

HD
5724
•C2
1986a



Government
of Canada

Regional Industrial
Expansion

Gouvernement
du Canada

Expansion industrielle
régionale

Canada

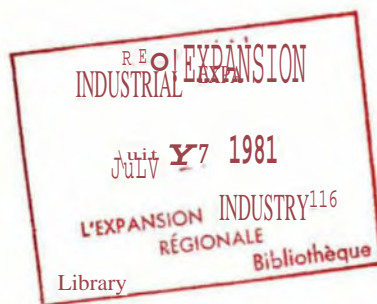
5

*

THE ROLE PLAYED BY INNOVATION
IN JOB CREATION IN CANADA 1976-1984



THE ROLE PLAYED BY INNOVATION
IN JOB CREATION IN CANADA 1976-1984



Statistical Analysis
Policy
Department of Regional
Industrial Expansion
1986

TABLE OF CONTENTS

	<u>PAGE</u>
EXECUTIVE SUMMARY	i
I Introduction	1
II Background	3
III Identifying the High Innovation Sectors in Canada	10
IV Job Creation Performance of High Innovation Sector	17
V Impact of Recession	32
VI Firm Evolution	35
VII Acquisition of Independent Firms	41
VIII Geographic Location of High Innovation Jobs	47
APPENDIX A: Growth Index	52
APPENDIX B: Growth Index Groupings for U.S.	54
APPENDIX C: Jobs and Job Creation by Industry Group in U.S.	56
APPENDIX D: Net Employment Change 1976-1980 by Enterprise Size and Sector	57
APPENDIX E: Net Employment Change 1980-1984 by Enterprise Size and Sector	61

EXECUTIVE SUMMARY

The study described in this report extends our earlier analysis of job creation in Canada over the 1976-1984 period, in an attempt to assess the role of high growth - innovative firms in employment growth. The Methodology on which the study is based was developed by Dr. David Birch and his staff at the Massachusetts Institute of Technology's Program on Neighbourhood and Regional Change for a similar analysis which they undertook in the U.S. Their study generated considerable interest, as it broke new ground by developing a performance based approach to identify the High Innovation sector of the economy.

The concept of an High Innovation sector also originates with Dr. Birch's work. It is a much broader concept than the High Technology sector as defined in other studies based on such factors as the level of R&D, occupation mix of the labour force, level of technology exhibited in the production process and products of an industry. By using a performance based measure related to an industry's growth to identify the High Innovation sector, Dr. Birch has attempted to identify not only those sectors marked by the development of new technology but also those where firms have been successful for other reasons, i.e. broadly speaking through innovation.

In our previous job creation studies, our Directorate has utilized a Dun and Bradstreet Longitudinal Data Base for Canada similar in format to one which Dr. Birch has based most of his analysis on in the U.S. In light of the interest generated by his concept of a High Innovation sector, it was suggested that we undertake this study to test his methodology with the Canadian Data Base.

Highlights

1. With the much smaller size of the Canadian economy, the number of establishments on the Canadian Dun and Bradstreet Longitudinal Data Base is only about a tenth that on the U.S. file. Due to the micro nature of the Birch methodology, we are forced in some instances to base our findings from this study on only a few observations, thus leading us to express some concerns about their representativeness.
2. Taking as a measure of the level of innovation in a sector, the existence of a significant proportion of rapidly growing establishments, the High Innovation sector identified for Canada includes industries in the primary, manufacturing and service sectors. These include many of the traditional High Technology industries. The following are the sectors

identified as being the most innovative (excluding some where the coverage of the data base was very weak):

Coal Mining	Electronic Components
Crude Petroleum and Natural Gas	Miscellaneous Electrical Equipment
Crushed Stone	Aircraft and Parts
	Photographic Equipment
Miscellaneous Food Preparations	Railroads
Fabric Mills	Electric Services
Pulp Mills	Banks
Organic Chemicals	Hospitals
Computers	Universities

- Examining the list of Canadian industries identified in the High Innovation sector, it is obvious that Canada's natural resource base was a significant factor in determining which industries had a large number of rapidly growing establishments. That is not to say that technology did not also play some role in the growth these establishments experienced, enabling them to better utilize the comparative advantage the resource base provided. Among both the Canadian and American High Innovation industries, however, there are some that are not readily justified based on our knowledge of technological change and innovation.

4. Almost a half of the industries identified in the Canadian High Innovation sector also appear on the U.S. list. Many of the differences between the two countries can be explained by cyclical or structural factors. The U.S. analysis was based on the 1969-1981 period, prior to the full impact of the post 1980 recession being felt. Thus in the U.S. High Innovation sector one finds a number of cyclically sensitive industries, whose growth depends on the level of construction activity. Again in the Canadian analysis the the resource industries are found to be more of a factor, while in the U.S. with its larger more mature economy the manufacturing and service industries are somewhat more significant.
5. For the comparative analysis described in the report, the High Innovation industries were aggregated into two groups based on the proportion of high growth establishments in each industry, with Group 1 having the largest proportion. In spite of differences between the two countries in the composition of their respective High Innovation groups, the share each represents of total employment in the economy is remarkably similar. In Canada the job creation performance of the most innovative industries (Group 1) was much stronger than the other industry groups identified, with an 18.0% increase in employment over the 1976-1984 period compared to the 8.0% increase reported over all sectors. In the U.S. analysis very little difference was noted in the growth rates of the industry groups identified. The performance of Group 2 was however similar in the

two countries. Over the 1976-1984 period in Canada and the 1977-1981 period in the U.S. the industries comprising Group 2 in each country grew at a rate slightly lower than the overall average.

6. The strong job creation performance of small businesses noted in our previous job creation studies is even more remarkable in the two High Innovation sectors. In particular establishments with less than 20 employees in Group 1 reported a growth rate of 203.6% over the 1976-1984 period, while those in Group 2 reported a growth rate of 73.8%.

7. Similarly the polarization of job creation between the smallest and largest enterprises reported in our earlier studies, is also evident in the High Innovation sectors. Over all sectors it is the smallest establishments (less than 20 employees) who accounted for the largest share of the employment growth (87.3%) followed by those which are units of very large enterprises (500 or more employees) who contributed 46.2% of the new jobs created over the 1976-1984 period. This pattern is reversed among the more innovative industries in Group 1, where establishments belonging to the largest enterprises were the major contributors to employment growth (62.9%) followed by establishments with less than 20 employees (17.6%). Among establishments which are units of medium-sized enterprises (50-499 employees) only those in Group 1 reported a net increase in employment. Overall establishments in this size class reported a significant drop in employment.

8. With respect to employment growth by enterprise size the Canadian and U.S. results are quite comparable. In both countries, while it was the smaller High Innovation establishments who grew the most rapidly, it was those which are units of larger enterprises who accounted for the largest share of employment growth in that sector. Over all sectors however, it was the smaller establishments (less than 20 employees) in each country who reported both the highest rate of growth and accounted for the largest share of jobs created. Thus in both Canada and the U.S. large enterprises were a much greater factor in the growth experienced in the High Innovation sectors. The major difference found between the U.S. and Canadian results was the poor performance of medium-sized Canadian firms. Although some degree of polarization towards both ends of the enterprise size scale was also evident in job creation in the U.S., medium-sized companies reported smaller but positive rates of growth in each of the industry groups identified.
9. Canadian branch establishments have reported the highest rate of employment growth in all sectors followed by independent businesses. In contrast subsidiaries report a sharp decline in all sectors and the same for headquarters except those in the higher innovation - Group 1 industries. With the much larger overall base employment level of the independents however, the share of total jobs created is more evenly split between them and branches. The stronger performance of both

headquarters and branches in Group 1 is of course consistent with the fact that large enterprises were the major contributors to employment growth in the High Innovation Sector.

10. Some major differences are observed between the Canadian and U.S. results in the performance of the different establishment types. Compared to the decline in employment they have shown in Canada, subsidiaries in the U.S. have shown the strongest growth both overall and among the more innovative industries in Group 1. Independent businesses reported the second highest rate of growth in Group 1 and the highest in Group 2. In spite of their strong growth subsidiaries in the U.S. accounted for only a small share of the net growth in employment. The decline shown by subsidiaries in Canada had a much more significant impact. In the U.S. Multi unit enterprises accounted for the largest share of employment growth in all sectors, while in Canada independents have made a larger contribution in all sectors than headquarters and their branches combined.
11. The Service Industries have shown the strongest growth and have accounted for the largest share of the job creation in each of the industry groups identified for the Canadian analysis. Overall the Goods Producing Industries have shown a small decline in employment (-3.5%) and only in Group 1 do they show any real growth (8.5%). These results are again in contrast to those for the U.S. where the Goods Producing Industries

showed positive and fairly significant growth in all sectors, particularly at the High Innovation end. Thus the performance of Canadian Manufacturers in terms of their contribution to employment growth appears to have been weaker than their U.S. counterparts. Some of this difference may be attributed to the fact that the Canadian analysis captures the full impact of the 1981-1982 recession while the U.S. data does not.

12. One of the insights that has emerged from both the work which Dr. Birch has done in the U.S. and our own earlier job creation studies has been the very dynamic nature of firm growth. One observes a very high turnover of establishments and in particular of small businesses in the economy. Since only a small proportion of the smaller businesses who do survive show any substantial growth, their sizeable contribution to job creation is due largely to a number of new and existing small establishments each creating a few jobs. Although larger businesses appear somewhat less likely to go out of business, failure is by no means restricted to small businesses. Over time firms in fact tend to pulsate rather than to sustain any particular growth pattern. A rapidly growing company is as likely, if not more likely, to decline than to grow in the future, and a declining company (that survives) is more likely to grow than to continue to decline. Looking at this pulsation effect both the Canadian and U.S. results suggest that establishments in the High Innovation sectors are even more volatile than the overall average.

13. The Canadian results also generally support Birch's observation that change of ownership does little to dampen this pulsation effect, in particular, that in purchasing a successful business one is by no means assured that it will continue to grow. One difference that does emerge however is that in the U.S. acquisition was found to have little impact on the ability of an establishment to reverse a previous decline, while in Canada acquired firms were even less likely to recover than those that remained independent. This difference may however be due to the fact the Canadian results are based on a later time period, reflecting the impact of the post 1980 recession.
14. Both the Canadian and U.S. results suggest that regions (province and state respectively), enjoying concentrations of employment in the High Innovation sectors do not necessarily have better overall employment growth than other regions. Birch uses this result to suggest that there may be little to be gained in employment growth from programs which encourage or support these industries.

I Introduction

This report extends our previous analyses of Job Creation in Canada utilizing the Dun and Bradstreet Longitudinal Data Base, to examine the role of innovative industries in employment creation. The same data base has been used in two earlier studies undertaken by our Directorate which looked at general trends in job creation, by sector and province, over the 1974-1982¹ and 1976-1984² periods.

In the analysis presented here we are attempting to assess the role which industries marked by a large proportion of high growth-innovative firms have had in the trends observed in employment growth noted in our earlier analysis of the 1976-1984 period. This period also affords an opportunity to compare the performance of such companies both in a period of economic growth in the late 1970s and during a period of economic decline in the post 1980 recession.

The methodology applied in this analysis was developed by Dr. David Birch and his staff at the Massachusetts Institute of Technology's (MIT) Program on Neighbourhood and Regional Change, for a similar study³ in

¹ A Study of Job Creation in Canada 1974-1982
(Statistical and Data Base Services, DRIE, 1985)

² A Study of Job Creation in Canada 1976-1984
(Statistical Analysis, DRIE, 1986)

³ The Role Played by High Technology Firms in Job Creation
(David L. Birch & Susan J. MacCracken, MIT, 1984)

which they looked at the role of High Innovation sectors in job creation in the U.S. In their report they note that the High Technology sector itself is a very small part of the total economy. It is however critical in terms of its ability to generate innovation and hence growth throughout other sectors. In light of this, the argument was put forth by Birch and MacCracken that High Technology should in fact be considered part of a larger High Innovation sector comprised of companies who have successfully adapted new technologies or have developed innovative products or services in response to changing market or demographic factors. In their analysis they attempt to identify this High Innovation sector and compare its job creation characteristics with the rest of the economy.

In this report we are extending the methodology which Birch and MacCracken developed to look at the role of High Innovation sectors in job creation in the Canadian economy. Although we will be looking at a more recent time period than the MIT study (1969-1981 in the U.S. study versus 1976-1984 in the Canadian) where possible we will compare the results for the two countries.

II Background

1. Dun and Bradstreet Longitudinal Data Base

As noted in the introduction the analysis described in this report is based on the Dun and Bradstreet Longitudinal Data Base. This file links establishment records from the Dun's Market Identifier¹ (DMI) files (December update) for each of the years 1976, 1978, 1980, 1982 and 1984. The development of the data base and a discussion of some of the limitations which the origins of the DMI data places on the interpretation of the results are described in Section II of our initial report.² It is important to note for reasons described in that report, the analysis described here should only be taken as an indication of trends in employment growth, not as an absolute measure. Also because the DMI panel is neither a census or a random sampling, the results may not be strictly representative in all cases. This becomes a particular concern when attempting more micro analysis.

In spite of the limitations noted above, the DMI file is one of the most comprehensive listings of individual company records available in the public domain. About half-a-million establishments are identified in

¹ Dun's Market Identifier File is proprietary to:
Dun and Bradstreet of Canada Ltd., 365 Bloor St. East, Toronto, Ontario

² A Study of Job Creation in Canada 1974-1982
(DRIE, 1985, p. 2-10)

each of the observation years included on the data base. With turnover of businesses (closures and start-ups) the total number of establishments identified over the entire 1976-1984 period is considerably more (over 800 thousand). The data base thus affords a unique opportunity to track the employment growth and turnover of a sizeable segment of the Canadian business population. A brief examination of the characteristics of the panel of companies on the data base is given in our earlier analysis of employment growth over the 1976-1984 period.¹

2. Defining High Technology

One of the initial problems facing any study of the High Technology sector is in fact, to identify those industries which comprise it. As has been noted in the Birch and MacCracken study and others, although the term "High Tech" has been widely used and for several years in the early 1980's was viewed as a panacea for many of our economic ills, there was no clear consensus as to what sectors of the economy it described.

A number of recent studies have attempted to develop statistical measures in order to identify the "High Tech" sector, and thus facilitate more indepth analysis of its impact. In their report Birch and MacCracken² reference such a study done by the Bureau of Labour Statistics in the U.S.

¹ A Study of Job Creation in Canada 1976-1984
(DRIE, 1986, p. 2-9)

² The Role Played by High Technology Firms in Job Creation
(MIT, 1984, p. 1-21)

Three different statistical measures were utilized in that study to identify the "High Tech" sector. The first definition is based on an industry's employment of technology oriented workers (engineers, life and physical scientists, mathematical specialists, engineering and science technicians and computer specialists). The second is based on the level of R&D expenditures in each sector, and the third looks at both the number of technology workers employed and the level of R&D. In Canada the Economic Council has developed a similar list of "High Tech" sectors based on the technological sophistication both of the production processes and output of an industry.

Most other studies of the impact of high technology have used statistical measures similar to the four described above to identify the affected industries. In a parallel study* undertaken by our Directorate these four different measures of "High Tech" and the sectors they define are compared in terms of their employment growth and the number of business start-ups each contributed in Canada over the 1971-1981 period. We will refer readers to the Birch and MacCracken and DRIE studies for a full discussion of these definitions of the "High Tech" sector and a comparison of the U.S. and Canadian results.

¹ High Technology and Job Creation
(Statistical Analysis, DRIE, 1986)

In brief, however, both the U.S. and Canadian studies show that the "High Tech" sector as defined by the above measures represents a very small proportion of the total economy both in terms of its total employment and the new jobs which it has contributed. Part of the failure of the "High Tech" sector not to have shown a more impressive job creation performance may however stem from some shortcomings in the various definitions used. With the first, looking at the numbers of technology-related workers can be misleading, since in many cases such workers are not actively employed in R&D related functions. Similarly, looking at the level of R&D expenditures may identify sectors where new product development is critical to market share but the actual level of innovation remains relatively low. Assessing the level of technological sophistication of the production processes and output of an industry may also present a problem, since it can be quite subjective.

Although the "High Tech" sector may not be that significant in terms of its actual size or the direct employment it has generated, it is very critical as a generator of growth in other sectors of the economy. It provides the new technologies which others adopt to improve their efficiency and/or introduce new products or services. As Birch and MacCracken note in their report, such innovations are the key to growth and success in a modern developed economy. In their discussions with a panel of experts and through their own analysis of trends in the U.S. a prevailing theme emerged: products or services requiring a high degree of innovation are doing well and expanding while those not based on innovation are being eroded either by overseas competition or by automation.

The above observations led Birch and MacCracken to examine the nature of innovation itself. An important insight their analysis provides is that a good deal of innovation is not technology led, but stems from the development of new products, services or systems from existing devices or procedures. The innovation may be in response to changing market or demographic conditions or have in fact created its own market niche. This presents a further argument against focusing too narrowly on the level of technology, as was the case with the definitions of "High Tech" described earlier.

Thus in their report, Birch and MacCracken put forth the concept of looking instead at the High Innovation sectors of the economy rather than just those where the level of R&D expenditures or the technology applied qualify them as "High Tech". The High Innovation sectors are those dynamic industries which have been particularly successful in developing new products and markets in recent years.

3. Identifying the High Innovation Sector

Since the concept of High Innovation is performance based, the same must be true of the measures developed to identify it. Here Birch and MacCracken utilized the capacity of the Dun and Bradstreet longitudinal data base which they maintain for the U.S., to track the performance of a large proportion the American business population over a period of time. After some experimentation with measures that looked at business turnover

and efficiency, the most appropriate measure of innovation was found to be business growth. Industries which have been highly innovative and successful in developing new products and markets should contain a higher proportion of rapidly growing companies.

Using the Dun and Bradstreet data base the most accurate measure of establishment size and growth is the number of employees. In order to capture both absolute and relative growth an index was developed which consisted of the product of the absolute increase in employment and the percentage increase in employment. This index identifies firms that both have a high growth rate and add substantial numbers of employees, while large slow growing firms and rapidly growing but very small firms have lower scores. (See Appendix A for a technical description of the index)

In their analysis for the U.S., Birch and MacCracken calculated the growth index for individual establishments, and then examined the distribution of index values for industry groupings at a 3-digit Standard Industrial Classification (SIC) level. Rapidly growing and by definition High Innovation companies were considered those with an index value of over 100. In an attempt to control for cyclical factors and the impact of major economic disruptions such as energy price increases, the index was calculated for both the 1969-1976 and 1977-1981 periods. To be considered for the High Innovation sector, industries must have had a significant proportion of rapidly growing establishments in each of these periods. In the analysis two groups of such High Innovation industries

were defined: those with over 4 times as many rapidly growing establishments as the national average (Group 1) and those with 2 to 4 times as many (Group 2). The lists of industries thus defined for the U.S. are included as Appendix B to this report.

Although the growth index is a rather indirect measure of innovation, it does identify those sectors where significant numbers of establishments have been able to expand their activities and maintain this growth through several business cycles. In the U.S. analysis the index was quite successful at both identifying the sectors which one normally defines as "High Tech", and perhaps more importantly those sectors which in aggregate may not have performed that well but do contain a number of high growth (innovative) firms. Among the latter were some of the older manufacturing sectors such as Steel (Group 1) and Textiles (Group 2).

Since the Birch and MacCracken analysis helped to break new ground in identifying High Innovation sectors through the development of a performance based measure, their study has generated considerable interest. It was thus suggested that our Directorate test the same methodology for Canada.

III Identifying the High Innovation Sectors in Canada

To identify the High Innovation sectors in Canada we have applied the same growth index methodology and algorithm which Birch and MacCracken utilized for their U.S. analysis. Since the current Canadian Dun and Bradstreet data base covers the 1976-1984 period, our results will of course not be strictly comparable with those reported for the U.S. (1969-1981). In addition to being more current, the 1976-1984 period for Canada covers a much more extreme business cycle, the strong energy led growth reported in the late 1970's and the major recession in the early 1980's. It thus affords a good opportunity to identify which sectors had a large number of establishments that sustained growth in spite of the generally poor economic climate which developed.

To compare these two distinct phases of the business cycle the growth index was calculated for both the 1976-1980 and 1980-1984 periods, based on the growth in employment reported by establishments on the Canadian Dun and Bradstreet Longitudinal Data Base over these respective periods. The same two groups of industries which were defined in the Birch and MacCracken analysis for the U.S. were then identified for Canada: the first, those with over 4 times as many rapidly growing establishments as the national average (Group 1) and the second, those with 2 to 4 times as many (Group 2).

As was the case in the U.S. analysis, rapidly growing establishments were considered to be those with a growth index over 100. It is interesting to note that in the U.S. for the period studied, about 5% of the establishments had an index value of over 100. While for Canada even over the entire analysis period (1976-1984) only about 2.4% of establishments reported sufficient employment growth for an index value that high. This may not however be that poor a reflection on the performance of Canadian firms, in light of differences in the time periods studied, the structure and size of the two economies. Canadian firms are generally smaller overall than American, and thus may not be expected to show the same degree of absolute growth, so that a smaller proportion of firms will have an index value in excess of 100 even if growth rates were the same.¹

The two groups of High Innovation industries thus identified for Canada are listed in Figure 1. The sectors are described in terms of the U.S. Standard Industrial Classifications (SIC) at a 3-digit level. These are the industry codes currently used on the data base; in addition to being somewhat more detailed than the Canadian SIC's, they also permit a more direct comparison with the U.S. results. For industries common to the U.S. and Canadian High Innovation sectors the U.S. group number is also indicated in Figure 1.

¹ In light of these differences we have looked at what would have been the impact of using an index value of over 50 in the Canadian analysis, as the benchmark to identify rapidly growing establishments. Over the 1976-1984 period this would have only captured an additional 1% of the establishments. In terms of the composition of Groups 1 and 2 the total number of sectors included would drop from 87 to 75, but of those 63 were previously identified based on a benchmark of 100. Of the 12 new sectors identified, only 3 of these are in Group 1 and all very small.

Figure 1

Group 1: Over 4 Times the Level of High Growth Establishments
as National Average

<u>SIC</u>	<u>DESCRIPTION</u>	<u>U.S.</u>
121	Bituminous Coal and Lignite Mining	1
131	Crude Petroleum and Natural Gas	
142	Crushed and Broken Stone, Including Riprap	2
207*	Fats and Oils	2
209	Miscellaneous Food Preparations and Kindred Products	
211*	Cigarettes	
222	Broad Woven Fabric Mills, Man-made Fiber and Silk	2
227*	Floor Covering Mills	2
261	Pulp Mills	
286	Industrial Organic Chemicals	
302*	Rubber and Plastics Footwear	
357	Office, Computing and Accounting Machines	1
367	Electronic Components and Accessories	1
369	Miscellaneous Electrical Machinery, Equipment and Supplies	2
372	Aircraft and Parts	2
386	Photographic Equipment and Supplies	
401	Railroads	1
491	Electric Services	
602	Commercial and Stock Savings Banks	
636*	Title Insurance	
806	Hospitals	2
822	Colleges, Universities, Professional Schools and Junior Colleges	1

Group 2: Between 2 and 4 Times the Level of High Growth Establishments
as National Average

<u>SIC</u>	<u>DESCRIPTION</u>	<u>U.S.</u>
082*	Forest Nurseries and Tree Seed Gathering and Extracting	
085	Forestry Services	
102	Copper Ores	
104	Gold and Silver Ores	
108	Metal Mining Services	
141*	Dimension Stone	
148*	Nonmetallic Minerals (except fuels) Services	
149	Miscellaneous Nonmetallic Minerals (except fuels)	
201	Meats Products	
203	Canned and Preserved Fruits and Vegetables	
221	Broad Woven Fabric Mills, Cotton	
224	Narrow Fabrics and Other Small-wares Mills: Cotton Wools, Silk and Man-made fiber	
231	Men's, Youths' and Boys' suits, Coats and Overcoats	2
232	Men's, Youths' and Boys' furnishings, Work Clothing and Allied Garments	2
233	Women's Misses' and Juniors' Outerwear	2
236	Girls', Children's, and Infants' Outwear	
252	Office Furniture	2
262	Paper Mills, Except Building Paper Mills	2
264	Converted Paper and Paperboard Products, Except Containers and Boxes	

Group 2: Between 2 and 4 Times the Level of High Growth Establishments
as National Average (Cont'd)

<u>SIC</u>	<u>DESCRIPTION</u>	<u>U.S.</u>
277*	Greeting Card Publishing	
281	Industrial Inorganic Chemicals	2
299*	Miscellaneous Products of Petroleum and Coal	
301*	Tires and Inner Tubes	
306	Fabricated Rubber Products, Not Elsewhere Classified	2
307	Miscellaneous Plastics Products	2
313*	Boot and Shoe Cut Stock and Bindings	
314	Footwear, Except Rubber	2
334*	Secondary Smelting and Refining of Non-Ferrous Metals	
399	Miscellaneous Primary Metal Products	
346	Metal Forgings and Stampings	
353	Construction, Mining and Materials Handling Machinery and Equipment	2
363	Household Appliances	1
364	Electric Lighting and Wiring Equipment	2
365	Radio and Television Receiving Equipment, Except Communication Types	2
366	Communication Equipment	1
371	Motor Vehicles and Motor Vehicle Equipment	2
381	Engineering, Laboratory, Scientific and Research Instruments and Associated Equipment	
382	Measuring and Controlling Instruments	2
385	Ophthalmic Goods	
412	Taxicabs	
413	Intercity and Rural Highway Passenger Transportation	2
422	Public Warehousing	
442*	Deep Sea Domestic Transportation	
443*	Great Lakes - St. Lawrence Seaway Transportation	
451	Air Transportation, Certificated Carriers	1
489	Communication Services, Not Elsewhere Classified	
531	Department Stores	1
605*	Establishments Performing Functions Closely Related to Banking	
612*	Savings and Loan Associations	
615	Business Credit Institutions	
631	Life Insurance	2
633	Fire, Marine and Casualty Insurance	2
671	Holding Offices	1
672	Investment Offices	2
736	Personnel Supply Services	
737	Computer and Data Processing Services	2
752	Automobile Parking	
794	Commercial Sports	2
805	Nursing and Personal Care Facilities	2
809	Health and Allied Services, Not Elsewhere Classified	2
821	Elementary and Secondary Schools	
823	Libraries and Information Centers	
824	Correspondence Schools and Vocational Schools	
833	Job Training and Vocational Rehabilitations Services	2
836	Residential Care	2

* - Total number of establishments in these sectors less than 50,
thus number of high growth firms very small.

Of the 22 industries listed for Group 1 (Figure 1), only 5 were also identified in that group in the U.S. analysis. In common are two of the traditional "High Tech" sectors: Computers and Other Office Machines, Electronic Components. Also in common are Coal Mining, Railroads, Colleges and Universities. Of the remaining 17 sectors identified in Group 1 for Canada, 5 fell into Group 2 in the U.S. analysis. Comparing the lists of industries which comprise Group 2, 24 of the 65 sectors identified in the Canadian analysis appeared in the same group in the U.S. study, while 5 appeared in Group 1 in the latter analysis. Although there are a number of industries common to the groups identified for the U.S. and Canada, there are also some major differences in their composition.

Some of the differences between the U.S. and Canadian lists of industries can readily be explained by the natural resource base and other comparative advantages which Canada enjoys. Thus one finds in Group 1 for Canada such industries as Coal Mining and Crude Petroleum and Natural Gas, Fats and Oils, Fabric and Carpet Mills, Pulp Mills, Industrial Organic Chemicals, Rubber and Plastic Footwear, Electric Services. Market conditions at the time also favored the rapid growth of some companies in these sectors. (If a sector is expanding rapidly chances are that a larger proportion of establishments will have a high index value.) That is not to say however that innovation did not play some role in the performance of these sectors, enabling them to capitalize on their advantage.

In some of the sectors identified in Group 1 for Canada the role of innovation is, of course, more apparent: Office, Computing and Accounting Machines, Electronic Components and Accessories, Miscellaneous Electrical Machinery, Aircraft and Parts, and Photographic Equipment. Growth in other sectors such as Hospitals and Post-Secondary Education may be explained largely by demographic and social factors. The importance of the service industries to the growth in employment in our economy is reflected in sectors such as Railroads and Commercial Banking being identified in Group 1, plus the number of business and personal services listed in Group 2.

Examining the list of industries which were identified in either Group 1 or 2 based on the U.S. analysis but not at all in the Canadian (Appendix B), suggests that some of the differences between the two countries may also be cyclical due to the different time periods examined. We note that in the U.S. analysis we find a number of cyclically sensitive sectors dependent on the level of construction activity identified: in Group 1 Steel and Steel Products, in Group 2 Non Residential Buildings, Heavy Construction, Prefabricated Buildings, Paving and Roofing Materials, Glass, Plumbing and Heating. The Transportation, Distribution and Service Sectors are also more heavily represented among the industries identified in Group 1 and 2 in the U.S. This is likely a reflection of the larger, more industrialized and mature economy of the U.S. By the same token there are fewer primary industries identified in either Group 1 or 2 in the U.S. analysis than in the Canadian.

For some of the sectors selected in the U.S. and Canadian Analysis, one would have difficulty claiming that innovation had little if any impact on their performance. Further, with the smaller number of establishments on the Canadian data base (about one-tenth the number on the U.S.) there must be some concern about the representativeness of the panel of establishments in some of the smaller sectors and the fact that the group designation was determined by the performance of just a few firms. In the analysis which follows this problem is circumvented to some extent by undertaking comparisons only for group level aggregations.

IV Job Creation Performance of High Innovation Sector

1. Performance by Sub-Period

In this section we examine the job creation performance of the two groups of the High Innovation sectors which were identified in Section III. As was the case in our previous job creation studies, we will track the employment growth of firms at an establishment level, unless otherwise stated. In this respect we will differ somewhat from the Birch and MacCracken analysis which was a blend of enterprise and establishment based results. The reasons for restricting this analysis to tracking employment at an establishment level are two-fold: first to maintain consistency with previously reported results, second, the Canadian Dun and Bradstreet data base has been found to overestimate employment at an enterprise level. Multi-national enterprises often include activity outside of Canada when quoting their total employment levels. Also the number of acquisitions and mergers which occurred over the analysis period have tended to bias upward the employment levels and growth at an enterprise level. With the information provided on the data base it is difficult to make any sort of adjustment for this problem.

In Figure 2 the performance of the two groups of High Innovation industries are compared with respect to their base year employment levels, share of new jobs created and percentage growth in employment.

Figure 2

JOBS AND JOB CREATION BY INDUSTRY GROUP

Industry Group	# of Industries	% of Total Jobs		% of Net New Jobs			% Growth in Employment		
		1976	1980	1976-80	1980-84	1976-84	1976-80 ²	1980-84 ²	1976-84 ³
Group 1	22	10.0	11.3	25.1	-8.51	22.4	8.8	3.8	18.0
Group 2	65	17.7	18.0	13.4	12.9	16.6	2.7	-3.6	7.5
All Other	311	72.3	70.7	61.4	95.6	61.0	3.0	-6.8	6.8
TOTAL	398	100.0	100.0	100.0	100.0	100.0	3.5	-5.0	8.0

- 1 Over all sectors a net loss of jobs was reported (-320 046) over the 1980-84 period, thus a negative percentage in fact indicates a net increase in employment in Group 1.
- 2 Over the shorter 4 year intervals the DMI data seriously under estimates the impact of new business start-ups and thus the net growth in employment. These figures should be used largely for comparative purposes between the 1976-80 and 1980-84 periods, since the degree of bias should be the same in each.
- 3 The results for the 1976-1980 and 1980-1984 periods will not add to equal the growth reported over the full 1976-1984 period due to the following factors:
 - a) over the longer period (1976-1984) far more births will be identified in the analysis, because of the lag in the reporting of new businesses on the DMI file;
 - b) the 1980 base population is much larger than the 1976 base, since it includes all new listings on the DMI file in the interim.

The results are presented for 3 different time periods (1976-1980, 1980-1984 and 1976-1984), to highlight the effects of the post 1980 recession.

We note that over all three time periods the Group 1 industries have performed considerably better in terms of their contribution to job creation than the other groups categorized. This is particularly true when one looks at the 1980-1984 period, where due to the economic downturn, Group 1 was in fact the only one showing positive growth, 3.8% compared to an overall decline of -5.0%. Over the 1976-1980 and 1976-1984 periods, Group 2 industries grew at a rate slightly less than the national average, while over the 1980-1984 period they reported a somewhat smaller decline (-3.6%). Although in aggregate Group 2's growth has not been that impressive, the industries which comprise it do appear to be somewhat less recession sensitive than the average.

The U.S. results for the 1977-1981 period in a comparable format to those presented in Figure 2 are included as Appendix C to this report. We would however caution readers from drawing any conclusions from direct comparison of the statistics for the two countries. Although the respective household-labour force surveys show a 12% increase in employment in Canada over the 1976-1980 period compared to a 9% increase in the U.S. over the 1977-1981 period, the growth rates based on the DMI data suggest Canada's performance has been much weaker. While the Canadian results for the 1976-1980 period show a 3.5% growth in

employment overall sectors, the U.S. results for the 1977-1981 period show a 10% increase. As noted in the footnotes to Figure 2 the DMI data seriously underestimates employment growth over shorter intervals. These results suggest then that this bias is more a factor on the Canadian data base than on the American, at least over the period in question. It is difficult to document the reasons for this difference, however we do know from earlier work done by Birch and MacCracken that there was a major attempt to expand the coverage of the U.S. DMI file in the mid to late 1970fs. The variation in the employment growth rates may be a reflection of the improved coverage that resulted, or other structural differences between the U.S. and Canadian files. In light of these concerns we will restrict comparisons made in this paper largely to a discussion of general trends between the two countries.

In relative terms the performance of the industries identified in Group 1 for Canada was considerably stronger than the equivalent group identified for the U.S. in the Birch and MacCracken report. There the performance of Group 1 was only marginally better than the overall average (Appendix C). The performance of the Group 2 industries however was similar in both countries, showing a rate of growth slightly less than national average for the 1976-1980 period in the Canadian analysis and 1977-1981 period in the U.S. analysis. It is interesting to note that in spite of the differences between the composition and performance of the High Innovation groups identified in the U.S. and Canadian studies, the share of jobs each represents is very similar.

Much of the analysis presented in the remainder of this text will be based on the full 1976-1984 period. The equivalent tables, looking separately at the 1976-1980 and 1980-1984 periods are provided in Appendices D and E respectively and will be referenced where appropriate. This approach is taken to avoid confusion and in recognition of the fact that the statistics provided by the Dun and Bradstreet Data Base are more representative the longer the analysis period.* Also, looking at the 1976-1984 period smooths out, to a large extent, the impact of the post 1980 recession.

2. Performance by Enterprise Size

In Figure 3 we examine the job creation performance of the High Innovation sectors by the size of enterprise each establishment is a unit of. As was noted in our earlier analysis of the 1976-1984 period, it is the smallest establishments who have experienced the highest rate of growth (Figure 3a). This is found to be even more the case for the two High Innovation sectors, in particular, in Group 1 where establishments with less than 20 employees recorded a growth rate of 203.6%.

The polarization of job creation between the largest and smallest enterprises noted in our earlier job creation studies is also observed in each of the sectors identified in Figure 3b. While over all sectors it

¹ See explanation given on pages 6-8 of "A Study of Job Creation in Canada 1974-1982".

was the smallest enterprises with less than 20 employees who accounted for the largest share of the net employment growth (87.3%), for the High Innovation industries in Group 1 the reverse is true. There establishments which are units of enterprises with over 500 employees accounted for the largest share (62.9%) of the growth in employment in that sector. Except for Group 1, establishments belonging to medium-sized enterprises (50 or more but less than 500 employees) all report a decline in employment over the 1976-1980 period. Looking at the comparable table to Figure 3 for the 1976-1980 period in Appendix B, we find the poor performance of medium-sized Canadian firms predates the post 1980 recession.

In spite of the differences noted previously between the U.S. and Canadian analysis, the results of the two studies are remarkably similar with respect to the apparent relationship between large and small firms and the level of innovation as determined by the Growth Index. In both countries, although it was the smaller High Innovation establishments who grew the most rapidly it was those which were units of larger enterprises which accounted for the largest share of the job creation in that sector. For the low innovation sector it was the smallest firms which reported both the strongest growth (although at a much lower rate than their high innovation counterparts) and generated the most jobs. Since that sector accounts for the largest share of employment in economy (72.3% in 1976), overall establishments with less than 20 employees were found to account for 87.3% of the jobs created (Figure 3C).

Figure 3a

Net Employment Change 1976-1984 by Enterprise
Size and Sector
Expressed as a Percentage of 1976 Base Employment

<u>Sector</u>	<u>Enterprise Employment Size Group</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Group 1	203.6	48.4	17.6	22.2	11.8	14.4	18.0
Group 2	73.8	25.2	-1.8	-12.5	-14.3	7.7	7.5
Other	21.9	1.8	-6.9	-19.6	-16.8	12.6	6.8
Total	25.2	4.8	-5.4	-16.5	-12.9	11.6	8.0

Figure 3b

Percentage Distribution of Net Employment Change 1976-1984
by Enterprise Size Within Sector

<u>Sector</u>	<u>Enterprise Employment Size Group</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Group 1	17.6	4.9	2.4	4.1	8.1	62.9	100.0
Group 2	67.9	22.8	-1.9	-16.9	-26.8	55.0	100.0
Other	118.2	3.8	-10.1	-25.8	-23.8	37.7	100.0
Total	87.3	7.2	-5.9	-17.6	-17.1	46.2	100.0

Figure 3c

Percentage Distribution of Net Employment Change 1976-1984
by Enterprise Size and Sector

<u>Sector</u>	<u>Enterprise Employment Size Group</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Group 1	3.9	1.1	0.5	0.9	1.8	14.1	22.4
Group 2	11.3	3.8	-0.3	-2.8	-4.4	9.1	16.6
Other	72.1	2.3	-6.1	-15.8	-14.5	23.0	61.0
Total	87.3	7.2	-5.9	-17.6	-17.1	46.2	100.0

The major difference found between the U.S. and Canadian results was the weak performance of medium-sized Canadian enterprises, which overall reported a decline in employment. In the U.S. for each of the industry groups defined all sizes of enterprises reported a net increase in employment, while based on the Canadian analysis only those in Group 1 did. Although some degree of polarization is also observed in the U.S. analysis, with the smallest and largest enterprises still creating the most jobs it is not nearly as evident as found for Canada. Over the 1977-1981 period enterprises with 20 or less employees created 51.3% of the jobs in the U.S.¹, while those with over 500 employees created 20.9% of the jobs.

3. Performance by Type of Establishment

Figure 4 shows the variation in the performance of the 3 sectors we have defined for our analysis, by type of establishment and ownership. The four establishment types identified are:

1. Independent: independently owned, single location;
2. Subsidiary: single unit establishment, owned by another enterprise;
3. Headquarters: head office of a multi-unit (branch) operation;
4. Branch: the units of the headquarters identified on the data base.

¹ In deriving these figures Birch and MacCracken have adjusted for the under reporting of births on the DMI file. The unadjusted figures are 36.9% and 43.7% respectively.

In all sectors branches have shown the highest rate of employment growth followed by independent establishments (Figure 3a). Subsidiaries have shown a sharp decline in employment, and with the exception of those of the high innovation - Group 1 industries, headquarters have also shown a decline in all sectors.

Figure 4a

Net Employment Change 1976-1984 by Establishment Type
and Sector
Expressed as a Percentage of 1976 Base Employment

<u>Sector</u>	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Group 1	15.2	-22.0	14.1	44.7	18.0
Group 2	13.3	-30.5	-12.4	28.9	7.5
Other	8.0	-21.1	-7.6	25.5	6.8
Total	9.5	-23.6	-6.7	27.8	8.0

Figure 4b

Percentage Distribution of Net Employment Change 1976-1984
by Establishment Type within Sector

<u>Sector</u>	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Group 1	54.8	-4.7	13.1	36.8	100.0
Group 2	66.5	-38.1	-39.2	110.8	100.0
Other	69.8	-18.4	-18.8	67.4	100.0
Total	65.9	-18.6	-15.1	67.7	100.0

Figure 4c

Percentage Distribution of Net Employment Change 1976-1984
by Enterprise Size and Sector

<u>Sector</u>	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Group 1	12.3	-1.1	2.9	8.3	22.4
Group 2	11.0	-6.3	-6.5	18.4	16.6
Other	42.6	-11.2	-11.5	41.1	61.0
Total	65.9	-18.6	-15.1	67.7	100.0

Overall one finds an almost even split between independents and branch establishments in terms of the share of jobs each created (Figure 4b). For the Group 2 industries, branches accounted for the largest proportion of the net gain in employment while independent establishments accounted for the largest share in Group 1. In the latter case however, the combined contribution of both headquarters and the associated branches (49.9%) almost equaled that of the independent establishments. The strong performance of both independents and branches is of course consistent, with the polarization of job creation between small and large enterprises observed in Section 2. Small businesses are more likely to be independents and branches units of large enterprises.

Comparing the Canadian and U.S. results some major differences are found in terms of the growth rates the various establishment/enterprise types

experienced. First all types of enterprises report positive growth in the U.S. analysis and there is not nearly the degree of variation in their performance as found in the Canadian results. In the U.S. subsidiaries have shown the strongest growth both overall (14.1%) and in Group 1 where they reported 42.3% increase in employment. Just the opposite is observed in Canada where they report a sharp decline in all sectors. Independent businesses have also shown relatively stronger growth in the U.S. analysis, where in Group 2 they report the highest rate of job creation (15.2%), while in Group 1 (30.2%) and overall they report the second strongest (12.5%).

In spite of their strong growth subsidiaries in the U.S. accounted for only a small share of the net growth in employment (3.5% over all sectors). The decline shown by subsidiaries in Canada had a much more significant impact (-18.6%). In both the High and Low Innovation sectors multi unit enterprises (headquarters and their branches) accounted for the largest proportion of the growth in employment reported in the U.S. over the 1977-1981 period. In Canada, if one nets the impact of headquarters and branch units, independent establishments would account for the largest share in all sectors. Although independents in Canada do not appear to be able to compete as effectively against multi unit enterprises (branches) in terms of their growth rates as those in the U.S., the results suggest they are in fact more critical to job creation in our economy even at the High Innovation end.

4. Performance by Type of Product

In this section we examine the variation in the performance of the High Innovation sectors, by the type of product (goods vs service) they are producing. This will thus provide an indication whether the jobs they created were in the manufacturing or service sectors. The distributions given in Figure 5 confirm the poor job creation performance of the goods producing/manufacturing sector that was noted in our earlier analysis of the 1976-1984 period. It was only in the High Innovation groups that the goods producing industries reported a net increase in employment and only in Group 1 was the growth that significant (8.5%). In all sectors the vast majority of jobs were generated by the service producing sector (Figure 5b).

Figure 5a

Net Employment Change 1976-1984 by End Product
and Sector
Expressed as a Percentage of 1976 Base Employment

<u>Sector</u>	<u>Good</u>	<u>Service</u>	<u>Total</u>
Group 1	8.5	21.8	18.0
Group 2	0.4	16.3	7.5
Other	-6.0	15.6	6.8
Total	-3.5	16.5	8.0

Figure 5b

Net Employment Change 1976-1984
Percentage Distribution by End-Product Within Sector

<u>Sector</u>	<u>Good</u>	<u>Service</u>	<u>Total</u>
Group 1	13.7	86.3	100.0
Group 2	3.0	97.0	100.0
Other	-36.2	136.2	100.0
Total	-18.5	118.5	100.0

Figure 5c

Net Employment Change 1976-1984
Percentage Distribution by End-Product and Sector

<u>Sector</u>	<u>Good</u>	<u>Service</u>	<u>Total</u>
Group 1	3.1	19.4	22.4
Group 2	0.5	16.1	16.6
Other	-22.1	83.1	61.0
Total	-18.5	118.5	100.0

A comparison with the equivalent table to Figure 5 in Appendix D, for the 1976-1980 period shows that the goods producing sector did perform somewhat better prior to the recession, but still reported an overall decline in employment of -0.4%

The above results vary significantly from the findings of the U.S. analysis, where the goods producing industries showed positive and fairly significant growth in all sectors, particularly at the High Innovation

end where they accounted for almost 50% of the jobs created over the 1977-1981 period. Over all sectors they still accounted for over 30% of the job creation in that period. These results suggest then that the performance of manufacturers in Canada, in terms of their net employment growth has been much weaker than those in the U.S.

5. High Tech

In the U.S. the Bureau of Labour Statistics defines "High Tech" to include the following six sectors (at a 3-digit SIC level):

- a) Drugs (283);
- b) Office, Computing and Accounting Machines (357);
- c) Communication Equipment (366);
- d) Electronic Components and Accessories (367);
- e) Aircraft and Parts (372);
- f) Guided Missiles and Space Vehicles and Parts (376).

Birch and MacCracken presented a brief comparison in their report of the performance of the "High Tech" group identified above to that of the High Innovation sectors they defined for their analysis. These six "High Tech" industries are generally felt to represent the high end of the manufacturing sectors included in the High Innovation group. In our analysis for Canada, four of the six industries (b through e) were identified in either Group 1 or 2. In 1976, however, they accounted for only 3.7% of the combined employment in those two groups. Figure 6

examines the job creation performance of these six "High Tech" industries by enterprise size and establishment type.

The pattern that emerges here for the more narrowly defined "High Tech" sector is very similar to that observed for the broader High Innovation sector. Although smaller establishments report the highest rate of job creation (141.8% for those with less than 20 employees), it is establishments which are part of larger enterprises, in particular branches which account for the largest share of the net growth in employment. These results are quite comparable to those observed in the U.S.

Figure 6

Job Creation by BLS-Defined High Tech Sector
by Enterprise Size and Establishment Type

	<u>Enterprise Size</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Average Firm Growth Rate	141.8	56.2	26.9	10.9	-7.5	13.2	18.1
Share of Net New Jobs	32.0	17.4	8.8	4.6	-6.8	43.9	100.0

	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Average Firm Growth Rate	28.2	-16.5	4.5	67.3	18.1
Share of Net New Jobs	32.4	-19.4	9.4	77.6	100.0

V Impact of Recession

Although we have restricted our analysis thus far, largely to the 1976-1984 period, in this section we will compare briefly the performance of the more innovative sectors over the 1976-1980 and 1980-1984 periods. This will allow us to examine the impact of the recession which occurred during the latter period, and provide a lead-in for the analysis of firm evolution to be presented in subsequent sections.

Figure 7 shows the rates of net employment change over the 1976-1980 and 1980-1984 periods for the three groups of industries identified in Section III. Before describing the results, it should be noted again that the statistics presented for these two time periods are not additive for the 1976-1984 period (Figure 2 - Footnote 3, p. 18).

Figure 7a

Net Employment Change 1976-1980
Expressed as a Percentage of 1976 Base Employment Levels
by Enterprise Employment Size and Sector

<u>Sector</u>	<u>Employment Size Range</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Group 1	118.1	32.4	0.1	12.3	3.1	7.1	8.8
Group 2	38.6	14.9	-3.0	-12.9	-4.0	2.1	2.7
Other	14.7	-0.5	-4.9	-12.1	-11.2	1.5	3.0
Total	16.3	1.6	-4.5	-11.3	-7.9	3.1	3.5

Figure 7b

Net Employment Change 1980-1984
Expressed as a Percentage of 1980 Base Employment Levels
by Enterprise Employment Size and Sector

<u>Sector</u>	<u>Employment Size Range</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Group 1	58.1	20.8	10.4	2.3	3.4	2.3	3.8
Group 2	27.6	1.4	-11.0	-12.0	-9.5	-4.6	-3.6
Other	-3.0	-11.6	-14.3	-17.0	-14.0	0.1	-6.8
Total	-1.2	-9.7	-12.9	-14.8	-10.5	-0.7	-5.0

Comparing the 1976-1980 and 1980-1984 periods, we note that the recession has caused a major decline in the job creation performance of all sectors, including the two High Innovation groups. The latter however were not as adversely affected, in particular the Group 1 industries which still reported a positive rate of employment growth overall (3.8% for the 1980-1984 period). Within the high innovation sectors the smaller establishments with less than 20 employees have generally experienced less of a decline than did other size ranges. A notable exception was Group 1 establishments in the "50-99" employment size range which in fact reported much stronger performance during the 1980-1984 period.

These results again appear to be quite consistent with the findings of the Birch and MacCracken analysis for the U.S.A. Although in their report the High Innovation sectors were found to be even more immune from a recession, it was also based on an earlier and less severe economic downturn (1974-1976).

VI Firm Evolution

One of the most important observations which has emerged from both the analysis of job creation undertaken by David Birch and his staff at the MIT Program on Neighbourhood Change and that undertaken by our Directorate using the Canadian Dun and Bradstreet data, has been the dynamic nature of firm growth.

There is a very high turnover of establishments and in particular small businesses in the economy. Only a small proportion of small businesses who do survive show any substantial growth; thus their sizeable contribution to job creation is largely due to a number of small establishments who have each created a few jobs. Although larger establishments are somewhat less likely to go out of business, failure is by no means restricted to small businesses. Over time in every size range we find a significant proportion of establishments who show increases and decreases in their employment¹. We also find however that the turnover of establishments due to "births" and "deaths", and the shifts between size classes tend to offset each other, such that the proportion who are in any size class remains relatively stable.

¹ A Study of Job Creation in Canada 1976-1984
(DRIE, 1986, p. 52-53)

In this section we address the question of what happens to the relatively few small businesses who do show substantial growth. How well are they able to sustain this growth and is there any variation according to the level of innovation. Based on the results of their earlier studies, Birch and MacCracken noted in their report* that firms tend to pulsate rather than to sustain any particular growth pattern. That a rapidly growing company is as likely, if not more likely, to decline than to grow in the future, and a declining company (that survives the decline) is more likely to grow than to continue to decline. In fact, it is companies who try to avoid these swings and remain stable who are the most likely to disappear, rather than those companies who are forced to continuously adjust.

In Figure 8 we attempt to quantify this "pulsation effect" looking at the performance of some 300 thousand establishments who were continuously active over the 1976-1984 period. It categorizes the performance of these establishments over the 1976-1978 and 1978-1980 periods and examines their behaviour over the subsequent 1980-1984 period.

* The Role Played by High Technology Firms in Job Creation
(MIT, 1984, p. 38)

The following are the "performance categories" which are defined for the 1976-1978 and 1978-1980 periods:

<u>Type of Change 1976-1978</u>	<u>Type of Change 1978-1980</u>	<u>Net Effect of Both Changes</u>	<u>Abbreviation</u>
Expansion	Expansion	Big+	EE/++
Expansion	Expansion	Small+	EE/+
Expansion	Contraction	Big+	EC/++
Contraction	Expansion		
Expansion	Contraction	Small Change	EC/4-
Contraction	Expansion		
Expansion	Contraction	Big-	EC/—
Contraction	Expansion		
Contraction	Contraction	Small-	CC/-
Contraction	Contraction	Big-	CC/—

Where the net effect described above is based on the following growth rates:

- Big+: more than 20% increase;
- Small+: 11% to 20% increase;
- Small Change: increase or decrease in the range of 0-10%;
- Small-: -11% to -20% decrease;
- Big-: more than 20% decrease.

Looking at the distribution of establishments which results from the categorization described above, we note that in general the High Innovation establishments pulsate as much as was found for all establishments (Figure 8). In total and for the two High Innovation groups, the vast majority of establishments have shown only a slight variation in their employment over the 1976-1980 period. For these more stable establishments the 1980-1984 performance is also quite similar with those in Group 1 being somewhat more likely to have shown a big increase and less likely to have failed, while those in Group 2 being less likely to have remained stable and more likely to have failed.

Figure 8

Employment Change as a Function of Past History (1976-1980)

<u>Total (1980-1984)</u>						
<u>1976-1980</u>	<u>Big+</u>	<u>Neutral</u>	<u>Big-</u>	<u>Death</u>	<u>Total</u>	<u>No. of Establishments</u>
EE/-H-	17.9	41.5	23.1	17.5	100.0	9703
EE/+	12.6	53.6	19.9	13.9	100.0	1506
EC/-H-	13.5	46.2	19.6	20.7	100.0	41471
EC/+	10.5	51.9	9.6	28.1	100.0	262594
EC/-	21.8	44.2	6.8	27.2	100.0	10788
CC/-	16.0	47.0	15.5	21.4	100.0	2020
CC/-	<u>23.5</u>	<u>38.7</u>	<u>8.8</u>	<u>28.9</u>	<u>100.0</u>	<u>2086</u>
TOTAL	11.6	50.5	11.2	26.7	100.0	330168

<u>Group 1 (1980-1984)</u>						
<u>1976-1980</u>	<u>Big+</u>	<u>Neutral</u>	<u>Big-</u>	<u>Death</u>	<u>Total</u>	<u>No. of Establishments</u>
EE/-H-	29.1	44.6	10.8	15.5	100.0	148
EE/+	17.5	65.0	15.0	2.5	100.0	40
EC/-H-	18.9	43.6	17.3	20.2	100.0	376
EC/H-	17.4	51.6	9.8	21.2	100.0	1790
EC/-	26.9	43.6	6.4	23.1	100.0	78
CC/-	9.5	61.9	4.8	23.8	100.0	21
CC/-	<u>56.2</u>	<u>18.7</u>	<u>12.5</u>	<u>12.5</u>	<u>100.0</u>	<u>16</u>
TOTAL	18.8	49.8	10.9	20.5	100.0	2469

<u>Group 2 (1980-1984)</u>						
<u>1976</u>	<u>Big+</u>	<u>Neutral</u>	<u>Big-</u>	<u>Death</u>	<u>Total</u>	<u>No. of Establishments</u>
EE/-H-	22.6	39.8	21.6	16.0	100.0	733
EE/+	17.1	55.0	17.8	10.1	100.0	129
EC/-H-	17.8	41.1	18.9	22.2	100.0	2008
EC/H	11.9	46.5	10.6	31.0	100.0	11744
EG/-	24.5	36.4	8.1	31.0	100.0	690
CC/-	11.7	55.2	17.9	15.2	100.0	145
CC/-	<u>21.7</u>	<u>40.8</u>	<u>11.7</u>	<u>25.8</u>	<u>100.0</u>	<u>120</u>
TOTAL	13.8	45.2	12.2	28.8	100.0	15569

When looking at the 1980-1984 performance of those establishments who reported greater variation in their employment over the 1978-1980 period, one should be cautioned that because of the small number of establishments who fall into these categories, the results may not be that representative since they reflect the performance of just a few firms. This is a particular concern with the small cells for Group 1.

With the above concerns in mind, we note that establishments in the more innovative sectors who reported consistent and sizeable growth over the 1976-1980 period are more likely to continue to do so over the subsequent (1980-1984) period. Establishments in Group 1 who reported a substantial decline in employment over the 1976-1980 are also much more likely to have shown a strong recovery in the subsequent period. The reverse is found for those who only reported a moderate decline in the previous period, although in this case the probability of a subsequent large decline is also much less.

The results of the analysis of firm evolution are quite comparable for Canada and the U.S. Both suggest that establishments in more innovative sectors are generally more volatile.

VII Acquisition of Independent Firms

In this section we extend our analysis of firm evolution begun in the previous section, to assess the impact which acquisition has had on previously independent enterprises, in particular those which have become units of other enterprises. This is in recognition of the trend for many small businesses once they grow and become successful, to be bought out and absorbed by larger companies. Often this stems from a desire on the part of the original owners to realize the monetary benefits from their achievements, rather than to risk any future economic decline and resulting loss of equity. Here we look at what impact such transfers of ownership have on establishment growth patterns.

Figure 9 compares the rates of employment growth between the 1976-1980 and 1980-1984 periods for establishments identified as independents in 1976, who remained independent throughout and those who had been acquired during the initial (1976-1980) period. It further sorts these establishments according to the level of growth experienced over the 1976-1980 period. Overall however, less than 3% of the independent establishments active in 1976 had been acquired by 1980, thus the results reported here for acquisitions are based on very small numbers of establishments and in particular for the two high innovation groups where a number of the cells in the tables presented are blank. In light of this we will restrict our analysis mainly to a discussion of the results over all sectors, and a comparison with the U.S. findings at that level.

Figure 9a

Average Annual Growth in Employment for Establishments
Identified as Independent in 1976 and Remaining Active in 1984

A Comparison of 1976-1980 and 1980-1984 Periods by Growth
Experienced over 1976-1980 Period and Establishment Status in 1980

Total Sector
1980 Status: Independent

<u>% Growth (1976-1980)</u>	<u>% Growth Between</u>		<u>Change In Growth rate</u>
	<u>1987 - 1980</u>	<u>1980 - 1984</u>	
15+	17.8	-0.1	-17.9
10-15	3.0	-0.1	-3.1
5-10	1.8	0.3	-1.5
0-5	0.8	0.6	-0.2
Decline	-8.9	1.6	10.5

Total Sector
1980 Status: Acquired

<u>% Growth (1976-1980)</u>	<u>% Growth Between</u>		<u>Change in Growth rate</u>
	<u>1976 - 1980</u>	<u>1980 - 1984</u>	
15+	18.5	-0.5	-19.0
10-15	3.4	-3.0	-6.4
5-10	2.1	-0.7	-2.8
0-5	0.7	0.9	0.2
Decline	-5.5	-6.0	-0.5

Figure 9b

Average Annual Growth in Employment for Establishments
Identified as Independent in 1976 and Remaining Active in 1984

A Comparison of 1976-1980 and 1980-1984 Periods by Growth
Experienced over 1976-1980 Period and Establishment Status in 1980

Group 1
1980 Status: Independent

<u>% Growth (1976-1980)</u>	<u>% Growth Between</u>		<u>Change in Growth rate</u>
	<u>1976 - 1980</u>	<u>1980 - 1984</u>	
15+	13.3	0.9	-12.4
10-15	3.0	0.3	-2.7
5-10	1.7	0.9	-0.8
0-5	0.7	1.6	0.9
Decline	-4.5	3.4	7.9

Group 1
1980 Status: Acquired

<u>% Growth (1976-1984)</u>	<u>% Growth Between</u>		<u>Change in Growth rate</u>
	<u>1976 - 1980</u>	<u>1980 - 1984</u>	
15+	6.5	-2.5	-9.0
10-15	-	-	-
5-10	-	-	-
0-5	-	-	-
Decline	-14.0	19.5	33.5

Figure 9c

Average Annual Growth in Employment for Establishments
Identified as Independent in 1976 and Remaining Active in 1984

A Comparison of 1976-1980 and 1980-1984 Periods by Growth
Experienced over 1976-1980 Period and Establishment Status in 1980

Group 2
1980 Status: Independent

<u>% Growth (1976-1980)</u>	<u>% Growth Between 1976 - 1980</u>	<u>% Growth Between 1980 - 1984</u>	<u>Change in Growth rate</u>
15+	15.7	0.2	-15.5
10-15	3.1	0.0	-3.1
5-10	1.7	1.8	0.1
0-5	0.6	2.1	1.5
Decline	-7.9	1.1	9.0

Group 2
1980 Status: Acquired

<u>% Growth (1976-1980)</u>	<u>% Growth Between 1976 - 1980</u>	<u>% Growth Between 1980 - 1984</u>	<u>Change in Growth rate</u>
15+	24.3	0.0	-24.3
10-15	2.6	-16.7	-19.3
5-10	2.2	-2.2	-4.4
0-5	-	-	-
Decline	-3.3	-10.7	-7.4

As was described in Section V, with the recession that occurred during the 1980-1984 period, employment growth rates dropped significantly from the levels reported during the 1976-1980 period. Figure 9a shows that this was very much the case for establishments who were identified as independents in 1976. Those establishments who had been acquired by 1980 showed a generally larger decline in the 1980-1984 period than those who remained independent. In both cases establishments who had shown strong growth in the initial period were unable to maintain it in the subsequent period. Those who remained independent however more readily reversed a previous decline than those who were acquired.

Except in the latter case, the above results are quite comparable to those described in the Birch and MacCracken analysis for the U.S. In both countries there is a strong tendency for rapidly growing establishments to reach a plateau, causing a sharp decline in their growth rates. In the U.S. however, acquired establishments were as likely as those who remained independent, to be able to reverse a previous decline. As noted above, this does not appear to be the case in Canada. The sharp downturn in the Canadian economy after 1980 may be a factor contributing to this difference, making it more difficult for new management to facilitate a reversal than if the ownership had remained constant.

In spite of these differences the Canadian results generally support Birch and MacCracken's conclusion that acquisition does little to dampen the pulsation phenomenon described in the previous section. A similar pattern is observed in the tables for the two High Innovation groups (Figures 9b and 9c respectively), with the exception that for Group 1 acquired establishments showed a strong reversal where there had been a previous decline in employment. As cautioned earlier however, because of the small number of observations these results may not be strictly representative.

VIII Geographic Location of High Innovation Jobs

In both Canada and the U.S. the "High Tech" sector has tended to be highly geographically concentrated, often in a few cities or communities. This reflects the historic development of the industry around major educational institutions, research facilities, manufacturers and major purchasing groups. As a result the job creation contribution of the "high tech" sector has had a high degree of regional concentration.

In this section we look at the geographic breakdown of our more broadly defined High Innovation sectors, to determine if the growth in employment they have contributed has been more widely dispersed. Figure 10 compares and ranks the eleven provinces and territories according to the following dimensions:

- a) The number of High Innovation jobs in 1984 (employment in industry Groups 1 and 2 combined);
- b) The growth in employment in the High Innovation sector over the 1976-1984 period;
- c) The percentage of total employment (as reported by Dun and Bradstreet) accounted for by the High Innovation sector;
- d) The growth in total employment 1976-1984.

Figure 10a

High Innovation
Employment and Employment Growth by Province

<u>Province</u>	<u>% of Total High Innovation Jobs 1984</u>	<u>% of Total Growth in High Innovation Jobs 1976-1984</u>	<u>% of All¹ Jobs in High Innovation 1984</u>	<u>% of Growth in Total Employment 1976-1984</u>
Newfoundland	1.6	-5.6	38.0	1.2
P.E.I.	0.3	3.1	23.9	0.2
Nova Scotia	2.1	16.0	28.1	1.2
New Brunswick	2.1	-5.9	31.4	1.5
Quebec	28.8	29.3	33.0	-0.3
Ontario	41.1	29.7	32.0	30.0
Manitoba	4.2	2.7	33.0	3.6
Saskatchewan	2.4	0.8	24.5	6.8
Alberta	8.0	28.6	26.3	35.9
British Columbia	9.4	1.4	25.8	19.4
Yukon/N.W.T.	<u>0.1</u>	<u>0.0</u>	<u>13.9</u>	<u>0.4</u>
Total	100.0	100.0	32.0	100.0

¹ These percentages reflect the share Groups 1 and 2 combined represent of total employment in the province.

Figure 10b

Provinces Ranked by Extent of High Innovation
Employment and Employment Growth

<u>Province</u>	<u>Abs. # of High Innovation Jobs 1984</u>	<u>Abs. Growth in High Innovation Jobs 1976-1984</u>	<u>% of All Jobs in High Innovation 1984</u>	<u>Abs. Growth in Total Employment 1976-1984</u>
Newfoundland	9	10	1	7
P.E.I.	10	5	10	10
Nova Scotia	7	4	6	7
New Brunswick	7	11	5	6
Quebec	2	2	2	11
Ontario	1	1	4	2
Manitoba	5	6	2	5
Saskatchewan	6	8	9	4
Alberta	4	3	7	1
British Columbia	3	7	8	3
Yukon/N.W.T.	11	9	11	9

The geographic breakdown of the absolute number of High Innovation jobs closely mirrors that of the provinces' total labour forces. When ranked according to the growth in employment in the High Innovation sector, Ontario and Quebec are again in first and second place, but Alberta, Nova Scotia and P.E.I. move up to place 3 through 5 respectively. Among those provinces whose ranking with respect to the growth in the High Innovation sectors is lower, British Columbia shows by far the largest difference (from third to seventh place).

It is interesting to note that the rankings of the provinces according to the growth in total employment differ somewhat from those for the growth in the High Innovation sectors. For total employment Alberta, Ontario, British Columbia, Saskatchewan, and Manitoba rank 1 through 5 respectively. Of these provinces, only Alberta and Ontario are among the top five in terms of growth in High Innovation sectors. With the exception of Manitoba, in the western provinces the industries included in Group 1 and 2 also account for a smaller proportion of total employment. The opposite is true in the Maritime provinces except P.E.I. This is due to the inclusion in the High Innovation sector of industries such as Coal Mining, Pulp and Paper, which are major employers in that region. These industries however do not appear to have been significant sources of job creation for the Maritime economy, given the relatively low growth rates reported by provinces in that region.

To sum up, employment growth reported by the High Innovation sectors has been far from evenly distributed across provinces. Also, having a High Innovation sector alone does not guarantee new jobs in these sectors. Similar results were found for the U.S.

APPENDIX A

Growth Index

As noted In the text the Growth Index was developed as a measure of both absolute and relative growth. The formula used to calculate the index is the product of these two terms:

$$(EMP^2 - EMP^1) ((EMP^2 - EMP^1) / EMP^1)$$

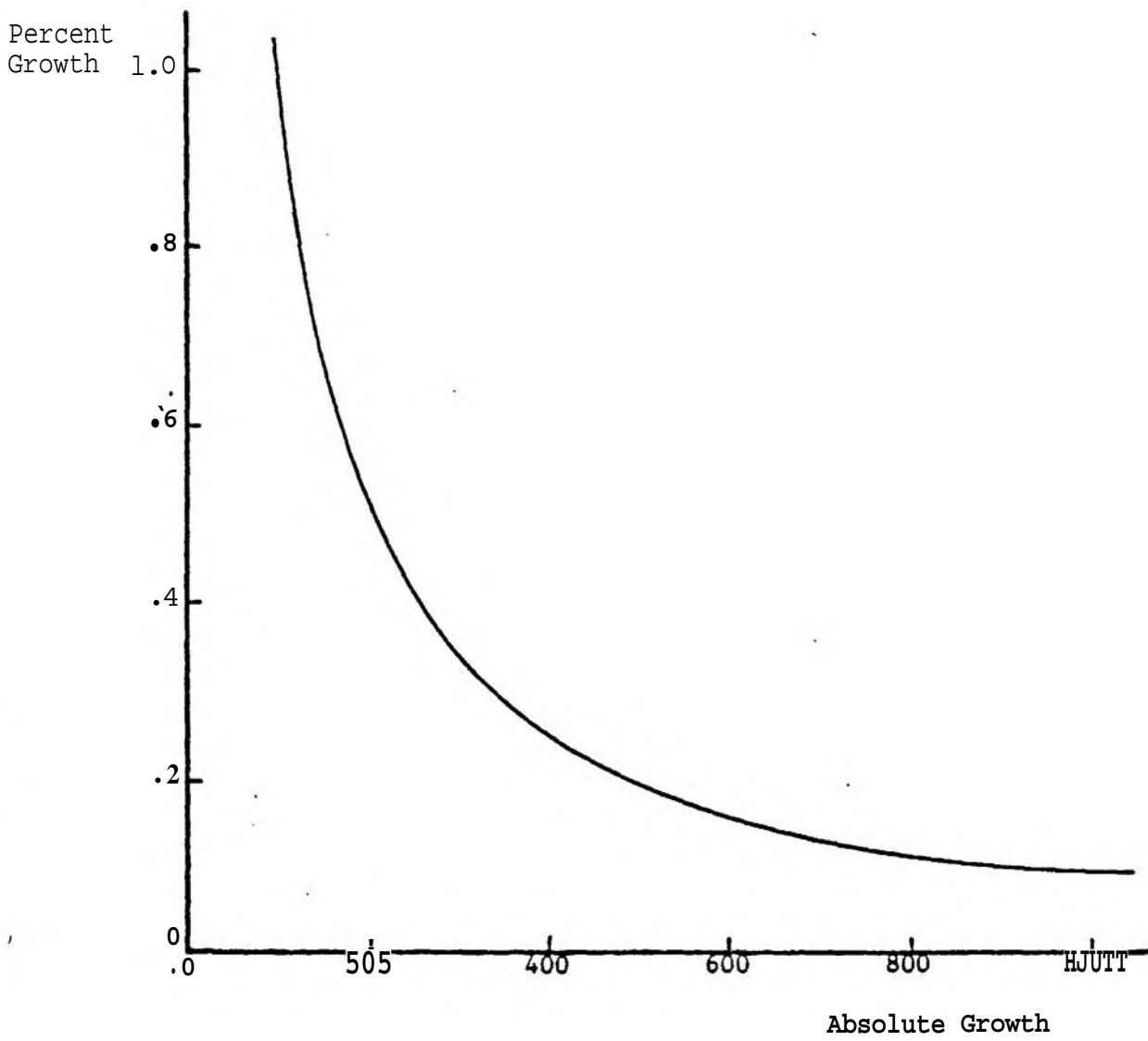
where EMP^1 = employment in year 1

EMP^2 = employment in year 2

In the analysis a high growth-innovative establishment was defined as one with an index value of over 100. Figure 11 used in the Birch and MacCracken analysis illustrates the locus of absolute and relative growth rates which would define the curve for an index value of 100. As it illustrates, we would treat as equivalent a growth of 50 employees representing a 200% growth ($50 * 2.0$) and an expansion of 400 employees that represents only a 25% increase ($400 * .25$). Any establishment whose growth places it above the curve (Index = 100), is considered to show strong signs of innovation. Industries which contain a significant population of establishments above the curve, are considered part of the "High Innovation" sector examined in this report.

Figure 11

Growth Index with Curve
for Value of 100



APPENDIX B

Growth Index Groupings for U.S.¹

Group 1: Over 4 Times the Level of High Growth Establishments
as National Average

	<u>Canada</u>
Bituminous Coal and Lignite Mining	1
Preserved (Dried and Frozen) Fruits and Vegetables	
Petroleum Refining	
Steel and Steel Products	
Computers and Other Office Machines	1
Household Appliances	2
Communication Equipment	2
Electronic Components	1
Motorcycles, Bicycles and Parts	
Railroads	1
Airlines	2
Department Stores	2
Medical and Health Insurance	
Holding Companies	2
Colleges and Universities	1

Group 2: Between 2 and 4 Times the Level of High Growth Establishments
as National Average

	<u>Canada</u>
Vegetable and Melon Crops	
Oil and Gas Field Services	
Crushed and Broken Stone	1
Non-residential Buildings	
Heavy Construction except Highways (Bridges, Tunnels)	
Fats and Oils	1
Weaving Mills, Synthetics	1
Knitting Mills	
Textile Finishings Except Carpets	
Carpets	1
Yarn and Thread Mills	
Men's and Boy's Suits	2
Men's and Boy's Furnishings	2
Women's and Misses' Outerwear	2
Women's and Children's Underwear	
Miscellaneous Apparel and Accessories	
Prefabricated Buildings and Mobile Homes	
Office Furniture	2
Paper Mills	2
Industrial, Inorganic Chemicals	2
Plastics and Synthetic Fibers	
Drugs	
Paving and Roofing Materials	
Fabricated Rubber Products	2

¹ The Role Played by High Technology Firms in Job Creation
(MIT, 1984, p. 16-19)

Group 2: Between 2 and 4 Times the Level of High Growth Establishments
as National Average (Cont'd)

	<u>Canada</u>
Miscellaneous Plastic Products	2
Leather Tanning and Finishing	
Footwear, except Rubber	2
Handbags and Personal Leather Goods	
Glass and Glassware	
Pottery and Related Products	
Primary Non-Ferrous Metals	
Non-Ferrous Rolling and Drawing	
Metal Cans and Shipping Containers	
Plumbing and Heating	
Engines and Turbines	
Construction and Related Machinery	2
Electric Distribution Equipment	
Electrical Industrial Apparatus	
Electrical Lighting and Wiring Equipment	2
Radio and TV Receiving Equipment	2
Miscellaneous Electrical Equipment	1
Motor Vehicles and Equipment	2
Aircraft and Parts	1
Ship and Boat Building	
Measuring and Controlling Devices	2
Medical Instruments and Supplies	
Toys and Sporting Goods	
Local and Suburban Transportation	
Intercity Highway Transportation	2
Transportation Charter Services	
School Buses	
Local Water Transportation	
Non-certified Air Carriers	
Pipe Lines, Except Natural Gas	
Gas Production and Distribution	
Combination Utility Services	
Life Insurance	2
Fire, Marine, and Casualty Insurance	2
Investment Offices	2
Services to Buildings	
Computer and Data Processing Services	2
Commercial Sports	2
Nursing and Personal Care Facilities	2
Hospitals	1
Health and Allied Services	2
Individual and Family Services	
Job Training and Related Services	2
Residential Care	2
Other Social Services	
Non-Commercial Research Organizations	

APPENDIX C

Jobs and Job Creation by Industry Group in U.S.¹

<u>Industry Group</u>	<u>No. of Industries</u>	<u>% of Total Jobs</u>	<u>% of Net New Jobs 1977-1981</u>	<u>% Growth in Employment 1977-1981</u>
Group 1	15	11	14	10.6
Group 2	70	22	20	8.6
All Other	313	67	66	10.3
All Businesses	398	100	100	10.0

¹ The Role Played by High Technology in Job Creation
(MIT, 1984, p. 20-21)

APPENDIX D

Figure 3a

Net Employment Change 1976-1980 by Enterprise
Size and Sector
Expressed as a Percentage of 1976 Base Employment

<u>Sector</u>	<u>Enterprise Employment Size Group</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Group 1	118.1	32.4	0.1	12.3	3.1	7.1	8.8
Group 2	38.6	14.9	-3.0	-12.9	-4.0	2.1	2.7
Other	14.7	-0.5	-4.9	-12.1	-11.2	1.5	3.0
Total	16.3	1.6	-4.5	-11.3	-7.9	3.1	3.5

Figure 3b

Percentage Distribution of Net Employment Change 1976-1980
by Enterprise Size Within Sector

<u>Sector</u>	<u>Enterprise Employment Size Group</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Group 1	20.8	6.7	0.0	4.7	4.3	63.5	100.0
Group 2	100.0	38.1	-9.1	-49.5	-21.1	41.7	100.0
Other	180.7	-2.4	-16.4	-36.0	-36.2	10.5	100.0
Total	129.6	5.3	-11.3	-27.6	-24.0	28.0	100.0

Figure 3c

Percentage Distribution of Net Employment Change 1976-1980
by Enterprise Size and Sector

<u>Sector</u>	<u>Enterprise Employment Size Group</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Group 1	5.2	1.7	0.0	1.2	1.1	16.0	25.1
Group 2	13.4	5.1	-1.2	-6.7	-2.8	5.6	13.4
Other	111.0	-1.5	-10.1	-22.1	-22.3	6.4	61.4
Total	129.6	5.3	-11.3	-27.6	-24.0	28.0	100.0

Figure 4a

Net Employment Change 1976-1980 by Establishment Type
and Sector
Expressed as a Percentage of 1976 Base Employment

<u>Sector</u>	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Group 1	6.2	-17.9	10.3	25.3	8.8
Group 2	6.4	-17.8	-10.2	15.0	2.7
Other	5.0	-9.4	-2.0	5.1	3.0
Total	5.3	-12.1	-2.8	9.2	3.5

Figure 4b

Percentage Distribution of Net Employment Change
by Establishment Type within Sector

<u>Sector</u>	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Group 1	45.6	-7.8	19.6	42.5	100.0
Group 2	91.1	-62.7	-90.4	162.0	100.0
Other	99.6	-18.6	-11.3	30.4	100.0
Total	84.9	-21.8	-14.2	51.1	100.0

Figure 4c

Percentage Distribution of Net Employment Change
by Enterprise Size and Sector

<u>Sector</u>	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Group 1	11.5	-2.0	4.9	10.7	25.1
Group 2	12.2	-8.4	-12.2	21.8	13.4
Other	61.1	-11.4	-7.0	18.7	61.4
Total	84.9	-21.8	-14.2	51.1	100.0

Figure 5a

Net Employment Change 1976-1980 by End Product
and Sector
Expressed as a Percentage of 1976 Base Employment

<u>Sector</u>	<u>Good</u>	<u>Service</u>	<u>Total</u>
Group 1	6.9	9.6	8.8
Group 2	1.8	3.8	2.7
Other	-1.8	6.3	3.0
Total	-0.4	6.3	3.5

Figure 5b

Net Employment Change
Percentage Distribution by End Product Within Sector

<u>Sector</u>	<u>Good</u>	<u>Service</u>	<u>Total</u>
Group 1	22.7	77.3	100.0
Group 2	36.7	63.3	100.0
Other	-24.8	124.8	100.0
Total	-4.5	104.5	100.0

Figure 5c

Net Employment Change
Percentage Distribution by End Product and Sector

<u>Sector</u>	<u>Good</u>	<u>Service</u>	<u>Total</u>
Group 1	5.7	19.4	25.1
Group 2	4.9	8.5	13.4
Other	-15.2	76.6	61.4
Total	-4.5	104.5	100.0

Figure 6

Job Creation by BLS-Defined High Tech Sector 1976-1980
by Enterprise Size and Establishment Type

<u>Sector</u>	<u>Enterprise Size</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Average Firm Growth Rate	71.9	25.3	3.6	3.3	-12.8	-2.0	1.5
Share of Net New Jobs	196.0	94.8	14.3	16.8	-140.2	-81.8	100.0

<u>Sector</u>	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Average Firm Growth Rate	19.3	-23.1	0.9	9.9	1.5
Share of Net New Jobs	268.2	-328.1	22.0	137.9	100.0

APPENDIX E

Figure 3a

Net Employment Change 1980-1984 by Enterprise
Size and Sector
Expressed as a Percentage of 1980 Base Employment

<u>Sector</u>	<u>Enterprise Employment Size Group</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Group 1	58.1	20.8	10.4	2.3	3.4	2.3	3.8
Group 2	27.6	1.4	-11.0	-12.0	-9.5	-4.6	-3.6
Other	-3.0	-11.6	-14.3	-17.0	-14.0	0.1	-6.8
Total	-1.2	-9.7	-12.9	-14.8	-10.5	-0.7	-5.0

Figure 3b

Percentage Distribution of Net Employment Change
by Enterprise Size Within Sector

<u>Sector</u>	<u>Enterprise Employment Size Group</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Group 1	23.1	9.8	6.8	2.5	10.8	46.9	100.0
Group 2	-58.2	-2.6	24.4	31.1	34.4	70.9	100.0
Other	17.3	25.0	20.1	20.6	17.3	-0.3	100.0
Total	7.1	22.8	21.7	23.5	20.0	4.8	100.0

Figure 3c

Percentage Distribution of Net Employment Change
by Enterprise Size and Sector

<u>Sector</u>	<u>Enterprise Employment Size Group</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Group 1	-2.0	-0.8	-0.6	-0.2	-0.9	-4.0	-8.5
Group 2	-7.5	-0.3	3.1	4.0	4.4	9.1	12.9
Other	16.6	23.9	19.2	19.7	16.5	-0.3	95.6
Total	7.1	22.8	21.7	23.5	20.0	4.8	100.0

Figure 4a

Net Employment Change 1980-1984 by Establishment Type
and Sector
Expressed as a Percentage of 1980 Base Employment

<u>Sector</u>	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Group 1	5.7	-16.1	2.2	0.6	3.8
Group 2	-1.5	-22.0	-10.4	3.2	-3.6
Other	-8.6	-24.8	-8.4	6.3	-6.8
Total	-5.9	-23.6	-7.6	4.9	-5.0

Figure 4b

Percentage Distribution of Net Employment Change 1980-1984
by Establishment Type within Sector

<u>Sector</u>	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Group 1	97.2	-10.1	10.2	2.7	100.0
Group 2	17.4	47.6	60.9	-25.8	100.0
Other	77.9	19.4	19.4	-16.7	100.0
Total	68.5	25.5	25.5	-19.5	100.0

Figure 4c

Percentage Distribution of Net Employment Change 1980-1984
by Enterprise Size and Sector

<u>Sector</u>	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Group 1	-8.3	0.9	-0.9	-0.2	-8.5
Group 2	2.2	6.1	7.8	-3.3	12.9
Other	74.5	18.6	18.6	-16.0	95.6
Total	68.5	25.5	25.5	-19.5	100.0

Figure 5a

Net Employment Change 1980-1984 by End Product
and Sector
Expressed as a Percentage of 1980 Base Employment

<u>Sector</u>	<u>Good</u>	<u>Service</u>	<u>Total</u>
Group 1	-7.0	7.3	3.8
Group 2	-9.0	1.8	-3.6
Other	-12.2	-3.4	-6.8
Total	-11.1	-1.2	-5.0

Figure 5b

Net Employment Change
Percentage Distribution by End Product Within Sector

<u>Sector</u>	<u>Good</u>	<u>Service</u>	<u>Total</u>
Group 1	-46.2	146.2	100.0
Group 2	124.8	-24.8	100.0
Other	68.3	31.7	100.0
Total	85.3	14.7	100.0

Figure 5c

Net Employment Change
Percentage Distribution by End Product and Sector

<u>Sector</u>	<u>Good</u>	<u>Service</u>	<u>Total</u>
Group 1	3.9	-12.4	-8.5
Group 2	16.1	-3.2	12.9
Other	65.3	30.4	95.6
Total	85.3	14.7	100.0

Figure 6

Job Creation by BLS-Defined High Tech Sector 1980-1984
by Enterprise Size and Establishment Type

<u>Sector</u>	<u>Enterprise Size</u>						<u>Total</u>
	<u>0-19</u>	<u>20-49</u>	<u>50-99</u>	<u>100-199</u>	<u>200-499</u>	<u>500+</u>	
Average Firm Growth Rate	52.1	28.8	14.5	15.4	5.9	4.8	10.5
Share of Net New Jobs	27.4	15.9	9.5	13.0	6.6	27.6	100.0

<u>Sector</u>	<u>Establishment Type</u>				<u>Total</u>
	<u>Independent</u>	<u>Subsidiary</u>	<u>Headquarters</u>	<u>Branch</u>	
Average Firm Growth Rate	17.0	-7.4	-1.0	30.0	10.5
Share of Net New Jobs	43.6	-7.4	-3.7	67.5	100.0

