results of these analyses are shown in Appendices F.1 through F.9.

The population of 10,764 observations was divided among the nine industries to allow an assessment of any differential impacts of the variables on the different industries. For example, notwithstanding Stayner's (1990) finding, one might expect firms in the agricultural industry to be more affected by price changes in local commodities than might be firms in the hospitality industry. Construction, on the other hand, might be more sensitive to interest rates than would be food suppliers.

Set out below are the most important variables for each industry as determined by the variables having the smallest probability $|t| \geq x$ (see Appendices F.1 through F.9).

Table 5.28

Most Important Variable by Industry

Industry	Most Important Variables*	Sign of Coefficient as Hypothesised ?
Agricultural	level of diversification (.0091)	yes
	drought (.0215)	yes
	change in lamb price index (.0508)	yes
	change in liquidity (.0555)	no
Automotive	level of diversification (.0001)	yes
	change in GDP (.0133)	no
	change in population (.0152)	no
	inflation rate (.0185)	yes
Consumer Goods	level of diversification (.0000)	yes
	Index of Managerial Comp. (.0104)	no
	interest rate (.0389)	no
	change in GDP (.0587)	no

Table 5.28 (cont'd)

Industry	Most Important Variables*	Sign of Coefficient as Hypothesised ?
Construction	franchise competitors/pop. (.0061)	yes
	change in population (.0121)	no
	location (.0160)	yes
	level of diversification (.0365)	yes
Financial Services	chain competitors/pop. (..0162)	no
	location (.0199)	no
	competitors/pop. (..0213)	yes
	franchise competitors/pop. (.0455)	no
Food Suppliers	change in GDP (.0000)	no
	drought (.0229)	yes
	change in population (.0237)	no
	party in power nationally (.0269)	no
Hospitality	Index of Managerial Comp. (.0103)	no
	location (.0145)	yes
	change in liquidity (.0147)	yes
	change in wool price index (.0225)	no
Office & Other	change in lamb price index (.0015)	yes
	change in sheep price index (.0028)	no
	change in population (.0063)	no
	change in stock price index (.0075)	no
Transportation	age (.0785)	yes
	Index of Managerial Comp. (.0847)	no
	party in power nationally (.0851)	no

* $|t| \geq x$ shown in parentheses

For 15 of the 35 variables listed above, the sign of the coefficient was as hypothesised. This is not an outstanding hit rate as is demonstrated in Table 5.29 on the next page.

Table 5.29

Hit Rates of Variables

Variable	No. of Appearances among Industry Top Variables	Hit Rate*
age	1	100%
chain competitors/population	1	0%
change in GDP	3	0%
change in lamb price index	2	100%
change in liquidity	2	50%
change in population	4	0%
change in sheep price index	1	0%
change in stock price index	1	0%
change in wool price index	1	0%
competitors/population	1	100%
drought	2	100%
franchise competitors/population	2	50%
Index of Managerial Competence	3	0%
inflation rate	1	100%
interest rate	1	0%
level of diversification	4	100%
location	3	67%
party in power nationally	2	0%
TOTAL	35	43%

* Hit Rate shows % of appearances where the sign of the coefficient was as hypothesised

* * * * *

The results of the analysis of data on Armidale firms has been shown in Chapter 5. In Chapter 6 is set out conclusions that can be drawn from the results, together with the implications of those conclusions.

6. CONCLUSIONS and IMPLICATIONS

This chapter begins by describing the limitations of the current study. It then examines what the current study shows about the hypotheses set out in Chapter One and Appendix A. It then outlines the importance of the findings for owner-managers of small businesses, for policy makers, and for researchers in the field.

6.1 Limitations

This study has a variety of limitations which should be acknowledged.

It relies heavily on numerical data collected over time, for a variety of other purposes, by other people. As Griliches (1974, 971) points out, " . . . observed econometric magnitudes are subject to both errors of measurement and to random disturbances." A more trenchant critic of economic time series is Morgenstern (1950) whose "horrifying little book", as Griliches (1974) characterises it, calls all sorts of economic data into serious question. So, much of the economic data in the study are suspect *prima facie*. This is not a limitation specific to this study but applies to virtually any study based on secondary data: *qui numerare incipit errare incipit.*

Even if we ignore or assume away the problems described above, much of the economic data is still less than ideal. It is useful, perhaps, to have access to a time series on an index of prices paid for lamb in New South Wales, but it would be better to have the same time series for Armidale lamb prices. Alas, no such disaggregated index exists.

The analysis depended necessarily on data that were available. The swings-and-roundabouts character of ecological studies like this one has been discussed in Chapter Four. The approach chosen for this study sacrifices some cross-sectional data for the benefits of longitudinal data.

In some instances, although data bearing directly on the matter of interest do not exist, there may be surrogates that could be used. Thus a stock price index (or, more correctly, a measure of changes in the index) could be taken as a surrogate for level of consumer confidence. Or the Dipietro and Sawhney approach can be used to develop a surrogate measure for managerial competence. In both of these instances, the surrogates are better measures than no measures at all, but they should not be mistaken for the real thing.

One of the explanatory variables, location, was subjectively determined taking into account the nature of each firm's business and its geographical location. The theory on location is reasonably clear, but using the theory to characterise a location as "good" or "less good" is not easy. Moreover, the shopping patterns and the commercial geography of Armidale have both changed over time, so the same location that was "good" for a firm in 1954 may be "less good" for the same firm in the same business in 1984. If we accept the theory on location (shopping goods located together, specialty goods anywhere, and convenience goods dispersed) as revealed truth, a demonstration of the difficulty of making correct subjective decisions in creating a time series is that location turned out to have a very weak relationship to success/failure of small firms. Obviously, the problems of past location research which were pointed out in Chapter Three have persisted into the current study.

Armidale was chosen for the study because it appeared to be as self-contained a market area as could reasonably be found in Australia. Althought the data do not support this conclusion, it seems intuitively obvious that Armidale has become less insulated over time. That is, although the level of in-shopping and out-shopping was probably quite low at the beginning of the study period (the 1950s), it was probably less low by the 1980s. Moreover, the precise levels at either the beginning or the end of the study period cannot be determined.

Finally, one should note that the subject of the study was Armidale small businesses in the period 1954 - 1986. A different time frame could have been chosen, a different

individual town/city could have been chosen, and/or a sample of firms in a number of different locations could have been used. They were not, and this could be seen to limit the applicability of the findings of this study. In some sense, all studies could attract this criticism. They were done where and when they were done and not somewhere else at some other time. But, in fact, it makes sense to choose one locale for a study of this sort and Armidale is a good choice of locale.

Using the whole population of a single location eliminates the sampling error problem associated with using a sample drawn from a number of locations. Armidale is ideal because it is sufficiently isolated that the problem of in-shopping and out-shopping is very much reduced. Thus the local environmental variables could be expected to have a much more pronounced impact on businesses in Armidale than they would have in a city more dependent on visitors for creation of demand or more subject to "leakage" of local resident purchases to other cities

6.2 The Hypotheses

The general hypothesis was that the probability of failure and failure rates can be linked to firm specific, local environmental, and macro-economic factors. The probit of all firms in all years shows the following regressors to be significant (prob. $| t | \geq x$ is shown in parenthesis):

Firm specific factors:	Age of the firm (.0000)
	Level of diversification (.0000)
	Index of Managerial Competence (.0016)
Local environmental factors	Drought (.0024)
	Local member in state government (.0387)
	Change in population (.0000)
Macro-economic factors	Inflation rate (.0956)
	Party in power nationally (.0879)
	Changes in money supply (.0380)
	Changes in GDP (.0000)

Moreover, the explanatory power of the model is better when all three categories of variables are used than when any one category is used alone.

The general hypothesis is accepted.

6.2.1 Managerial Factors

6.2.1.1 Age of the firm It was hypothesised that the probability of failure would decline with age. This phenomenon, it was believed, would demonstrate itself in the analysis of when businesses failed, in the probits which looked at probabilities of failure, and in the regression of failure rates on the independent variables. The data indicate that the incidence of failure is tri-modal. There is the expected high rate of failure in the early years of firms. There are two additional peaks at years six/seven and eleven/twelve. Thus the data seem to confirm all of the literature about the relationship of age and failure. Stinchcombe (1965) hypothesised a "liability of newness" which would explain a higher failure rate among newly established businesses. Bruderl and Schussler (1990) argued a "liability of adolescence" rather than newness. Aldrich and Auster (1986) suggest that there may be a "liability of age". All of these positions are supported by the current study's analysis of failures by age. Neither the least squares regression nor the probit analysis used models that would pick up a tri-modal distribution. The MDA analysis which sought to explain the tri-modal nature of the failures by age distribution was inconclusive. There do not appear to be any factors at play in Armidale that link to the literature in a convincing way.

6.2.1.2 Type of business It was believed that the rate of failure would be different for different types of business. This was confirmed by the analysis which showed failure rates ranging from 4.1% in Financial Services to to 8.4% in Food Suppliers and in Office and Other Supplies and Services.

6.2.1.3 Location of business It was hypothesised that having a good location would reduce the likelihood of failure. Although the analysis demonstrated this to be true, the $\chi 2$ p of 0.517197 indicates that the difference in observed failure rates was not significant.

6.2.1.4 Index of managerial competence An improvement in static competence was observed over the study period, that is, the correlation between GDP and failure rates declined over the period, indicating an enhanced ability of firms to survive independent of macro-economic factors. When this improvement was reflected in an index and used in the probit analysis, it was found to be a significant influence on the chances of individual firm failure in the 1954 - 1969 period, for the full period, and in the consumer goods, food supply, hospitality and transportation industries. In each of these industries, the relationship was the opposite of what was hypothesised.

6.2.1.5 Diversification The hypothesis that diversification of business activities would reduce the probability of failure was very strongly supported by the analysis.

6.2.2 Local Environment Factors

6.2.2.1 Population It was hypothesised that a larger population would be associated with less risk of failure. This has been demonstrated: over the period of the study, population trended upward while failure rates trended downward.

However, when the analysis shifts to changes in population, it was observed that periods of rapid change in population are associated with higher rates of failure. Over the years 1954 - 1986, the chances of failure were higher with larger changes in population. This finding reflects much higher failure rates in high growth periods from 1954 - 1969, and lower failure rates in high growth periods after 1969. In short, the hypothesis is confirmed for 1970 - 1986, and not confirmed for earlier years.

6.2.2.2 Direct competitors The hypothesis for this and the next two variables was that as the number of competitors (adjusted for changes in population) went up, the risk of failure would go up.

This was confirmed for direct competitors by the sign of the coefficient in most of the probit analyses. The only exceptions, where more competition from all sources was associated with a lower risk of failure were the agricultural industry, consumer goods, and food suppliers. In none of the probits, however, was the t statistic low enough to accept any of the results for this variable to be significant.

6.2.2.3 Major chain competitors It was believed that the presence of major chain competitors would increase the probability of failure. The analysis does not confirm this hypothesis with any consistency, and most of the t statistics on the probits suggest that the findings are not significant. Exceptions are construction firms where the impact of chain competitors is positive at a .09 level of significance and financial services which appear to be positively affected by chain competition (.02 significance).

6.2.2.4 Franchise competitors The hypothesis with respect to franchise competition is not proven. Most of the probits are insignificant and for those with significant findings, more franchise competitors per unit of population seems to improve chances of success. Financial services firms, for example, are affected positively at the .05 level of significance. An exception is construction firms where the impact of chain competitors is very significantly negative (.006 level of significance).

6.2.2.5 Drought It was believed that drought would be positively associated with business failure in Armidale. This proved to be the case. The two sample t test was significant at the .01 level; the χ^2 test was significant at the .02 level; and over all years of the probit analysis drought was significant at the .002 level. Moreover, drought was significantly associated with increased chances of failure in agricultural firms, financial services, and food suppliers. In other industries, the sign of the coefficient was as hypothesised, but the finding was not significant.

6.2.2.6 Commodity price indices Increases in commodity price indexes were thought to be negatively associated with failures. The two sample t test confirmed significant relationships between changes in all of the commodity indices and failure rates. The coefficients, however, were erratic. Changes in the sheep price index seemed to occur with increases in failure rates, changes in the other three (wool, lamb, cattle) with declines in failure rate. In the probit analysis, overall the commodity price indexes were not significant. On an industry by industry basis, there was occasional significance but on an apparently random basis. One is led to conclude that variations in commodity prices are not significant in explaining probability of failure.

6.2.2.7 Local member in govenment Having a local member in the state government was expected to reduce the probability of failure. This appears to be true for the full time period of the study (although not for 1954 - 1969, and especially so for 1970 - 1986). The relationship is significant for financial services firms, and for office supply and other firms. For the balance of the group studied, the relationship was not significant. On balance then, the hypothesis is accepted.

6.2.2.8 Local member in state cabinet It was thought that having a local member in the state cabinet would reduce the incidence of business failure. The failure rate was, in fact, higher when there was a cabinet position for the local member. This may reflect the fact that a cabinet minister might be distracted from electorate concerns by the heavy workload of the cabinet role.

6.2.3 Macro-Economic Factors

6.2.3.1 Gross Domestic Product It was hypothesised that upward changes in GDP would reduce the chances of failure. On the two-tailed t test, GDP was shown to be significant at the .02 level. When regressed against failure rates, however, positive changes in GDP appear to be associated with increases in failures. On the probit covering all industries and all years, there is a highly significant relationship between increases in GDP and increases in failures. This holds true for all industries except

transportation (although the results are not significant for all industries). The hypothesis is not proven.

6.2.3.2 Liquidity The amount of purchasing power in the economy (as measured by changes in the money supply) was hypothesised to be positively associated with success in business. That is, increases in money supply should go with fewer failures. Overall, this appears to be significantly true. When looked at with individual industries, however, there was one anomaly: the sign of the coefficient is not as expected for agricultural firms (at the .06 level of significance). On balance, the hypothesis should be accepted.

6.2.3.3 Inflation It was believed that inflation would be associated with fewer failures. The two- sample *t* test showed a significant impact of inflation on failure rate and in the expected direction. The overall probit showed a relationship in the expected direction, significant at the .1 level. Inflation was not significant on all of the industry probits, but where it was (automotive and hospitality) the sign was as expected.

6.2.3.4 Interest rates It was believed that higher interest rates would be associated with higher failure rates. It appears that the opposite is more likely to be true. Where significant relationships were found in industry probits (consumer goods, hospitality, office and other), only the office and other category had the expected sign.

6.2.3.5 Stock price index Stock prices were seen as a surrogate for level of consumer confidence, and it was hypothesised that an increasing stock price index would be associated with fewer failures. Only the office and other category gave any significance to stock prices, and there the relationship found was the opposite of what was hypothesised.

6.2.3.6 Party in power nationally The hypothesis being tested was that the rate of failure would be higher when Labor was in office. Note that the long early period when Labor was not in office but failure rates were high relative to later years should bias the

results against the hypothesis. The failure rate was slightly higher for Labor years but the difference was not significant. The probit of all firms for all years has a significant reduction in the probability of failing during years that Labor was in office. Construction failure probability was significantly reduced in years when Labor formed the Commonwealth government, as it was for financial services, food suppliers, and transportation. The hypothesis appears to have been disproven.

6.3 Implications of the Study

6.3.1 For Owner-Managers

Owner-managers can do little to avoid the consequences of changes in the local environment or macro-economic changes. There are, however, a few useful observations that can be made based on the results of the current study.

6.3.1.1 Importance of survival It is not particularly helpful to suggest that businesses will be more successful if they survive. What this study makes clear is that survival is an on-going process and problem. The early years of a business's life are risky. But the survival of early perils only moves the firm on to liabilities of adolescence and then of age.

There appear to be crisis points as businesses age. The current study has identified these as years 1 and 2, years 6 and 7, and years 10 and eleven. The first point corresponds to the crisis of start-up. One can speculate that the two later crisis points correspond to stages of the development of the business, perhaps to the delegation stage, and the succession stage, although there is no direct evidence of this. The various crises described by Greiner (1972) do not appear to apply here, perhaps because the focus of his research was large, complex enterprises rather than small businesses. It is difficult, for example, to visualise in a small business a crisis of red tape following a period of growth based on coordination.

What is clear is that the owner-manager would not be well advised, having survived start-up, to relax and assume that all would now be relatively clear sailing.

6.3.1.2 Importance of choice of business A second important finding for the owner-manager is the importance of choosing the right business to enter. Choice of business obviously depends on a number of factors including the background, training and experience of the owner-manager, the amount of investment capital available, and the local competitive situation at the time of entry. But the differences in failure rates that were observed in the current study suggest that there are systematic differences in the risk levels associated with different businesses. The potential owner-manager who ignores these is likely to find herself/himself in a business with significantly reduced chances of success.

An associated observation is the considerable importance of diversifying the businesses in which the firm is engaged. There was strong evidence in the current study to support the notion that being involved in more than one kind of business has useful survival value.

6.3.2 For Policy Makers

It is obvious that public policy is, and should be, driven by a variety of imperatives. One of these should be a desire to maintain a healthy small business sector. The beginning of understanding in regard to the health of the small business sector is explicit recognition that public policy has an impact on whether or not a small business succeeds. Moreover, the public policies that will help need not be of the traditional government subsidy, government program, training or retraining sort.

Of greater concern, and (it has been argued by McKenna *et al.* 1990) of greater effect, would be efforts to ensure that the environment in which small businesses operate is both fair and friendly. This implies attention being paid to both the local environments and the macro-economic environment.

6.3.2.1 Effect of general economic policies on failures The current study demonstrates that there is, if anything, a negative relationship between interest rates and failure rates. That is, higher interest rates do not necessarily lead to more failures. However, there is a strong relationship between liquidity and success. For small business, the major problem is lack of access to credit, not its cost. This has two implications for policy-makers.

First, when faced with the choice of using interest rate or money supply tools of monetary policy, it should be recognises that the two will have differential impacts on small businesses. Increases (or decreases) in interest rates appear to have little effect on the probability of a small business failing. Increasing money supply has a positive effect on small business survival, while decreasing M3 is associated with higher failure rates.

Second, if a limited-environmental or strategic interventionist stance is to be taken by government (Peterson 1988), a public policy aimed at increasing the availability of credit for small business might be a more useful exercise than a policy of providing concessionary lending terms by subsidising interest rates. This is particularly important given the small business owner-managers' perception that the banking system deals ". . with the small business sector . . . in a less than competitive and fully informed way" (R.A. Stayner 1995, pers. comm.). Since the availability of finance from private lenders reflects, in part at least, their perception of risk, the appropriate public policy might be communication of true risk (which we have found to average about 7.5% failures per year without any discrimination among small firms) or reduction of risk to some extent by underwriting of some proportion of losses.

6.3.2.2 Effect of the local environment The major local environmental variable in Armidale, the factor that impacts very widely across industries and time periods, is drought. Although the relationship of drought to small business failure in towns like Armidale is undoubtedly complex (R.A. Stayner 1995, pers. comm.), it should be seen

that government efforts to reduce the incidence and impact of drought benefit not just the pastoralists who have traditionally been seen as the recipients of public policy benefits, but also the small business sector which is as devastated by drought as the "man on the land."

This argues that any government activity to reduce the incidence of drought will result, if successful, in a reduction in the rate of small business failures. This is true even if, or perhaps especially if, other long-term environmental factors (such as decline in agricultural terms-of-trade) are hostile to small business prosperity in towns which rely to some extent on farm customers (R.A. Stayner 1995, pers. comm.). It also argues that any programmes of drought relief should target as beneficiaries not just the agriculturalist but also the small businesses in country towns. Further research on the impact of drought on small businesses in country towns may allow more precise identification of the kinds of businesses most at risk in drought situations. What would remain problematic is how best to structure any assistance programs aimed at small businesses in drought affected rural towns. As Stayner (1995, pers. comm.) points out, any reasonable and publicly justifiable set of support criteria would eliminate almost all potential recipients, while a more open-handed approach would support those who either do no need or cannot benefit in the longer term from support.

6.3.3 For Researchers

6.3.3.1 Importance of detailed area studies It is probably true to say that a replication of the current study carried out almost anywhere would show that firm-specific factors, local environmental factors and macro-economic factors all make a significant impact on failure rates among small businesses and on the probability of individual firms failing. What also seems intuitively obvious, but remains to be demonstrated, is that the precise factors of significance, particularly among what have been termed local environmental factors, will be different in different places and for different industries.

What is needed are the sort of detailed area studies that will eschew easy generalizations for the kind of understanding that can only come from an in-depth analysis of specific local situations. An emphasis on what might be termed "business population ecology" will, I believe, advance the small business field in a dramatic way.

6.3.3.2 Extensions of the current work A number of steps can be taken to extend the current study:

The available data can be subjected to further analysis. For example, it may be possible to disaggregate industry data to examine sub-industries. Possible candidates for this sort of treatment are those with the largest number of observations : petrol depots and service stations (744), clothing stores (337), contractors (1,229), butchers (315), mixed businesses (525), hotels (339), restaurants (336), beauty parlors/barber shops (379), and trucking firms (442).

Case studies could be carried out for specific sub-industry groups that may have been subject to special pressures. For example, the number of firms providing taxi service dropped dramatically over the study period. There may have been an absolute drop in number of taxis on the road due to more families having their own vehicles. There may also have been a concentration of ownership of taxis caused by the technological changes that made radio dispatching (and the centralisation that it requires) possible.

The data used in the study could be extended into the 1990s.

The study could be replicated in another town or city. Indeed, steps a have already been taken to apply this methodology to two cities in Nova Scotia, Canada.

6.4 Conclusions

This thesis set out to evaluate the relative importance of management, the local environment, and the macro-economic environment in small business failures.

The sample used was thirty three years of business directory data from Armidale, NSW. The start-ups and disappearances of all small businesses in the geographic area were recorded and local environmental and macro-economic variables noted for each of the thirty-three years.

Probit analysis was used to associate success or failure with each of the variables.

It was found that the explanatory power of the model was improved by including in it variables from each of the three categories: management, local environmental variables, and macro-economic variables. From this we can conclude that all three categories of variables have some impact on the success or failure of small businesses. This is highly suggestive that the population ecology view of business failure is to be preferred over the managerial incompetence view.

Among the individual variables most associated with small business failure are poor choice of type of business to enter, lack of business diversification, drought in the local area, and reductions in the money supply (M3).