automobile industry in order to provide some insights for adjustment policy.

The automotive agreement between Canada and the United States sought to rationalize the production of automotive products and to create the basis for an integrated automotive market by removing many impediments to trade between the two countries. While the U.S. continued to keep the research and development functions and the bulk of the parts production, the auto pact helped Canada create thousands of new jobs in low skill assembly of cars for the U.S. market. In Canada, about 58 percent of the employment in the auto industry was in assembly operations in 1979. An analysis of Canadian data revealed that a higher proportion of workers in assembly operations were unskilled as compared to their counterparts in the U.S.A. In parts and accessories, skill levels of workers were higher than assembly operations but were below the U.S.A. level.

A combination of factors appear to have led to the current problem of the automobile sector: increasing import competition particularly from Japanese manufacturers, increased price of gasoline, slow growth in real income and high interest rates. These have led to a change in the total demand as well as the mix of types. Foreign manufacturers have been able to meet this demand in terms of price, quantity and mix. There has been a substantial gain in import market share in the U.S.
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EMPLOYMENT PERFORMANCE AND COST OF

LABOUR ADJUSTMENT IN THE AUTOMOBILE INDUSTRY

BY

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A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfillment of
the requirements for the degree of
Doctor of Philosophy

Department of Economics
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December, 1983

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ABSTRACT

Trade liberalization and any other economic condition that causes the movement of socially valuable resources between and within industries will improve allocative efficiency in the long run. However, the resources released from a declining industry are not normally immediately absorbed by other sectors with equivalent earnings because of many market imperfections. Under such a situation, the private individuals as well as the national economy will suffer a loss, i.e. adjustment costs in the value of output produced during this transitional period.

This dissertation attempts to measure and quantify the labour adjustment costs for the permanently laid off automobile workers in Ontario during 1974-79. Based upon the estimates from our sample of individuals, we attempt to project the potential labour adjustment problems under severe layoff conditions such as were experienced by the automobile industry during 1979-81. A theoretical income loss model is specified. The main determinants of this model are: worker's prior earnings before separation; worker's alternative earnings; permanency of prior employment; and the probability of being employed in alternative jobs. Estimates of the main determinants of the income loss model have been made by using the longitudinal data base which was developed by Employment and Immigration Canada. The estimated values of the main determinants are then substituted into the income loss model in order to estimate both private and social costs of adjustment.

The estimation of the labour adjustment costs provide us with a crude measure of the potential gains that can be obtained by applying the appropriate government policy. Any government intervention, however, should be based (mainly) upon
efficiency criteria, i.e. an investigation to determine whether the benefits resulting from government action exceeds costs. In the presence of labor adjustment costs based on efficiency criteria, four main government policy options have been analyzed: (1) reliance on private adjustment mechanism; (2) tariff protection; (3) employment subsidy; and (4) retraining programs.
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The errors that remain and the opinions expressed are, however, the responsibility of the author alone.
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EMPLOYMENT PERFORMANCE AND COST OF LABOUR ADJUSTMENT IN THE AUTOMOBILE INDUSTRY

I. INTRODUCTION

There is growing movement towards industrial rationalization in the Canadian manufacturing industries. The development of policies that facilitate shifts in productive resources between and within industries in response to economic changes has become one of the main aims of industrial strategy in the developed world. In particular, the adjustments include intra-industry shifts, involving changes in industrial structure and product mix within an industry to maintain its competitive position and inter-industry adjustments involving large scale transfers of productive resources from a declining industry to a more viable industry. Such industrial adjustment may occur in response to any of the following economic changes: income change and related demand change, technological change and trade liberalization. 1/

The pace of the adjustment, however, is often hampered by structural rigidities and by the burden of the short run adjustment costs inflicted on factors of production. While most firms and workers are, in the long run, capable of carrying out the process of adjustment in response to changes in the economic environment, there is an increasing concern about the magnitude and the distribution of these adjustment costs in the short run.
This is especially the case where the magnitude of the adjustment required is large and possibly also unexpected. In particular, the concern for income protection for affected workers and their families might prompt a government to respond positively to pleas for increased protectionism or other forms of assistance. This is intended to provide a breathing space for domestic industries to become more viable and competitive enough to withstand import penetration.

In such a situation, a large part of the labour force in these industrial countries is not willing to accept economic and social burdens that may be forced upon them because of increased trade liberalization. The resistance of workers and firms in those sectors adversely affected by trade liberalization to move their resources into new areas may slow down the process of structural adjustment and eventually the potential rate of economic growth.

An alternative response from the government would be to provide adjustment assistance to workers and capital to move into alternative more viable sectors. Consideration of the economic efficiency consequences of the different possible interventions should play a major role in their choice. The Canadian automotive industry has the symptoms of a sensitive adjustment problem. This thesis makes an initial attempt to analyze the dimensions of the adjustment problem in the
automobile industry in order to provide some insights for adjustment policy.

The automotive agreement between Canada and the United States sought to rationalize the production of automotive products and to create the basis for an integrated automotive market by removing many impediments to trade between the two countries. While the U.S. continued to keep the research and development functions and the bulk of the parts production, the auto pact helped Canada create thousands of new jobs in low skill assembly of cars for the U.S. market. In Canada, about 58 percent of the employment in the auto industry was in assembly operations in 1979. An analysis of Canadian data revealed that a higher proportion of workers in assembly operations were unskilled as compared to their counterparts in the U.S.A. In parts and accessories, skill levels of workers were higher than assembly operations but were below the U.S.A. level.

A combination of factors appear to have led to the current problem of the automobile sector: increasing import competition particularly from Japanese manufacturers, increased price of gasoline, slow growth in real income and high interest rates. These have led to a change in the total demand as well as the mix of types. Foreign manufacturers have been able to meet this demand in terms of price, quantity and mix. There has been a substantial gain in import market share in the U.S.
Excluding trade between the U.S. and Canada, the share of foreign imports in the U.S. auto market rose from 15.9 to 21.8 percent between 1974 and 1979. This further increased to 28 percent in 1980, and it is predicted that the U.S. share of the domestic auto market will continue to shrink.

The increasing import penetration has serious consequences on the Canadian automobile trade, production and employment. The Canadian automobile trade surplus of $83 million in 1970 declined to a deficit of $3.48 billion in 1979. One recent study on the automotive industry portrays a very pessimistic view about the future employment situation in the industry. It suggests, a view not shared by the industry, that employment in the Canadian auto industry could conceivably drop to 40-45,000 by 1990 (as compared to 118,000 and 98,000 in 1978 and 1980, respectively), based on the levels of efficiency which the industry has to attain in order to compete internationally. While these predictions may be unrealistically pessimistic, it is clear that import competition and the labour productivity increases that appear to be required to meet this competition are going to place numerous jobs at risk in the automobile sector. This, in turn, faces the government with the alternatives, if it decides to intervene, of protectionism or adjustment assistance.

In addition to normal cyclical fluctuations in employment in the industry, the present downturn appears more
fundamental. Although, the automobile industry is currently passing through a transitional phase, the North American auto manufacturers have been slow to respond to changes in the pattern of consumer demand. This pattern of consumer demand favouring smaller, fuel efficient cars is likely to persist in the foreseeable future.

As of 1981, 83 percent of auto jobs are situated in Ontario: Windsor, Oshawa, St. Catharines, London and Toronto account for the vast majority of these jobs. Quebec employs about 8 percent of the total auto labour force and the rest is distributed across the country. The geographical concentration of the industry in a few towns serves further to complicate the adjustment problem of the displaced workers. The problem is accentuated in towns where the industry is the major source of employment. For example, the transportation industry absorbs about 25 percent and 20 percent of the employed labour force in Oshawa and Windsor respectively. The city of Windsor has been of particular concern where the poor performance of Chrysler and Ford Motors since the middle of 1979 caused unemployment to rise to a peak of 19 percent in February 1980. At the same time, this concentration problem is ameliorated by the automobile industry generally being located in the central industrial belt of Canada where a wide range of alternative employment opportunities have traditionally been available.
Although tariff rates protecting the auto industry have been falling in both Canada and the United States as a result of the multinational trade negotiation, MTN, round,\(^{10}\) the industry and its employees may expect the Federal Government to lean toward a more protectionist policy until the industry achieves a comparable productivity through modernization and rationalization. Any rational government intervention should be based on estimates of the benefits of trade liberalization and the cost of labour displacement. If the costs of the distortion (i.e. benefits of trade liberalization) exceed the cost of labour displacement,\(^{11}\) the appropriate government policy should be toward more trade liberalization accompanied by appropriate adjustment assistance plans to mitigate hardships which a particular group of individuals may face due to structural changes. Ideally, the maximum amount to be devoted to adjustment assistance ought to be equal to the net present value of the benefits which may accrue as a result of structural changes and higher productivity in other activities.

If, in fact, the restructuring currently underway is expected to revitalize the auto industry and any intervention is perceived to generate incremental net economic benefits, then the appropriate government policy may be to assist the industry temporarily, by some means, in its restructuring effort. It would then be important to understand the structure of employment provided by the Canadian automotive industry.
However, if restructuring does not bring employment to pre-1979 levels, or government assistance to the industry does not appear to be economically beneficial, then the appropriate approach would be to analyze the economic opportunities and the reemployment prospects of the auto workers. The worker's subsequent employment/unemployment experiences depend upon his personal characteristics and the general labour market and of course macro-economic conditions. Therefore, it would be important not only to analyze the cost of labour displacement but also the various socio-economic factors that affect the costs and the adjustment process of the unemployed. By analyzing the experience of automobile workers who have experienced some unemployment and particularly those permanently separated from the industry, this thesis attempts to provide some insights into a number of important policy questions. The study is organized in the following way.

A brief discussion on the nature of the adjustment process and the benefit of trade liberalization appears in Section II while Section III deals with the past and the present events that led to the present labour adjustment problem in the auto industry. The income loss model and the estimation of the major components of the income loss model are presented in Section IV and V respectively. Section VI shows the actual estimation of the private and social costs of adjustment. Summary of the thesis and government policy implications are presented in Section VII.
II. TRADE LIBERALIZATION AND ADJUSTMENT PROBLEMS

(A) The General Adjustment Problem

Economists have tended to reject the concept of domestic adjustment costs associated with the lowering of tariffs by saying that they disappear in the long run, while consumer benefits from the lower import prices continue indefinitely. The pure theory of international trade assumes that the gainers will be able to compensate the losers and still end up as gainers but full compensation is in fact almost never provided to those who actually lose as a result of trade liberalization. The comment by Lord Keynes, "We are all dead in the long run" reminds us that this position may be important for political decisions in the short run.\(^{12}\) The traditional approach fails to take into account the realities of international trade. Much of the discussion on the static and dynamic benefits of trade theory does not explicitly concern the income distribution aspect, yet the income distribution effect is immediately felt by the workers who are indefinitely laid off from the industry vulnerable to import competition. This financial hardship of the displaced workers may produce enough lobbying power in a democratic society against freer trade unless alternative programs exist to assist the affected workers.
This lack of adequate attention to the income distribution effects may be the main underlying reason for developed countries' opposition to expanding trade not only with Japan but especially with the developing countries' labour-intensive manufacturers. The groups which benefit, because of trade liberalization, i.e., consumers, are not well organized and do not form a strong political force. The groups which bear the burden of freer trade, principally the workers of the firms directly affected, are well organized and have a strong political representation. If the exchange rate is at an appropriate level and the structure of the economy is flexible, then the other groups of beneficiaries are workers and firms engaged in export industries. We may assume that these groups are less conscious of the effects of protection on them and have less interest in making their views felt than the workers of firms displaced by increased imports. The latter groups feel an immediate reduction in real income and in a democratic society, they are likely to be vocal and in the absence of any adjustment assistance policies, very protectionist.

The loss in income resulting from these adjustments will be greater if the displaced workers and firms are located in communities where alternative employment is not easily available, when industries are concentrated in one geographical area and when because of age, training or other socio-economic reasons, labourers are less mobile. In the Canadian context,
this tends to be the case when some labour intensive products are imported from developing countries.

To summarize our discussion of the adjustment costs of trade liberalization, there is a transitional loss of real income to individuals in the affected industry when domestic productive resources are transferred from the declining industries, i.e., from import competing to other domestic industry. Furthermore, this loss in income will be higher, the longer the transitional period which in turn depends upon general economic conditions and the particular characteristics of the labour force. This dislocation period may be higher if the affected industry is concentrated in a particular geographic region. How the traditional analysis tends to ignore this income loss can be demonstrated by Figure 2.1.

Removing the import duty will cause the domestic price to fall to PW and using the conventional consumers' and producers' surplus concept, the net gain to consumers after elimination of the tariff is represented by the two shaded triangles, ABC and GEP. The value of the released resources involved in domestic production, namely BQpQ'A, is assumed to be absorbed in alternative production sufficiently rapidly that adjustment costs can be ignored. In such a situation, the value of the additional output from released resources in alternative
jobs will exceed the value of labour's output in the import competing industries. However, if all or part of the resources measured by $B_0 Q_0^A$ are not immediately employed in other industries at an earning rate equal to the marginal productivity of labour, then a relevant portion of $B_0 Q_0^A$ should be deducted in order to determine the contribution to output in alternative jobs by the released resources. The relationship of long run and short run value of labour's output is shown in figure 2.2.
Figure 2.1

Partial Equilibrium Analysis of Adjustment Costs

PW₁ = PW(1+t)

- t = tariff rate

PWW' = foreign supply curve for imports, assumed to be infinitely elastic

DD' = domestic demand curve of imported commodity

SS' = domestic supply curve of imported commodity if import taxes of t/PW are imposed. Imports are equal to Q₀Qₜ and domestic production is Q₀. It may be mentioned that a measure of the costs of protection also gives an indication of the benefits of trade liberalization. Both are aspects of the same process.
The rationale of trade oriented adjustment policies is based upon the estimation of the cost and benefits of trade liberalization and a comparison of the net benefits of such liberalization with the cost of adjustment policies themselves. The benefits of trade liberalization will be approximately equal to the cost of protection although dynamic aspects of the former should be taken into consideration. From this must be deducted the adjustment cost of unemployed resources to obtain the net benefits of trade liberalization. This in turn should be compared with the cost of specific adjustment policies designed to assist the unemployed resources. An operational principal could be deduced by saying that the maximum amount to be devoted to a particular industry as adjustment assistance should be equal to the present value of the net benefit of trade liberalization.
in that industry. The costs involved are localized and affect a concentrated group while benefits are spread widely and are not easily measured or segregated. Long periods of unemployment and reduced incomes of the displaced workers cannot be ignored even if the process concerned results in a net gain to the society. The purpose of adjustment policies is to respond to the dislocations associated with trade liberalization and subsequent structural changes.

(B) Static and Dynamic Aspects of Liberalized Trade

Heckscher-Ohlin trade theory is based upon differences in resource endowment; for example, a capital-abundant country will export capital-intensive goods in exchange for labour-intensive goods, thus efficiently conserving its scarce labour. This benefit is emphasized in trade theory models and exists even if larger markets and sales volume do not lead to a reduction in the cost of producing any specific commodity in any country. The idea is that countries reduce the production of goods they produce expensively in favour of the goods they produce relatively inexpensively. This enables each country to acquire goods less expensively from its trading partners than it previously did from its high-cost domestic producers. All countries gain in this example of beneficial exchange.
Static Welfare Gains

A measure of the cost of protection also gives an indication of the benefits of trade liberalization. As Corden\(^{16}\) indicates the principal effect of tariff protection are:

(i) It affects the allocation of resources within the country.

(ii) It affects the consumption pattern through the change in relative prices to consumers of the protected goods.

(iii) It affects the terms of trade.

The first effects will produce inefficiency in production and the second will bring about inefficient consumption. The production and consumption distortions together constitute the deadweight loss of protection.

The welfare effects of trade liberalization can be measured by using the conventional consumer surplus concept. One way is to capture the consumer benefits from lower prices of imports after liberalization. For any pre-existing level of imports, any price reduction to the consumer will merely represent a transfer away from government and therefore does not
produce any net gain to the country. But for the increase in imports, there will be a net welfare gain equal to the domestic consumers' valuation of extra imports minus the cost of extra imports at world price. This welfare gain* is depicted in Figure 2.3.

After complete trade liberalization, there will be an increase in consumer surplus of \( A+C \). However, there is an offsetting decline in government revenue equal to \( C \). The net welfare gain is equal to area \( A \):

* While we are concerned with these effects in relation to imports as a whole, they are most clearly identified with respect to a single industry in isolation.
\[-\frac{1}{2}(PW(1+t)-PW)\Delta IM\]
\[-=\frac{1}{2} t \cdot \Delta IM \].................(1)

The gain equals the increase in import value multiplied by half of the initial tariff rate. But the increase in import value IM is equal to:
\[\Delta IM = \eta_m t \cdot IM \].................(2)

Where \( \eta_m \) = import price elasticity.

\[\frac{\Delta IM}{IM} = \frac{\eta_m}{1+t} \]

percentage change in consumer price caused by the particular tariff change (force of tariff) and IM = Base level of imports.

Now substituting equation (2) into (1), the welfare gain (W) equals:
\[W = \frac{1}{2} \eta_m \cdot \frac{t^2}{1+t} \cdot IM \].................(3)

The previous approach is based on an examination of the demand curve for imports, assuming an infinitely elastic supply curve of imports. The traditional approach examines domestic demand and supply, treating imports as residuals, as shown in Figure 2.1. Total static gain in welfare can be represented by the area of two triangles: ABC and GEP.

Area of GEP = \[\frac{1}{2}((PW_1-PW)(Q_c-Q_c))\]
\[=\frac{1}{2} t^2 \cdot \eta_D \cdot Q_p \cdot PW_1 \].................(4)

and similarly area of ABC = \[\frac{1}{2} t^2 \cdot \eta_s \cdot Q_p \cdot PW_1 \].................(5)
where $\eta_d, \eta_s$: price elasticity of demand and supply respectively.

$Q_{c1}$: value of quantity demanded before liberalization.

$Q_{p1}$: value of quantity supplied before liberalization.
Figure 2.3
Static Gains from Trade Liberalization

Price

\[ P_w(1+t) \]
\[ P_w = 1 \]

D = Demand for imports
SS = World supply of imports
Pw = World price
t = Tariff rate

*The static gains depend on the height of the tariff, the percentage tariff cut, and the increase in imports. The percentage reduction in the import price to consumers will be equal to the change in tariffs divided by unity plus the original tariff, i.e. \( \Delta P = \frac{\Delta t}{1+t} \). For example, if the original tariff were 10 percent and now it is cut to 5 percent, then the consumers will experience a decline in price of 4.76 percent.
Adding equations (4) and (5) will give us a measure of the static welfare gain which is exactly equal to the measure as expressed by equation (1).

The static measure (joint effect of equations (4) and (5)) represents the economic efficiency gain for a single year. The discounted value of such benefits overtime is the welfare gain to be calculated. If elasticities remain constant and the rate of growth of imports remains constant at 'g', then the discounted present value of benefits from tariff removal will be:

\[
B = \lim_{t \to 0} \int_{0}^{\infty} W e^{-(\alpha - g)t} \, dt \tag{6}
\]

where \(W_0\) = static gain from trade liberalization.
\(\alpha\) = appropriate discount rate.
\(g\) = growth rate of imports.

From this benefit estimate, the social cost of adjustment that arises because of dislocation of labour after trade liberalization should be deducted to arrive at the net static gain of free trade. This is the maximum amount that
could be devoted to a trade adjustment assistance plan in the trade dislocated sector.

Dynamic Efficiency Gains

The total welfare gains would be far in excess of equation (6) if several other dynamic effects are included in the traditional static welfare measures. These are: gains from increased economies of scale; increased growth rates caused by the stimulus to net investment provided by new market opportunities; increased efficiency resulting from greater technological change and the reduction in x-inefficiency provided by greater import competition; and the output effect made possible through downward pressure on domestic prices. Intra-industry specialization will permit the exploitation of economies of scale through the building of larger plants, longer production runs and the use of specialized machinery and techniques.
As Bela Balassa states, "intra-industry specialization involves an increased exchange of national products as well as greater product specialization through reduction in product varieties and models manufactured in particular plants. The welfare effects of the increased exchange of consumer goods largely take the form of improvement in the efficiency of exchange while horizontal and vertical specialization permit the exploitation of economies of scale." 18/

**Economies of Scale**

Some Canadian manufacturing industries face a problem in attaining a sufficient volume of output to reduce unit costs to levels which are competitive internationally. The fact that the U.S. is able to pay the highest level of manufacturing wages and still is competitive in almost every sector of manufacturing (although not in every product line) is attributable mainly to larger market size and longer production runs. 19/ The fact that the domestic market may not be large enough to absorb the minimum-cost output of a single firm or few firms does not establish that there will be no cost reduction if we reduce the varieties in order to achieve longer production runs. If the product is differentiated, the consumers' and the producers' desire for variety and model proliferation may mean that the firm is restricted to part of the market or shorter production runs. Even if the product is homogeneous, the protected
producer may become a monopolist (or few producers may become oligopolists) and restrict output which may prevent some from obtaining economies of scale. In this case, trade liberalization may increase efficiency as opening the domestic market to foreign competitors breaks this monopoly power, thus lowering both prices and cost. It is also important, in the context of economy of scale, to know how production is organized within a plant of given size i.e. the size of production runs.

Size of Production Runs

The size of the production run refers to the number of items of a specific commodity that are produced on a given machine or assembly line without change-overs. The range of manufactured products made in Canada is not significantly different than those produced in the U.S.A. but this similar range is produced by a smaller number of Canadian plants and firms. This means that the variety of items produced, due to non-price competition, by a typical plant in Canada is much higher than that of the U.S.A. Such short runs will result in the inefficient use of labour and capital; frequent change-overs require the halting of production to adjust or clean machinery and more 'down-time' to move different types of products.
"Those who argue from the small size of the Canadian markets show that runs of single products in Canadian factories are shorter than their counterparts in the U.S.A."22/

X-Efficiency

Another approach is indicated by the literature on x-efficiency.23/ It suggests that, as trade is liberalized, inefficiency will be squeezed out of domestic production because entrepreneurs will react to increased pressure from imports by cutting costs. In an oligopolistic market structure, this may induce the producers to reduce costs with the resulting increase in demand for its product. However, this argument alone does not explain why the increase in efficiency does not occur even without trade liberalization as a result of profit maximization. Otherwise the method seems to overstate the gains from trade liberalization.24/

The dynamic effects of trade liberalization also depend upon the point in time we are talking about. It may be argued, for example, that for European countries the critical gains in economies of scale were achieved when these countries moved to form a common market. In this viewpoint, the extra gains from economies of scale through further trade liberalization might be smaller than such gains for Canada. Indeed, recent studies on Canada have arrived at large estimates of dynamic welfare gains from trade liberalization.25/
The benefits of trade liberalization and the subsequent adjustment costs may not be evenly distributed across regions in the Canadian confederation. Canadian tariff protection has been a chronic source of contention in federal-provincial relations. The Atlantic provinces and the West have continued to argue that national tariff policy was aimed at diverting imports from low-cost suppliers to high-cost suppliers and the consumers in those provinces paid a higher price as a result of the tariff whose benefits completely accrue to Ontario and Quebec. Despite the fact that many industries outside these two provinces receive government support and despite the fact that Canadian tariffs are imposed to bargain down foreign tariffs on manufacturing, the Atlantic and the Western provinces feel strongly that they have paid continuously for the industrialization of central Canada.26/

A tariff is like a tax which all Canadians must pay when they buy either the dutiable import commodity or domestically produced goods that are protected to keep their price above world price level. On imported goods the tax represents a transfer to the government and on domestically produced goods, it is a transfer to producers. When the buyers and the producers are in different parts of the country, the payment between them involves an interregional transfer of funds. Manufacturing activities are concentrated in Ontario and Quebec, hence, these provinces receive a much larger share of
transfer to producers compared to other provinces. As Pinchin suggests, "for the Atlantic and the Pacific regions, the tariff represented a burden on local consumers that was not offset by income receipts of local producers, and manufacturing employment in these regions was substantially reduced by the existence of the tariff."27/

If trade is liberalized, real income in Canada will rise but since industries are not distributed evenly across the country, the prospective gains will differ among the various regions. The Atlantic and Western provinces could expect substantial gains with relatively little adjustment and reorganization. There will be contraction in the small import-competing sector but the core of the economy, export industries, will expand while remaining undisturbed structurally.28/ In Central Canada, there will be dramatic changes in the industrial structure. The greatest scope for restructuring and reorganization would be provided by removal of both Canadian and foreign trade barriers. While trade liberalization would offer greater long run gains to Ontario and Quebec (i.e., after reorganization and specialization take place) than the Atlantic and Pacific regions, there will be higher short run adjustment costs in these two provinces.
III. THE AUTOMOTIVE PROBLEM AND POLICY IN THE EARLIER PERIODS

A. The Policy Record in Earlier Periods

Historically, the tariff has played an important role in the growth and development of the Canadian automotive industry particularly in its formative stages. The industry inherited a 35 percent tariff rate in order to entice the United States' firms to begin domestic Canadian assembly rather than exporting finished vehicles into Canada. By 1926 the industry was flourishing, at least temporarily, with higher production of motor vehicles and more jobs for Canadians. Also at this time, Canadians became aware of the price differential of similar automobiles produced in the United States and in Canada and this led to tariff reduction of as much as 20 percent in 1926.

The major revisions in the Canadian tariff rate on automotive products took place in 1936. The rate of duty on all completed motor vehicles was reduced to 17.5 percent. A new system of conditional free entry of auto-parts was introduced. For free entry, the following conditions were to be satisfied: the parts were to be of a class or kind not manufactured in Canada, and the manufacturers had to meet content requirements of 60 percent for passenger cars and 50 percent for commercial vehicles.29/ When the kind or class of parts were manufactured in Canada, the regular rate of duty of 17.5 percent applied on its import.
The logic of free entry of certain categories of parts is clearly understandable. The cost of production in the U.S. was sufficiently low because of the high volume of production that even high tariffs would not induce domestic production. If tariffs were imposed, these parts would still be imported which would raise the price of completed vehicles and subsequently reduce demand and sales. This would reduce the demand for those parts which were advantageously being produced in Canada. Furthermore, the content requirement offered a good alternative to tariff protection. The content requirements did not specify which parts should be made in Canada, this only required that a certain proportion of factory cost of production must be incurred in Canada. The manufacturers were left to discover the areas in which the disadvantages of low volume production were minimized.

During the twenty-five year period from 1936 to 1960, the Canadian automobile industry had a mixed record. The outbreak of war provided a stimulus to the automobile industry and in 1941 production had risen to about 300,000 units a year. Production increased further as a result of the Korean War and a record production level of 500,000 units was achieved in 1953. Exports also reached all time highs during that year and were in balance with imports. However, from 1955 through to 1961, the
number of motor vehicle units produced declined, exports declined and imports increased. By 1960, exports had declined to one third of the 1953 level and imports had risen by a factor of three. Most of the increased imports originated from Europe in general, and England in particular. There was a large scale penetration of European vehicles in the North American market in the fifties. Consumer acceptance of the European car in North America was widespread and in Canada it was further encouraged by preferential tariff treatment in favour of British imports.30/

In August 1960, the Canadian government appointed a Royal Commission (also referred to as the Bladen Commission) to study both the automobile industry and the problem of increased European imports of automobiles into Canada. Bladen's report also touched upon the closer integration of Canadian production with that in the United States. In his final report, submitted in April of 1961, Bladen recommended the removal of the 7.5 percent excise tax (the only proposal almost immediately adopted by the Canadian government), the establishment of a 10 percent tariff on British automotive products and an extended Canadian content requirement (this one is considered as his most ingenious innovation). Before the Bladen report, Canadian
content was calculated on the basis of parts and services incorporated into cars that were assembled in Canada. Bladen's proposal was that Canadian content in automotive parts sold to foreign buyers should also be counted in determining Canadian content. As Wonnacott pointed out, Bladen's recommendations "would not have much effect on the total quantity of Canadian automotive production, but it would cause a reorganization of the Canadian industry; production would tend to be narrowed to those parts on which the excess of Canadian costs over world costs is smallest, while the scale on which these parts are produced would be increased".31/

Beigie also noted that the Bladen plan like the auto pact would have entailed a closer integration of Canadian production with that in the United States.32/ In 1962, European penetration into the Canadian auto market was subsiding and the Bladen plan of extended content was not implemented. During 1961-63, two duty remission plans were implemented, the first being the 25 percent duty introduced on the import of automatic transmissions and engine blocks. For every dollar of Canadian exports of motor vehicle parts in excess of the Canadian exports of motor vehicle parts during the base period from November 1, 1961 to October 31, 1962, however, duties would be remitted on a dollar of transmission or engine imports.
The above remission program was somewhat in contrast to the Bladen plan which advocated the removal of specific duties on parts and encouraged the choice of Canadian production of these parts which had the greatest cost advantage. The 1962 plan introduced a specific duty on transmission and engine blocks and encouraged an inefficient structure of Canadian industry. In October 1963, the duty remission program was extended to all imports of automotive products, i.e., tariffs on imports of motor vehicles and original parts were to be remitted to the extent that the Canadian content of exports of motor vehicles and parts of the company exceeded that of the base year (Nov. 1961-Oct. 1962).

B. *Auto-Pact* between Canada and The United States

The duty remission programs introduced by the Canadian government to help out its high cost automobile industry were creating irritants in economic relations between Canada and the United States. If the unilateral Canadian action were interpreted as export bounties, then the United States government might be obliged to impose countervailing duties. There was strong pressure growing in the United States to take such action. Under these circumstances, it seemed desirable for the two countries to develop a more rational and efficient Canadian automotive industry which would not adversely affect the U.S. industry. The resulting Automotive Agreement³³/
emerged to rationalize the production of automotive products and to create the basis for an integrated automotive market by removing duties on trade between the two countries in specified motor vehicles and original equipment automotive parts.

Under the Agreement, Canada could specialize in the production of a few makes and models for domestic and United States markets, while a great variety of United States produced automobiles could enter Canada duty-free from the larger parent company. The Agreement set forth three objectives:

(1) the creation of a broader market for automotive products within which the full benefits of specialization and large-scale production could be achieved.

(2) the liberalization of U.S.-Canadian automotive trade in respect to tariff barriers and other factors tending to impede it, with a view to enabling the industries of both countries to participate on a fair and equitable basis in the expanding total market of the two countries.

(3) the development of conditions in which market forces may operate effectively to attain the most economic pattern of investment, production and trade.
The above points seem to emphasize the underlying importance of rationalization of production process, i.e., specialize in fewer makes and models for the whole North American market. This enabled the Canadian plants of auto companies to have longer production runs and to realize the economies of large scale plants.

The industry grew rapidly after the implementation of the Canada-U.S. auto pact. The integration and rationalization of the Canadian and United States automotive industries resulting from the implementation of the agreement had provided benefits for both countries. In Canada, efficiency gains were realized from economies of scale that were made possible by the reduction in the number of model lines and through penetration of a much larger market.

North American car producers were relatively slow to react to the increase in gasoline prices which began in the early 1970s. This slowness of response was due, in part, to the ceilings placed on gasoline and crude oil prices by the U.S. and Canada. As the domestic price of gasoline started to rise (meaning higher operating costs), consumers turned towards smaller, fuel-efficient imported cars mainly from Japan. The switch to imported cars was accelerated by the price differential between foreign and North American cars which emerged at this time. The foreign made cars originating from
Japan is also perceived to be of better quality i.e. needing much fewer repairs and providing more interior room etc., than the comparable North American built cars.

The North American auto industry is currently adjusting to new international competition, and to the present general slump in the North American market. Appendix A provides statistical evidence of the major adjustment which has occurred in the automobile industry. This adjustment has involved mass layoffs of workers in the industry. On both equity and efficiency grounds it is then important to understand the short run adjustment problems experienced by automobile workers.
IV. THE MODEL AND ITS ESTIMATION

A. The Income Loss Model

The auto pact implicitly emphasized the importance of the rationalization process. This allowed the auto makers, by producing fewer models for the whole North American market, to enjoy economies of scale. The industry grew rapidly, especially in terms of production and employment, until 1978. Since that time, domestic auto sales have declined, causing a massive displacement of workers from the industry. The general recessionary environment during the same period also contributed to the total loss of about 30,000 jobs. On both income compensation and economic efficiency grounds, we are concerned with measuring the private as well as the economic costs of labour adjustment.

The private cost of displacement can be measured by taking the difference between the full income the worker would receive if he remained in his present pattern of employment and that which he expects to earn in alternative jobs if his present employment is terminated. Full income consists of the value of the worker's time attached to both market and non-market activities including the monetary equivalent of his leisure time. The private cost of displacement arises because of transitional or adjustment costs, because prices do not adjust instantaneously, or due to the loss of job-specific rents. The market

* See Appendix B for a brief description of the data base and the characteristics of individuals included in our sample.
equilibrates itself in the long run, but in the short run, the factors released from the declining sector incur costs. These include foregone earnings while unemployed (appropriately adjusted by UIC and other supplemental benefits including the value of leisure) and the possibility of lower earnings in alternative jobs. If firm-specific skill or union derived rents are lost because of final separation from a particular sector, and the costs of adjustment are visible and fall on the limited number of workers in a particular sector or region, then these workers can be expected to seek a more protectionist policy. This may frustrate the attainment of the benefits of freer trade and the more efficient allocation of resources in the long run. The government should arm itself with the option of worker assistance programs as a viable alternative to situations where the protection of a sector or direct assistance to vulnerable firms would be inefficient. Worker assistance programs include both reemployment assistance and compensation elements. Compensating the displaced workers with some monetary payments is the price the economy may have to pay for improved economic efficiency. Ideally, the compensation should be based upon the estimation of the costs of displacement of the affected workers in a particular sector.
In many occupational situations, periods of employment are separated by spells of unemployment. Therefore, prior to the final separation from a firm, a worker would expect to spend a proportion \((p^b)\) of his time employed while spending \((1-p^b)\) of his time unemployed. During the time he is working, let \(w^b\) measure the gross of tax (including supplementary benefits) wage rate while \(w^b (1-tav)\) is his net-of-tax private earning from market activities. The average rate of personal income tax, denoted as \(tav\), includes all federal and provincial income taxes plus payroll taxes. During the periods when the worker is laid off from the automobile industry, he is eligible to collect supplemental unemployment benefits (SUB) in addition to normal unemployment insurance benefits (UIB). The SUB plans supplements the normal UI benefits in some high wage industries such as the automobile sector since the proportion of income replaced by UI benefits is relatively low when a worker is unemployed. From an employer point of view, the workers are quasi-fixed factors since he has made an initial investment in hiring and training his work force. The employer would want to avoid repeating these expenses through the worker quitting or finding another job while on temporary layoff. Paying higher wages would be one strategy to retain a worker but a risk-sharing program such as an SUB plan would be a preferred method of reducing the variance in the income stream of the worker.
The length of time a worker may receive SUB payments depends mainly on three factors: the number of credit units accumulated in his favour, seniority in the corporation and the financial status of SUB funds. During the periods of unemployment, the worker is also eligible to receive regular UI benefits for a length of time which depends on his previous employment history and the regional unemployment rate. A worker can receive 60 percent of his previous wage rate (including supplementary benefits) as UI benefits during periods of unemployment if his previous earnings were below the maximum insurable earnings.

For a full week of layoff, a worker in the automotive industry will receive 95 percent of straight time related pay, net of tax. The total benefit during an unemployment period can be expressed as:

\[ \text{SUB} + \text{UIB} = f_1 W^R (1 - t\text{av}) \]

where \( W^R \) = straight time related pay only.
and \( f_1 \) = proportion of \( W^R \), net-of-tax wages replaced by SUB and UIB.

Let us suppose that a proportion \( f_2 \) denotes the time the worker expects to receive benefits, then the after tax total benefits from UI and SUB can be expressed as:
\[ f_2 (\text{SUB+UB}) (1-t) = f_1 f_2 \omega R (1-t) \omega R (1-t) \]

Again \( \omega R \) can be expressed as fraction \( f_3 \) of \( \omega b \),

\[ \omega R = f_3 \omega b \]

Where \( f_3 = \frac{\omega R}{\omega b} \)

using the relationship between \( \omega R \) and \( \omega b \), total benefits can
be expressed as a fraction of \( \omega b \):

\[ f_2 (\text{SUB+UB}) (1-t) = f_1 f_2 f_3 \omega b (1-t) \omega b (1-t) \]

In addition to the unemployment insurance payments and
supplemental unemployment benefits, the unemployed worker can
enjoy informal sector activities including leisure time for
which the monetary equivalent value is expressed as \( \nu b \).

Combining all these elements, a worker's full income
prior to the job termination can be denoted as:

\[ I = p b \omega b (1-t) + (1-p b) f_1 f_2 f_3 \omega b (1-t) \omega b (1-t) \omega b (1-t) + \nu b \]

The next step is to attach a monetary value to \( \nu b \).

In a competitive labour market with no involuntary unemployment,
a worker would be expected to equate the value to him of
employed and unemployed time. The net-of-marginal-tax wage rate
should be equated to the net-of-tax value of UIB and SUB plus
the equivalent monetary value of informal sector activities.

\[ \omega b (1-t_m) = f_1 f_2 f_3 \omega b (1-t_m) \omega b (1-t_m) \omega b (1-t_m) + \nu b \]
where $t_m$ is the marginal income tax rate.

In actual labour markets, there are many kinds of distortions which may increase the value of employed time as compared to the value of unemployed time. In a union wage situation, for example, the actual negotiated wage will exceed the market clearing wage. Let $B$ denote the ratio of the union wage to the competitive wage, then, the equivalent monetary value attached to informal sector activities can be expressed as:

$$v^b = \frac{w^b(1-t_m)-B(f_1f_2f_3w^b(1-t_m)^2)}{B} \ldots \ldots \ldots (6)$$

where $B$ equals unity in a competitive labour market and is greater than unity in a distorted labour market.

Unemployment insurance benefits in Canada are limited to the wage rate earned by the worker up to some maximum amount of insured earnings (i.e., $315$ in 1981). From equation 1, it is evident that the employer's contribution to SUB plans increases gradually if the wage rate exceeds the maximum insurable earnings limit. SUB payments must rise to compensate for the low proportion of income replaced by UIB payments. However, the maximum amount of SUB that can be paid to an unemployed individual was $115$ in 1979. Equation (3) must be modified if an individual has already received the maximum SUB payment:

$$f_2(SUB+UIB)(1-tav) = f_1f_2f_3f_4w^b(1-tav)^2 \ldots \ldots \ldots (7)$$
where $f_4$ is equal to a positive fraction if an individual's eligibility exceeds the maximum allowable SUB payment. It equals unity for other individuals who do not qualify for the maximum limit. By incorporating $f_4$ in equation (6) and substituting this equation into equation (4), we have the following expression for the full income of the worker prior to final layoff from the automobile industry:

$$I^b = \frac{w^b [P^b (1-tav) + (1-p^b) (P^b (1-tav)^2 + \frac{(1-t_m) - BF^b (1-t_m)^2)}{B}]}{B}$$

where $P^b = f_1 f_2 f_3 f_4$

The full income, $I^a$, that workers expect to receive after permanent layoff from the auto industry can be estimated from a similar relation. All the variables that determine a worker's income in an alternative job depend on his reemployment prospects.37/

$$I^a = \frac{w^a [P^a (1-tav) + (1-p^a) (P^a (1-tav)^2 + \frac{(1-t_m) - BF^a (1-t_m)^2)}{B}]}{B}$$

The probability that the worker will be employed at any point in time ($P^a_t$) depends upon the interval probabilities of obtaining and retaining a job. These interval probabilities of finding (losing) a job can be estimated by using the probit statistical technique with the dependent variable being set equal to one if a worker finds (loses) employment during the interval, and set to zero if he fails to find (lose) a job during the interval.
The private income loss that a worker expects to suffer over some finite time horizon after being permanently laid off from the automobile sector can be expressed as follows:

\[ L(N) = \sum_{t=1}^{N} \frac{(I^b_t - I^g_t)}{(1+d)^t} \]  

(10)

where \( N \) is the time horizon of estimation and \( d \) is the private discount rate.

The private cost of labour displacement expressed in terms of equation (10) will depend, among other factors, upon the reemployment prospects of the unemployed worker. In times of high economic growth, low unemployment rates and when the characteristics of the labour force are conducive to quicker reemployment, the private cost of adjustment may not be a serious problem. Furthermore, we also do not rule out the possibility that the worker's income at some point in time in the future may rise above \( I^b \). However, if a particular industry is situated in a small, isolated, slow growing town where a majority of the labour force is employed in a particular plant, a major layoff will create a serious adjustment problem. This, however, is not generally the case with the automobile sector.
Labours' private full income prior to layoff, as shown by equation 8, would be expected to differ from the social value of labours' output (SVLO) because of the presence of UI payments, taxes and other kinds of distortions in the labour market. Let us first consider the effect of UI payments. The labour supply curve indicates the value of foregone leisure at the margin. Now if we introduce UI payments, the labour supply curve would shift upward by the amount of the above payments and the worker would be only willing to supply his labour if the wage rate exceeds the value of leisure plus the UI payments. The social value of labours' output will be lower than the private evaluation by the amount of UI payments. The presence of income taxes would further introduce a wedge between the social and private valuation of labours' output. Therefore, the social value of output before layoff (SVLO) can be denoted by:

\[ b \text{SVLO} = p^b w^b + (1-p^b) v^b \]  

...(11)

and the social value of output after layoff may be written as:

\[ a \text{SVLO} = p^a w^a + (1-p^a) v^a \]  

...(12)

The present value of the labour externality may be expressed as:

\[ L(N) = \sum_{t=1}^{N} \left( b \text{SVLO} - a \text{SVLO} \right)/(1+d)^t \]  

...(13)
While equation 10 measures the private loss in income after indefinite layoff from the automobile industry, equation 13 calculates the externality from a social point of view. The private valuation of income loss would include any income loss caused by the non-availability of skill related and union related rents. However, the individuals included in our sample are less likely to be in this category as they fall in lower age groups and have less skill and fewer years in the labour force. Therefore, while some of the income loss may be related to union rents and job related skills, a good proportion may have been contributed by the lower proportion of time employed in non-auto jobs.

Figure 4.1 illustrates the relationship between the net of tax wage rate $W^b(1-tav)$, worker's income prior to layoff ($I^b$) and the income that is received in subsequent jobs ($I^a_t$). As the time since layoff increases, the probability of workers being at work also increases, therefore the foregone income decreases.

Both the durations of unemployment and subsequent employment and wage effects will produce $I^a_t$ in Figure 4.1. The longer the duration of unemployment, for example, the lower the probability that a worker will be at work after permanent layoff from the automobile industry. Furthermore, when a worker becomes reemployed, his average weekly earnings may be less
Figure 4.1

Foregone Private Income of Displaced Workers

\[ I_t^a, \quad I_t^b, \quad W^b(1-tav) \]

Time of Layoff

Time
than in his previous job. It is difficult to assess the length of time a worker's new wage will remain below his wage in his previous job. This will depend on the individual's personal characteristics, the states of the labour market and the economy as a whole, whether or not the new occupation is unionized, and the incentive to retrain. If the cause of layoff is due to increased trade liberalization and if we assume that Canada is poorly endowed with the kind of workers we are considering, then, according to the Stolper-Samuelson theorem, it follows that the worker's new wage will permanently remain below the pre-liberalized level.

However, the static nature of international trade theory assumes away the retraining possibility of the displaced workers. Displaced workers will have strong incentives to retrain themselves especially if they do not have to bear the full costs of training, and hence, the initial wage reduction may be expected to improve over time. The reemployment promotion programmes (i.e., wage subsidy, job counselling, better information media such as Manpower Centres, etc.) may be expected to speed up the rate of adjustment in the economy. This in return would reduce the short run adjustment costs and in the long run may in effect shift $I_t^a$ to $I_t^{rel}$ in order to capture the different structure of employment that would exist under the programme. However, in a two factor economy, (capital and labour), the returns to capital would be higher and the total value of the output in the economy will be higher than that which would have existed in the absence of trade.
liberalization. Firms can potentially compensate the workers and the community would still end up on a higher indifference curve. In reality, however, actual compensation rarely takes place, and hence the burden of adjustment costs still lies on the displaced workers.

B. Empirical Estimation

In order to measure the cost of adjustment of the automobile workers, we require estimates of the parameters and variables outlined in equations (8) and (9). The key variables are: the proportion of time spent in employment in the prior jobs before being permanently laid off from the auto industry ($P^b$), the corresponding proportion in the subsequent non-auto jobs ($P^a$), and wage rate in the auto, and the non-auto jobs, $w^b$ and $w^a$. The variables $P^b$ and $w^b$ would affect both the private and social valuation of workers' output through equations (8) and (11) respectively. A higher proportion of time employed and a higher prior wage rate would be expected to raise prior full income of workers as well as social value of output (assuming away the presence of distortions). A lower proportion of previous time employed, $P^b$, would entitle workers to receive more UI benefits which would partially compensate the loss in wage earnings. However, the percentage of wage earnings replaced by UI payments would gradually decline as soon as the workers' prior wage exceeds the maximum insured
earning limit. Therefore, workers whose income exceeded the maximum insured earning limit would experience a relatively greater loss in absolute income after indefinite layoff from the automobile industry.

Similarly, if the workers find alternative stable jobs within a reasonable time (i.e., higher $P^c$) and at a high wage rate, then the extent of the income loss would be smaller. Some workers newly released from the depressed industry may find jobs in a more viable industry and increase their lifetime earnings.

It is also necessary to estimate $f_1$, the proportion of straight time related pay replaced by SUB plus UIC payments; $f_2$, the proportion of time a worker expects to receive benefits while unemployed; $f_3$, the ratio of straight time related pay to total pay (including supplementary benefits); $B$, the ratio of actual wages to competitive wages; and the average and the marginal income tax rates, $t_a$ and $t_{mr}$; and the value for $f_4$, the ratio of actual benefits to total eligible benefits if an individual reaches the upper limit of SUB payments. All variables outlined above except $B$ can be estimated from the provisions of the income tax and the unemployment insurance legislation, and the master agreement between the United Auto Workers and the Automobile Manufacturing companies.

**Specification of Wage Rates Before Job Loss ($W^b$)**

As mentioned above, the measurement of displacement cost
requires estimates of the gross-of-tax wage rates that these auto workers were earning in the job prior to final separation from the auto industry (Equation 8). It is also necessary to estimate the determinants of the wage that these workers would earn in alternative employment (equation 9). Since some wages exceed the maximum insured earnings, a maximum likelihood technique is used to allow for the truncation of the wage rate estimates.40/ Estimates of the sample of persons who left the auto industry and found subsequent jobs before the end of the sample period, allow us to make comparisons of the wage rates before and after job loss of the same group of workers. The wage rates in all non-auto jobs before the end of the sample period are included in the estimation of the alternative wage rates. This provides information on the extent to which workers return to their previous wage level over time.

Implication of the Human Capital Model

While estimating the previous wage rate, \( W^b \), and alternative wage rate, \( W^a \), the dependent variables are expressed as the natural logarithm of the weekly wage rate and the independent variables are entered linearly (not in logarithmic form). This semi-log relationship in which the dependent variable is expressed as the natural logarithm of the weekly wage rate closely follows the specification adopted by others in estimating the wage rate.41/ This formulation also affords an explicit relation to the human earnings model.
More specifically, the human capital model (Exhibit A and B) on earnings can be expressed as:

\[ \ln w_j^b = \sum_{i=0}^{K} b_i X_{ij} \]

or \[ w_j^b = e^{\sum_{i=0}^{K} b_i X_{ij}} \]

In this case, the coefficient on any variable can be interpreted as:

\[ \frac{d w_j^b}{dX_{ij}} = b_i \text{ if } X_i = \text{AGE, then the coefficient can be} \]

interpreted as the rate of return to a year increase in age.

However, the above specification assumes that the rate of return to a year increase in age remains unchanged (fixed \( b_i \)). Hausman and Wise, and Becker (41) indicated that the above may not necessarily hold true. The former explicitly took care of this problem by entering age in a piece-wise fashion.

Although the above semi-log relationship has more intuitive and economic meaning, it is difficult to explain the above relationship in its functional form which is shown in figure 4.2.
In estimating the wage rates, age may be entered as a continuous variable or as a piece-wise continuous variable where age is considered continuous within each arbitrary group but discontinuous between them. This kind of age categorization is used if it is expected that the rate of return to a year increase in age is different between age groups. We may expect that the coefficients would indicate that earnings tend to increase with age for younger workers, and then to decrease as age increases. Furthermore, this dummy continuous variable may be preferable to normal slope and intercept dummies for the following reasons: let us suppose that the wage \( W \) function assumes the form

\[
W = \alpha_0 + \alpha_1 D_1 + \beta_0 \text{AGE} + \beta_1 D_1 \text{AGE} + u
\]

where \( D_1 = \) intercept dummy and \( D_1 \text{ AGE} = \) slope dummy;
Suppose that \( D_1 = 1 \) if age \( > 25 \) years

That means \( W = (\alpha_0 + \alpha_1) + (B_0 + B_1)\text{AGE} + u \)

Otherwise \( D_1 = 0 \) if age \( < 25 \)

That means \( W = \alpha_0 + B_0\text{AGE} + u \)

![Figure 4.3](image)

Instead of shift and slope dummies, we can use the piece-wise age variable as follows:

\[
W = \alpha_0 + b_1\text{AGE}_1 + b_2\text{AGE}_2
\]

where \( \text{AGE}_1 = \text{AGE} \) if \( \text{AGE} \leq 25 \)

= 25 if \( \text{AGE} > 25 \)

\( \text{AGE}_2 = 0 \) if \( \text{AGE} \leq 25 \)

= \( \text{AGE} - 25 \) if \( 25 < \text{AGE} \leq 30 \)

For younger workers under 25 years of age, the earning equation becomes:

\[
W = a_0 + b_1\text{AGE}
\]

but for \( 25 < \text{AGE} \leq 30 \),

\[
W = a_0 + b_1\text{AGE}_1 + b_2(\text{AGE} - \text{AGE}_1)
\]

= \( a_0 + (b_1 - b_2)\text{AGE}_1 + b_2\text{AGE} \)
Hence, \( a_0 = a_0 \)
\( b_1 = b_0 \)
\( a_0 + (b_1 - b_2) \text{AGE} = a_0 + a_1 \)
\( b_2 = b_0 + b_1 \)

The coefficient on the age variable \((b_2)\) if age exceeds 25 can be directly estimated in the piece-wise formulation. For our purpose, age is used as a continuous variable in our wage estimates in order to maintain maximum flexibility while conducting the sensitivity analysis of income loss of individuals falling in different age brackets. However, in order to pick the marginal percentage effect of age on earning for different age categories, an alternative wage equation is estimated the results of which are reported in Appendix E.

Constant Variance

If the distribution of wage rates at each value of \(X_i\) does not have constant variance it may cause special estimation problems. By assumption, the variance of \(u_i\) about its mean is constant at all values of \(X\). In other words, for all values of \(X\), the \(U\)'s will show the same dispersion around their mean. Then if we assume, \(u \sim N(0, \sigma)\) then it also implies \(Y\) has a normal distribution with mean:

\[ E(Y_i) = a_0 + b_1X_i \]
and variance,
\[
\text{VAR}(Y_1) = E\{Y_1 - E(Y_1)\}^2
\]
\[
= E\{b_0 + b_1 x_1 + u_1 - b_0 - b_1 x_1\}^2
\]
\[
= E\{u_1\}^2 = \sigma^2 \text{ constant}
\]

The shape of the distribution of \( Y \) is determined by the shape of the distribution of \( U \) and the variance of \( Y \) is dependent upon the variance of \( U \) at each value of \( X \). If the distribution of wage rates at each level of \( X \) does not have constant variance, a semi-log formulation will make this variance approximate a constant. This helps us to get around the problem if the distribution of earnings have flatter tails than the normal distribution. This Pareto distribution of income is expected to be less troublesome if the logarithm of earning is used: this means that standard statistical tests of significance can be applied.

**Life-Cycle Earnings Profile**

An alternative formulation expresses the wage rate as a logarithmic function of age while entering other independent variables in linear fashion. This kind of specification more closely follows the life-cycle earning profile of individuals which may have a more intuitive meaning indicating that the marginal impact of age on earnings is much higher during earlier age than older age.
More specifically, the life-cycle profile of earning can be expressed in the following semi-log specification:

\[ W_j = \sum_{i=0}^{K} b_i \ln X_{ij} \]

In this case, the coefficient \( b_i \) can be interpreted as:

\[ \frac{dW_j^b}{dX_{ij}} = b_i \text{ for } 0 < b < 1 \]

in which case the exact meaning of the coefficient is the change in the wage rate due to percentage change in age, if \( X_i = \text{Age} \).

This latter formulation implies a functional form as shown in figure 4.4.

![Figure 4.4](image)

However, because of the human capital argument and the constancy of variance of the error term, the wage equation is estimated in the former specification.

Wage Rate Formulation Before Job Loss (W^b)

The following equation has been specified in order
to estimate the wage rate before job loss ($W^b$):

$$\ln (W^b) = \alpha_0 + \alpha_1 \text{SEX} + \alpha_2 \text{AGE} + \alpha_3 \text{SEPWKI} + \alpha_4 \text{LESKIL} + \epsilon$$

where the dependent variable is the natural logarithm of the real weekly wages (in 1971 dollars). The explanatory variables may be described as:

1. **SEX**: Male = 1, female = 0.
2. **AGE**: Age at the date of job loss.
3. **SEPWKI**: Calendar time of job separation measured in terms of the UIC week counter.
4. **LESKIL**: if specific vocational preparation (SVP) required to perform an operation is ≤.5 year, then = 1, otherwise = 0.

Table 4.1 shows the expected signs on the coefficients of the explanatory variables of wage rates before job loss. We would expect a positive coefficient on the SEX variable indicating that the marginal impact of being male on earnings is positive. The theory of investment in human capital may be the key factor in explaining earning differentials between men and women. More specifically, human capital theory could be used to explain the major differences in the types and amounts of education and training that they seek, and consequently the types of jobs they seek. If men invest more in market oriented activities than females then some of the earning differences between males and females may be due to productivity differences.42/
Productivity differences can be related to differences in general human capital, occupation-specific capital, and firm specific capital. One can assume that general human capital is as important in the production of household activity as in the market activities. Males therefore will have similar amounts of general human capital as females. However, males are found to spend a greater fraction of their time in market activities than do females. Returns to specific human capital will depend upon labour force participation and job tenure. Males tend to possess more job specific and firm specific capital.

Furthermore, female workers may experience increasing difficulty having access to jobs that have significant training potential. Becker's analysis on firm specific human capital showed that the sharing of costs of this kind of investment between workers and firm will be in the same proportion as the sharing of returns. The payoff itself continues only as long as the worker remains employed with the firm where training was obtained. If males have lower quit rates than females, then some of the wage differentials could be related to firm specific human capital.

Polachek argues that even if the non-market productivity of husband and wife are the same, the difference in the market value of embodied human capital would cause a
specialization within a family. The husband, with a greater stock of market earnings potential, would specialize more in market activities implying greater market investment. This specialization in market activities raises the husband’s earnings and creates further incentives for market investment.

A few authors in the economic literature attributed this differential in wage earnings between males and females to wage discrimination against female workers by employers. However, the marginal effect of wage discrimination on female earnings is likely to be smaller if a worker has been on the same job for a long time.

The individual's human capital characteristics are captured by both AGE and SEPWK1 variables. As the AGE of an individual increases, he is supposed to acquire more human capital and job related skills which are expected to have a positive impact on earnings. Furthermore, because of strong seniority rules practiced in the automobile industry, the most senior workers are laid off last (last separation week, SEPWK1). Therefore, SEPWK1 is expected to pick up some of the seniority effects on wage rates. LESKIL is expected to have a negative effect on prior wages since this variable is a dummy variable representing those workers with lower skill levels. A lower skill level also indicates the lower productivity and less investment in human capital which generates a negative effect on wage rates.
Table 4.1

The Expected Signs on the Coefficients of the Determinants of
Prior Wage Rates

<table>
<thead>
<tr>
<th></th>
<th>Wage before Job loss ( W_b )</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEX</td>
<td>+</td>
</tr>
<tr>
<td>AGE</td>
<td>+</td>
</tr>
<tr>
<td>SEFWK1</td>
<td>+</td>
</tr>
<tr>
<td>LESKIL</td>
<td>-</td>
</tr>
</tbody>
</table>
Specification of Wage Rate After Job Loss ($W^a$)

In estimating the wage rate after job loss ($W^a$), the duration of unemployment (WKSJTJ) may be an important explanatory variable. A priori, one would expect that the worker would reduce the asking price (price adjustment) as the duration of search activities continues to generate new information about the state of the labour market. If the worker faces the same wage offer distribution and cannot hold onto the previous offer then his reservation wage may fall in the following way as shown in figure 4.5.

![Figure 4.5](image)

- The worker searches in the labour market according to the reservation wage ($WR$) strategy. He accepts a wage offer if $W^a \geq WR$. Then the probability of obtaining a job offer at or above the reservation wage is given by:

$$P(W^a \geq WR) = \int_{WR}^{\infty} f(W)\,dW$$
If at point in time (D1) since job separation, the worker finds an acceptable offer at WR1, he has the choice of accepting the offer or looking for further high paying jobs. If he cannot hold onto this offer but chooses to look for more jobs, he may be willing to make concessions to obtain a job at D2. The only way to increase the probability of obtaining an acceptable offer is to reduce the reservation wage to WR2. His reservation wage curve over the duration of unemployment may be represented by LM in Figure 4.5.

We have a special estimation problem when both the alternative wage rate ($W^a$) and the duration of unemployment (WKSJTJ) affect each other simultaneously. In other words, $W^a$ may be dependent on WKSJTJ while the duration of unemployment itself is determined by $W^a$. We can get around this problem of simultaneity if we can estimate $W^a$ in reduced form. There should be two structural equations: one for the post layoff wage rate and the other for the duration of unemployment. Under this specification, search time will not appear in $W^a$ as shown in equation (3).

$$W^a = \alpha + \alpha_1 x_1 - \alpha_2 x_2 - \alpha_3 \text{WKSJTJ} - \alpha_4 x_3 \ldots \ldots (1)$$

$$\text{WKSJTJ} = \lambda + \lambda_1 x_1 + \lambda_2 x_2 + \lambda_3 W^a + \lambda_4 z_1 \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

Substituting (2) into (1), we obtain the following
reduced form:

\[ w^a = \pi_0 + \pi_1 x_1 + \pi_2 x_2 + \pi_3 x_3 + \pi_4 z_1 \]

\[ WKSJTJ = \pi_0 + \pi_5 x_1 + \pi_6 x_2 + \pi_7 x_3 + \pi_8 z_1 \]

Where \( \pi_0 = \frac{\tilde{\alpha} + \alpha_1}{1 - \alpha_3 \lambda_3} \)

\( \pi_0 = \frac{\tilde{\lambda} + \lambda_3 \tilde{\alpha}}{1 - \alpha_3 \lambda_3} \)

\( \pi_1 = \frac{\alpha_1 + \alpha_2 \lambda_1}{1 - \alpha_3 \lambda_3} \)

\( \pi_5 = \frac{\lambda_1 + \lambda_3 \alpha_1}{1 - \alpha_3 \lambda_3} \)

\( \pi_2 = \frac{\alpha_2 + \alpha_3 \lambda_2}{1 - \alpha_3 \lambda_3} \)

\( \pi_6 = \frac{\lambda_2 + \lambda_3 \alpha_2}{1 - \alpha_3 \lambda_3} \)

\( \pi_3 = \frac{\alpha_3 \lambda_2}{1 - \alpha_3 \lambda_3} \)

\( \pi_7 = \frac{\lambda_3 \alpha_3}{1 - \alpha_3 \lambda_3} \)

\( \pi_4 = \frac{\alpha_4 \lambda_3}{1 - \alpha_3 \lambda_3} \)

\( \pi_8 = \frac{\lambda_4}{1 - \alpha_3 \lambda_3} \)

If the equations are exactly identified, we can solve

for \( \tilde{\alpha}, \alpha_1, \alpha_2, \alpha_3, \alpha_4, \tilde{\lambda}, \lambda_1, \lambda_2, \lambda_3, \lambda_4 \)

The following explanatory variables have been used to estimate the reduced form equation for the wage rate after job loss:

1. SEX: Male = 1, female = 0
2. DEPST: If worker claims dependents, then = 1, otherwise = 0
3. AGE: Age at the date of job loss (years).
4. LESKIL: If specific vocation preparation (SVP) required to perform an operation \( \leq .5 \) years, then = 1, otherwise = 0.
5. REGIONAL DUMMY VARIABLES (Eight Ontario Regions):
   If job lost in Toronto, then D1=1, otherwise=0.
   If job lost in Oshawa, then D2=1, otherwise=0.
   If job lost in Windsor, then D3=1, otherwise=0.
   If job lost in St. Catharines-Niagara Falls, then D4=1, otherwise=0.
   If job lost in London, then D5=1, otherwise=0.
   If job lost in Kitchener, then D6=1, otherwise=0.
   If job lost in other southwest Ontario, then D7=1, otherwise=0.
   If job lost in other Ontario Regions, then D8=1, otherwise=0.

6. MOVE: Worker changed location of job (defined in terms of unemployment district office) by the time of the sample period then = 1, otherwise = 0.

7. SEPWKI: Calendar time of job separation measured in terms of UIC week counter.

8. QUIT: If separation reason from job is QUIT: QUIT1 = 1, if quit from job and duration of unemployment \( \leq 4 \) weeks, otherwise = 0. QUIT2 = 1, if quit from job and duration of unemployment > 4 weeks, otherwise = 0.

9. OTHER: If reason for separation from job was reason number "8" or "OTHER" on Record of Employment, then = 1, otherwise = 0.

Table 4.2 shows the expected signs on the coefficients of the explanatory variables of wage rates after job loss.
### Table 4.2

The Expected Signs on the Coefficients of the Determinants of Alternative Wage Rates

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wage after Job loss (W8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEX</td>
<td>+</td>
</tr>
<tr>
<td>AGE</td>
<td>+</td>
</tr>
<tr>
<td>SEPWK1</td>
<td>+</td>
</tr>
<tr>
<td>LSKIL</td>
<td>-</td>
</tr>
<tr>
<td>DEPST</td>
<td>+</td>
</tr>
<tr>
<td>QUIT1*</td>
<td>+</td>
</tr>
<tr>
<td>QUIT2</td>
<td>-</td>
</tr>
<tr>
<td>OTHER</td>
<td></td>
</tr>
<tr>
<td>MOVE</td>
<td>+</td>
</tr>
<tr>
<td>D1 (Toronto)**</td>
<td></td>
</tr>
<tr>
<td>D2 (Oshawa)</td>
<td></td>
</tr>
<tr>
<td>D3 (Windsor)</td>
<td></td>
</tr>
<tr>
<td>D4 (St.Cath-Niag.)</td>
<td></td>
</tr>
<tr>
<td>D5 (London)</td>
<td>Uncertain</td>
</tr>
<tr>
<td>D6 (Kitchener)</td>
<td></td>
</tr>
<tr>
<td>D7 (Other SW Ont..)***</td>
<td></td>
</tr>
<tr>
<td>D8 (Other Ont.)****</td>
<td></td>
</tr>
</tbody>
</table>

* Excluded separation reasons are layoff, labour dispute, return to school, injury, retired and pregnancy.
** Excluded regions are the rest of Canada's provinces except Ontario.
*** Hamilton, Sarnia, Brantford.
**** All other Ontario regions.
SEX is expected to have a positive and significant effect on the wage rate after job loss. This result is expected to arise due to differences in demand curves for investment in human capital between men and women. Shorter durations of labour force participation and possible job discrimination by employers will reduce the average level of women's demand for investment in human capital relative to men. Therefore, one would on average expect men to invest more and receive a higher rate of return than women.\textsuperscript{48} As Heckman and Willis\textsuperscript{49} argue, we expect an equal distribution of innate abilities but a significant variation in demand for human capital investment between men and women because of large differences between them in expected labour supply. Hence, males in general have higher average training and skill levels. These higher market oriented traits allow them to obtain higher paying jobs. Furthermore, wage discrimination on the basis of sex is also expected to be higher at the point of entry to new jobs.

AGE is also expected to positively affect the wage rate after job loss indicating the higher labour market productivity characteristics of older workers. Older workers with years of experience will have more human capital and other marketable qualities in general than the younger workers and therefore would attract high paying jobs. The variables indicating UIC separation week, SEPWK1, is a proxy variable for
the growth in the productivity of labour. This variable stands as a counter of the week of job separation. As the counter increases it indicates delayed layoff and more job experience on the part of the workers. Hence, this variable would be expected to capture some of the effects of productivity growth and would produce a positive effect on earnings. On the other hand, the variable, LESKIL, indicates the lower skill level of workers and is expected to have a negative sign. However, it should be noted that if the skills of workers were very specific to a job or firm, then the higher skill workers may not be in a position to attract higher wages in alternative jobs.

The variable indicating that the worker has dependents, DEPST, is expected to affect the after layoff wages positively. As Polachek (46) argues, "Differing market values of initial stocks of human capital at the outset of marriage implies a general division of labour perpetuated over the marriage such that married males specialize more in market activities than either their single counterparts or their wives. Further, if the existence of children increases female productivity in non-market activities to a greater extent than it increases male non-market productivity, this specialization may be intensified." However, it should be noted that with more dependents at home, the value attached to non-market activities would be higher which increases the costs of search. The workers may, therefore, search for a shorter time which will
reduce their alternative earnings. Furthermore, with fixed family income, consumption may be financed by borrowed funds, hence the benefits from search would be discounted at a higher rate reducing the duration of search.

QUIT1 is expected to pick up the effect of job switching. Those who become unemployed because of resignation or job switching are expected to receive higher wages in alternative jobs. Individuals taking such decisions are likely to have better information regarding job offers and wage prospects. Furthermore, these workers engage in search activities while employed on the job which is expected to increase their alternative earnings.

QUIT2 is a proxy variable for those individuals who were unemployed for more than 4 weeks after job separation from the auto industry. When the individuals are unemployed for a long time, this may be a signal to prospective employers about adverse market characteristics of individuals which may lower wage rates in alternative jobs. The coefficient on the QUIT2 variable is expected to have a negative sign. While we recognize the potential simultaneity problem between $W^*$ and QUIT, this may not have serious effects on our estimates. The coefficient on OTHER is expected to be negative meaning that workers whose separation reasons were OTHER (say fired) will have difficulty in finding alternative high paying jobs since it may give adverse market signals to prospective employers.
MOVERS may obtain higher or lower wages than the stayers depending upon what kind of people are engaged in moving. If the group of individuals who decide to move consists of mainly young, unskilled, marginal workers, then it is possible that this group would get lower alternative wage rates.

The coefficients on the regional dummies may have positive or negative signs depending upon labour market conditions in a particular region. However, the regional effect on \( W^d \) should be minimized given the fact that most of the regions in the sample fall within the central industrial belt in Ontario. Workers within the boundaries are expected to be mobile thereby equalizing any minor wage gap across regions.

**Specification of the Permanency of Employment Before Job Loss**

\(^{(p^b)}\)

In order to estimate the labour adjustment cost, it is important to know the proportion of time workers were employed before permanent job loss. If an industry were providing more permanent jobs, the workers released from such an industry may face a higher adjustment cost in the absence of other employers providing similar patterns of employment opportunities. Again the proportion of time an average worker spends on employment is

\(^*\) See appendix C for details on the structure of employment.
itself dependent on the profile and structure of employment provided in the auto industry. If most individuals among the adjustment cases spent a higher proportion of their labour force time on employment then it is expected that this group will experience higher income losses, in the absence of readily available reemployment opportunities, after permanent separation from the auto industry. It is then important to investigate the structure of employment experienced by the auto workers. Appendix C provides a brief note in this regard.

In this section we attempt to estimate the permanency of prior employment. The dependent variable is the proportion of time workers were employed before job loss from the auto industry ($P^b$). This is based on the worker's participation in the employment activities to the total time in the labour force (i.e., the number of weeks a worker has been employed divided by the number of weeks he has been in the labour force for both employed and unemployed). The value of $P^b$ will fall in the following range:

$$0 < P^b \leq 1$$

Given the limitations of the range, particularly at the upper limit, ordinary least squares estimations procedures which were used may encounter some estimation problems because of truncation of the error terms at the upper limit. However,
the truncation level is fairly low and any bias generated would likely be small. If there is tight concentration of actual observation on $P^b$ or if the predicted values on $P^b$ fall in the range 0-1, there should not be any serious estimation problem. The explanatory variables have the same definitions as in the previous sections, with the following additions:

**MAXI:** maximum insured earnings indicator. If the last job of the worker provided a wage above the maximum insured earning, then $= 1$, otherwise $= 0$.

**DSI:** Sector dummy. If a worker is employed in the automobile assembly sector, then $= 1$, otherwise $= 0$.

Table 4.3 gives the expected signs on the coefficients of the explanatory variables of the proportion of time employed. However, there is not much previous applied work on this economic model that will allow us to make a priori judgement as to the sign of the coefficients on the independent variables.

The coefficient on the sex variable is expected to be positive. This indicates that the male workers spend a higher proportion of labour force time in employment than female workers. The total number of hours devoted to market and non-market activity by men and women will obviously depend upon relative productivity in each market. An optimum allocation of time requires that the marginal hour yield the same productivity in each use. If an hour of time placed in home
activity produces a value (which the woman implicitly puts on her time) that exceeds the market wage rate, she will supply more labour to non-market activity. If men specialize in market activity and invest more in human capital specific to market activity, men would probably receive higher rates of return from such investment than women. An increase in returns (i.e., the wage rate) not only implies an increase in the price of leisure but also an increase in the productivity of time in the market relative to time at home. Therefore, men would be expected to spend more time in market activity compared to non-market activity.

Becker expanded and generalized the theory of time allocation on which this argument is based. He argued that an increase in the opportunity cost of time leads to an increase in the relative price of time-intensive commodities (home production and consumption time). This shifts demand toward relatively less time-intensive commodities (market activity). Leibowitz shows that married men devote only a small amount of time to non-market activity relative to married women. Gronau's result also indicates that certain family characteristics such as marriage increase market activity for men. For women, it means an increase in non-market work swamping a decrease in market work. Furthermore, the present UI scheme may attract many additional workers (such as female workers in many cases) to join the labour force for a limited time in order to build up the minimum insurable weeks to receive
This group of workers may be expected to work a lower proportion of their labour force time.

A positive sign on the coefficient on the age variable is expected. A priori it may be hypothesised that younger people would engage in more job search activities because of their lower search costs (i.e., lower opportunity costs, higher proportion of wages replaced by UI payments, less family responsibility and less saleable work experience). We would then expect the permanency of employment to rise with age. In Appendix E(iii), we entered age in a piece-wise fashion in order to find out how this permanency of employment changes for different age categories.

\textbf{MAX1} is a dichotomous variable and takes a value of 1 if a worker earns more than the maximum insured earnings. The coefficient on this variable is expected to be positive since the opportunity cost of unemployed time is higher and a smaller proportion of the previous wage is replaced by UI. If the wage rate is higher, workers would tend to increase the supply of labour. Again higher wage rates tend to be related to higher skill and high skill jobs tend to be more stable which increases the permanency of employment. The dependent status coefficient will also have a positive sign indicating that workers with dependents will spend a higher proportion of their labour force time employed as compared to other workers with no dependents. The specialization in market activity may be intensified in
Table 4.3
Expected Signs on the Coefficients of Explanatory Variables
of Proportion of Time Employed in the Auto Industry

<table>
<thead>
<tr>
<th>Variables</th>
<th>pb</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEX</td>
<td>+</td>
</tr>
<tr>
<td>AGE</td>
<td>+</td>
</tr>
<tr>
<td>MAX1</td>
<td>+</td>
</tr>
<tr>
<td>DEPST</td>
<td>+</td>
</tr>
<tr>
<td>LESKIL</td>
<td>-</td>
</tr>
<tr>
<td>DS1 (Motor Vehicle Assembly)</td>
<td>+</td>
</tr>
<tr>
<td>D1 (Toronto)</td>
<td>?</td>
</tr>
<tr>
<td>D2 (Oshawa)</td>
<td>?</td>
</tr>
<tr>
<td>D3 (Windsor)</td>
<td>?</td>
</tr>
<tr>
<td>D4 (St. Cath.-Niag.)</td>
<td>?</td>
</tr>
<tr>
<td>D5 (London)</td>
<td>?</td>
</tr>
<tr>
<td>D6 (Kitchener)</td>
<td>?</td>
</tr>
<tr>
<td>D7 (Other SW Ont.)</td>
<td>?</td>
</tr>
<tr>
<td>D8 (Other Ont.)</td>
<td>?</td>
</tr>
</tbody>
</table>
the presence of dependents (Polachek(47)). Furthermore, the presence of dependents may itself be a proxy for higher human capital (assuming older workers have dependents) which will induce them to spend a higher proportion of their time employed.

The coefficient of the LESKIL variable is expected to have a negative sign. Unskilled workers are expected to have a lower opportunity cost of unemployed time since most of the foregone wages would be replaced by UIB and SUB payments. Furthermore, as the result of on-the-job training, skill levels and the seniority of workers are positively correlated and according to the seniority clause in the union agreement, the more senior person is laid off last and recalled first after any unemployment period. This tends to reduce the proportion of time employed of unskilled workers. Again, if highly skilled labour is used with increasing amounts of physical capital in production, employers would be interested in offering more stable jobs to this skill category. Moreover, higher skill means the company has invested more in training the workers which is expected to raise productivity and the permanency of employment.

Completely specific training increases the marginal productivity of labour only in a particular firm. The firm investing in specific training will be interested in retaining the worker since the payoff continues only as long as the worker
remains employed there.

While the productivity of the worker has increased in the firm providing the training, his productivity in alternative firms remains unchanged. Thus, the willingness of either the firm or the worker to make these investments is inversely related to the expectation of turnover. Firms could finance the training and hiring expenditures by capturing sufficiently high returns from those staying with the firm. However, the firm realizes that turnover itself is related to worker's income during employed (wage earnings) and unemployed time (UIC + SUB payments). Firms attempt to reduce turnover by sharing the extra return from training with the worker by paying him higher wages during employed time and subsidizing the cost of being unemployed (SUB payment). This risk sharing arrangement exists between the employee and employer in the automobile industry. In other words, the firm does not want to lose the trained employee because an equally productive employee could not be obtained. The employee suffers a loss if he leaves the firm because he cannot find the same high wage rate elsewhere.\(^{54}\)

The regional dummies (i.e., eight Ontario regions) and the sectoral dummy, DSI (Motor Vehicle Assembly) may either exert positive or negative pressure on the proportion of time employed. This depends largely on the regional labour market condition as well as the type of employment provided by the motor vehicle assembly plant in that region. The regional
dummies mainly represent those areas that fall in the central industrial belt of Ontario and assuming high labour mobility between these sub-regions then a priori, one may assume that the regional dummies may not work that well in the regression. However, in particular, Windsor experienced a higher than average unemployment especially because of particular company effects: Chrysler experienced a larger decline in demand and the experience of auto workers in this particular area may be significantly different from those in other areas.

**Specification of the Probability of Finding Job**

The probability that an individual is at work \( (P^a) \) after having been laid off depends on the interval probabilities of finding work (i.e., duration of unemployment) and on the probability of losing a job (i.e., duration of employment). A brief description of the structure of unemployment is given in Appendix D. These interval probabilities of finding a job during various intervals (0-4 wks., 5-12 wks., 13-24 wks., 25-48 wks.) are estimated by using a probit statistical model.*

* There were not enough observations to run the probit estimates in the last interval (49+ weeks). Almost everyone found a job within 48 weeks and 100 percent of the workers lost jobs within 48 weeks after they found their first non-auto job.
The dichotomous dependent variable is set equal to zero or unity depending upon whether an individual is still unemployed or employed. If an individual becomes employed during an interval, his observation is dropped from the sample for the analysis of the remaining intervals. The estimation of the interval probability of retaining a job, the duration of employment, is basically analogous. In this case, if an individual retains the job during an interval, the dummy dependent variable is set equal to zero, otherwise it is equal to unity. The probit analysis allows us to identify the key variables that determine the interval probabilities of finding or keeping a job. Ideally the key variables should include all the relevant personal characteristics of an individual (i.e., incentive and ability factors) as well as local and general economic conditions (i.e., labour market and sectoral effects).

In particular, the personal characteristics should include his demographic features such as SEX, AGE, DEPST and SKILL level of workers. The extent of UI benefits will influence the incentive of a worker to find an alternative job through its effects on the costs of being unemployed. The UI scheme reduces these costs by lowering the opportunity cost of leisure time. Kaliski\textsuperscript{56} shows that the revision of unemployment insurance benefits in 1971 moderated or even reversed the trend toward declining seasonality. This indicates that the workers' incentive to find alternative jobs are reduced and encourage them to spend a higher proportion of their time
unemployed. General labour market condition and particularly the unemployment rate are also important variables in determining the extent of job opportunities.

All variables have the same definitions as in the previous section, with the following exceptions and additions:

1. **QUIT**: Quit from job, then = 1, otherwise = 0.

2. **EMPX**: Permanency of prior employment. Percentage of time a worker has been employed prior to losing his job (Time employed/total time in the labour force).

3. **SVP**: Specific vocational preparation to perform an occupation (years).

4. **BNWKEL**: Remaining UIC benefit weeks eligibility at start of interval

   If first interval, then BNWKEL = Total benefit weeks
   
   if second interval, the BNWKEL = Total benefit weeks - 2
   
   if third interval, then BNWKEL = Total benefit weeks - 10
   
   if fourth interval, then BNWKEL = Total benefit weeks - 22
   
   if fifth interval, the BNWKEL = Total benefit weeks - 46

5. **URATPI**: Average Ontario unemployment rate for the time interval on which the probit estimate is based.

6. **Sectoral dummy when unemployed**

   **SECD1**: if separated from the automobile assembly (SIC 323), then = 1, otherwise = 0.
SECD2: If separated from the parts industry (SIC 325), then
= 1 otherwise = 0.

The four dependent variables are defined in order to
estimate the four interval probabilities of finding a job:

EMPL1: If found work in the first interval
(1-4 weeks), then = 1, otherwise = 0.
EMPL2: If still unemployed after first interval
(EMPL1=0) but found work in the second interval,
then = 1, otherwise = 0.
EMPL3: If still unemployed after second interval
(EMPL1 = EMPL2 = 0) but found work in the
third interval, then = 1, otherwise = 0.
EMPL4: If still unemployed after third interval
(EMPL1 = EMPL2 = EMPL3 = 0) but found job within
48 weeks since separation, then = 1, otherwise = 0.

In these regressions, the sign on the sex variable is
expected to be positive. The theoretical justification for a
relationship between higher human capital and the probability of
finding a job is straightforward. Considering the supply side,
individuals with greater levels of human capital may be more
skilled in searching for jobs and consequently will have shorter
unemployment spells. On the demand side, unemployment may be
inversely related to the level of accumulated training and
experiences. Female workers may experience quantity
discrimination in the market place which will reduce their
probability of finding jobs. On the other hand, the relatively long duration of unemployment for females may be associated with the fact that their family responsibilities would tend to reduce their job search activities. Females in general earn lower wage rates than their male counterparts and it is likely that a larger fraction of their pre-layoff wages will be replaced by the UI benefits. This higher replacement rate for female worker's wages would reduce the cost of unemployed time and hence increase the duration of unemployment.

Even in the absence of UI payments, women may be expected to have higher productivity in non-market activities than males because of their lower demand for investment in human capital and a lack of job related experience. Empirical findings by Leibowitz support this hypothesis. He found that women are more productive in some household production than men. Therefore, men and women are imperfect substitutes. This reduces the cost of being unemployed for women. Furthermore, wives are more likely to be "tied movers" than husbands because of the likelihood that husbands' gains from migration will be greater than any losses experienced by wives. A previous study on this issue finds that, for males, geographical mobility has the effect of decreasing their unemployment rate, whereas for females, the opposite is true. This study by the Federal Department of Industry, Trade and Commerce also suggests that married males have average durations of unemployment that are shorter than those for unmarried males.
Married females however, recorded longer periods of unemployment when compared with unmarried females.61/

Age measures both the incentive and the capacity factor of an individual to find a new job. Age may be a proxy for greater human capital which would be expected to increase the probability of finding a job. A higher age may also indicate that workers fall into higher wage brackets and a lower fraction of their prior earnings will be replaced by the normal UI payment. This will increase the cost of unemployed time and reduce the duration of unemployment. However, it should be noted that as workers grow older beyond prime ages, we expect that they would have greater difficulty in finding a job because they are less mobile and retraining becomes a less attractive investment from the perspective of the employer.62/

Furthermore, age may be negatively correlated with schooling and this outdated human capital may reinforce the negative effect of age on the probability of finding subsequent jobs.

The coefficient on the QUIT variable is expected to be positive in the first interval because those who quit in order to take up new jobs are captured in the EMPL1 coefficient for quit. These workers may have quit in anticipation of layoff or a better job elsewhere. These resignation cases may have engaged in job search activities while they were employed in the previous job and this would be expected to speed up their reemployment rate.
Workers who are unemployed after the first or second interval may consist disproportionately of those workers possessing unfavourable market oriented characteristics. This hypothesis could not be generalized for those individuals experiencing a longer duration because of slack regional market conditions or adverse personal characteristics. This longer duration of unemployment also may give negative signals to prospective employers about the lower average market related attributes of workers. Hence, we expect a negative sign for such workers. Workers leaving jobs for OTHER reasons may be a mixture of layoff and quit cases and would be expected to show intermediate behaviour. Workers with dependents (DEPST) would be expected to find work faster because these workers may have more built-in human capital. The larger the family size, the greater the probability of financing consumption expenditure with a loan, for a given level of family assets. Following search theory, family heads with more dependents are expected to discount returns from search at a higher rate which suggests a shorter duration of unemployment.63/

The coefficient of the skill variable (SVF) may have a positive or negative sign depending upon whether the workers have acquired general or firm specific training. A general form of training would increase the probability of finding alternative jobs. Permanency of prior employment (EMPXPA)
may have a positive effect on the probability of obtaining subsequent jobs because it reflects on the ability and the work attitude of the worker. The coefficient on benefit week eligibility (BNWKEL) for UIC purposes would be expected to have a negative sign. The UIC system reduces the cost of unemployed time and therefore may reduce the incentive to find an alternative job immediately following job loss. Again the UI payments may have the effects of raising the reservation wage which would be expected to reduce the probability of finding a job for a given wage distribution.

MAX1 plays the dual role of indicating the relative attractiveness of UI benefit collection and the wage replacement rate of the UI system. Both would be lower for high wage earners and hence would provide less work disincentive.64/ The Ontario provincial unemployment rate (URATPI) should have a negative effect on the probability of reemployment since it reflects the general demand for labour. Eight Ontario regional dummies and two sectoral dummies have been included in our specification to estimate their effects on the reemployment prospects of workers. The automobile subsector dummies are important here as they will pick up the added work disincentive effects provided by the receipt of SUB payments.
Specification of the Probability of Losing Job

The probability of losing a job (duration of subsequent employment) is affected by many of the same explanatory variables as in the case of finding employment with the following exceptions and additions:

EXIXB: Proportion of time employed in previous jobs.

RECALL: If worker becomes reemployed with the same employer as previous job (same PDA number), then = 1, otherwise = 0.

PREEMP: Length of previous employment spell (weeks).

PRUNEM: Length of previous unemployment spell (weeks).

BNWKE1: Remaining weeks of UI eligibility at the beginning of a new job.

Four discrete dependent variables are defined in the following way in order to estimate the interval probabilities of losing a job:

LOSE1: If a worker loses a job within 1-4 weeks, then = 1, otherwise = 0.

LOSE2: If a worker is still employed after 4 weeks (LOSE1 = 0) but loses a job from the 5th week through the 12th, week, then = 1, otherwise = 0.

LOSE3: If a worker is still employed after 12 weeks (LOSE1 = LOSE2 = 0) but loses a job from the 13th week through the 24th week, then = 1, otherwise = 0.
LOSE4: If a worker is still employed after 24 weeks (LOSE1 =
LOSE2 = LOSE3 = 0) but loses a job from the 25th week
through the 48th week, then = 1, otherwise = 0.

The sign on the coefficient of the SEX variable
(M=1,F=0) is expected to be positive indicating a lower turnover
rate for females. Women in general experience a longer duration
of unemployment as well as employment. Once employed,
females tend to stay on the same job relatively longer because
of greater difficulty in finding other jobs after separation
from the present one. Furthermore, if they have already
experienced a longer duration of unemployment before
reemployment then these workers may not have accumulated enough
weeks of insurable employment to qualify for UI benefits. This
lower insurable weeks phenomenon increases the incentives for
female workers to stay on the present job for a longer time.
Both these UI and unemployment effects produce an increasing
pressure on the probability of retaining a job for female
workers.

The coefficient on the AGE variable is expected to
have a negative sign indicating that older workers may possess
more job related skills in order to obtain more stable jobs. If
general training, a measure of higher human capital, increases
with age of workers, it is possible that these workers may
obtain more stable jobs in alternative industries. However, if
the workers build up firm specific skills with age, that
would increase the probability of losing a job with AGE. The permanency of previous employment, EMPIXA, would have a negative effect on the probability of losing a job because of higher firm specific human capital. Bluh and Smith (57) argue that layoffs and, therefore, unemployment should be inversely related to the level of accumulated on-the-job training.

The coefficient on RECALL should have a negative sign as these workers represent the recalled cases which would be expected to reduce the probability of losing a job in the short run.

The dummy variable indicating that the worker has dependents, DEPST, and the skill level of workers, SVP, should have negative signs indicating the higher values attached to these workers. A higher provincial unemployment rate, URATPL, represents sluggish labour market conditions and therefore would increase the probability of losing a job. QUIT and QUIT2 should have negative and positive signs respectively. Workers falling in the first category represents those who have more suitable jobs lined up while the second group may represent those with unfavourable market characteristics.

The benefit week eligibility variable, BNWKEL, for the purpose of UI payments should have a positive sign. Individuals with higher benefit weeks eligibility may be
expected to leave jobs more frequently since more of the costs of unemployment is replaced by normal UI benefits. The length of the previous employment spell, PREEMP, would be expected to increase the probability of losing a job. A greater length of previous employment would mean that workers have built up more insured weeks which would be expected to increase the probability of losing a job. Conversely, the duration of previous unemployment, PRUNEM, would exert an opposite influence on losing a job. The regional dummies, D's, in Ontario may have positive or negative signs depending upon the regional labour market's demand and supply condition. A region characterized by high unemployment and slack demand conditions may experience higher layoffs and an increased probability of losing jobs for individuals.
V. ESTIMATION RESULTS

A. Source and Structure of Data Base

This study of the automotive industry uses the longitudinal database developed from the administrative records of the Unemployment Insurance Commission (U.I.C.) in Canada. This database gives us time series information regarding individuals' employment/unemployment episodes. All individuals who established UI claims between 1972 and 1979 are included in the database. The information about individuals' employment/unemployment history and personal characteristics are based on actual records of employment (ROE), and UI claim records and T4 supplementary tax data. This administrative information allows us to generate variables that can be used to measure the adjustment costs of workers permanently displaced from the automobile sector. Although the information about an individual is only used if he is unemployed and files a claim at least once, it is expected to cover the labour market experience of the vast majority of the auto workers experiencing unemployment. All available data regarding workers' socio-economic characteristics are included at the time of each employment/unemployment episode.

Using a one percent sample of all individuals who were unemployed at least once from the auto industry in Ontario between January 1974 and December 1979 and who have made
at least one claim from unemployment insurance (UI), we established the employment/unemployment experiences of individuals over time. (See Appendix B for further details about the database).

B. Wage Rate Before ($w^b$) and After Layoff ($w^d$)

The mean values of the explanatory variables and the results of the before layoff wage rate equations and for the equations determining the wage rate in alternative jobs are presented in Tables 5.1 and 5.2 respectively. The overall specifications for both prior and subsequent wage rates are all highly statistically significant (likelihood ratio statistics) and provide a reasonably good explanation of the variance in wage rates ($\text{Pseudo R}^2$). The signs of the coefficients are all as expected and statistically significant with a few exceptions.

SEX is the dominant explanatory variable in determining both before and after layoff wage rates. The significant positive coefficients on the sex variables indicate that wage rates for males are 53 percent and 60 percent higher than for females in prior and subsequent jobs respectively. While much of the wage gap can be explained by lower average investment in human capital and subsequent lower training and skill levels of female workers, some of the gap may be a measure of wage discrimination by employers. These results are
consistent with the earlier studies on this subject by Holmes and Robb. Holmes' study indicates that about 75 percent of the earnings differentials between males and females can be attributed to sex discrimination while Robb's study attributes only 63.3 percent of the differential to discrimination. It is interesting to notice that there is a significant difference between the sex coefficients in the before and after job loss wage estimates: the latter is about 7 percentage points higher than the former.

These results suggest that wage discrimination is higher for workers at the point of job entry than for workers who have been in the same job or firm for a long period of time. It should be noted, however, that our estimates are based on equations in which very few human capital indicators are included and as a result, the wage differential between men and women may in fact capture the effects of excluded human capital variables in the equations. Some of the wage gap may also be attributed to differences in occupations that males and females enter in the labour market.

The coefficients of AGE in both regressions have the right sign indicating that the return to a year increase in age is positive. This basically supports the human capital argument in which earnings are supposed to increase with age. However, the absolute value of the coefficients on the AGE variables are
TABLE 5.1
Mean Values of Explanatory Variables of $W^b$ and $W^e$
(Percentage Unless Otherwise Stated)

<table>
<thead>
<tr>
<th>Variables</th>
<th>$(W^b)$</th>
<th>$(W^e)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEX</td>
<td>.80</td>
<td>.82</td>
</tr>
<tr>
<td>AGE (Years)</td>
<td>27.67</td>
<td>26.98</td>
</tr>
<tr>
<td>SEPWK1 (UI Calendar Weeks)</td>
<td>575.07</td>
<td>601.88</td>
</tr>
<tr>
<td>LESKIL</td>
<td>.80</td>
<td>.81</td>
</tr>
<tr>
<td>DEPST</td>
<td></td>
<td>.29</td>
</tr>
<tr>
<td>QUIT1</td>
<td></td>
<td>.19</td>
</tr>
<tr>
<td>QUIT2</td>
<td></td>
<td>.13</td>
</tr>
<tr>
<td>OTHER</td>
<td></td>
<td>.20</td>
</tr>
<tr>
<td>MOVE</td>
<td></td>
<td>.04</td>
</tr>
<tr>
<td>D1 (Toronto)</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>D2 (Oshawa)</td>
<td>.06</td>
<td></td>
</tr>
<tr>
<td>D3 (Windsor)</td>
<td>.08</td>
<td></td>
</tr>
<tr>
<td>D4 (St.Cath.-Niag.)</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>D5 (London)</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>D6 (Kitchener)</td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td>D7 (Other SW Ont.)</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>D8 (Other Ont.)</td>
<td>.05</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 5.2

Estimates of the Determinants of Wage Rates Before and After Layoff from the Auto Industry
Dependent Variable: Natural Logarithm of the Weekly Wage Rate
In Constant 1971 Dollars

<table>
<thead>
<tr>
<th></th>
<th>Wage Before Layoff (Wb)</th>
<th>Wage After Layoff (Wa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>3.222</td>
<td>3.362</td>
</tr>
<tr>
<td>SEX</td>
<td>.529 (3.01)*</td>
<td>.595 (4.73)</td>
</tr>
<tr>
<td>AGE</td>
<td>.008 (1.18)</td>
<td>.0009 (.22)</td>
</tr>
<tr>
<td>SEPWK1</td>
<td>.0017 (2.12)</td>
<td>.0016 (2.55)</td>
</tr>
<tr>
<td>LESKIL</td>
<td>-.040 (-.29)</td>
<td>.045 (.41)</td>
</tr>
<tr>
<td>DEPST</td>
<td>.199 (1.60)</td>
<td>(-)</td>
</tr>
<tr>
<td>QUIT1</td>
<td>-.050 (-.44)</td>
<td>(-)</td>
</tr>
<tr>
<td>QUIT2</td>
<td>-.021 (-.14)</td>
<td>(-)</td>
</tr>
<tr>
<td>OTHER</td>
<td>-.148 (-1.35)</td>
<td>(-)</td>
</tr>
<tr>
<td>MOVE</td>
<td>-.243 (-1.36)</td>
<td>(-)</td>
</tr>
<tr>
<td>D1 (Toronto)</td>
<td>.155 (.50)</td>
<td>(-)</td>
</tr>
<tr>
<td>D2 (Oshawa)</td>
<td>(-) .009 (-.30)</td>
<td>(-)</td>
</tr>
<tr>
<td>D3 (Windsor)</td>
<td>.077 (.55)</td>
<td>(-)</td>
</tr>
<tr>
<td>D4 (St. Cath.-Niag.)</td>
<td>-.235 (-1.18)</td>
<td>(-)</td>
</tr>
<tr>
<td>D5 (London)</td>
<td>-.177 (-1.08)</td>
<td>(-)</td>
</tr>
<tr>
<td>D6 (Kitchener)</td>
<td>-.411 (-2.45)</td>
<td>(-)</td>
</tr>
<tr>
<td>D7 (Other SW Ont.)</td>
<td>-.087 (-.29)</td>
<td>(-)</td>
</tr>
<tr>
<td>D8 (Other Ont.)</td>
<td>-.017 (-.11)</td>
<td>(-)</td>
</tr>
<tr>
<td>Likelihood Ratio Test (X²)</td>
<td>79.82</td>
<td>207.42</td>
</tr>
<tr>
<td>(Degree of Freedom)</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>.358</td>
<td>.337</td>
</tr>
<tr>
<td>Observation</td>
<td>248</td>
<td>659</td>
</tr>
<tr>
<td>Degree of Truncation</td>
<td>.448</td>
<td>.476</td>
</tr>
</tbody>
</table>

* Figures in brackets are t-statistics
unexpectedly small and statistically insignificant.

An alternative semi-log relationship can be estimated where the wage is expressed as a function of logarithm of AGE. This formulation can be derived from the life-cycle profile of earnings of individuals meaning that the earnings of individuals should rise with AGE but the greatest marginal effect of age on earnings is achieved in the earlier years. While this life-cycle hypothesis about earnings of individuals is quite plausible, it possesses statistical problems which are discussed in the previous section. Furthermore, in Appendix E, the AGE variable is used in a piece-wise fashion in order to capture the marginal effect of age on the rate of return in different age categories. Hausman and Wise\(^68\) have improved their estimates on this variable by using age in a piece-wise fashion. It was found that the coefficients of AGE1, AGE2 and AGE4 have the right sign but are statistically insignificant. For the wage rate in the alternative job, the coefficients on AGE1, AGE2 and AGE4 have the expected sign but are again statistically insignificant. The coefficients of AGE4 in both regression equations have negative signs but are not statistically significant.

Practically, the older workers may be subject to discrimination by employers who prefer long-term employees in order to capitalize on initial training investments. Older workers also tend to be less mobile because of long term attachments to their family and their community.
The dummy variable indicating that the worker has dependents, DEPST, is significant and positively affects the wage rate in alternative jobs. Workers with dependents received wages that were about 20 percentage points higher than others. Osterman\textsuperscript{69} while examining the work history of workers in a large publishing company also found a positive effect of marriage and children on the husbands' incomes. If children are considered to be a normal good, however, higher income individuals may decide to have more children which may cause a simultaneity problem between $W_0$ and DEPST. While we recognize this simultaneity issue, we assume that it does not seriously affect our estimates.

The coefficient of the LESKIL variable has the right sign in determining the previous wage but this coefficient turns positive in the alternative wage regression. However, the coefficient is statistically insignificant in both regressions. The insignificance of the coefficient on LESKIL in the alternative wage estimates suggests that much of the job related skills in the auto industry are specific to the industry and are not generally transferable. The average skill level in the automobile industry is fairly low and about 80 percent of the workers may be classified as LESKIL. The seniority of workers seems to have a larger impact on earnings because of strong seniority rules practised in the automobile industry.
The significant coefficient on the separation week 'SEPWK1' (UIC week counter of job loss) has the expected positive sign indicating growth in labour productivity. The coefficient of .0017 implies an approximately 2.2 percent productivity growth rate per annum.

The negative coefficients on QUIT2 and OTHER are as expected meaning that workers whose separation reasons were as mentioned above will have difficulty in finding alternative high paying jobs since it may give adverse signals to prospective employers. The QUIT1 variable has a negative sign although the coefficients on QUIT1, QUIT2 and OTHER are statistically insignificant in affecting the wage rate after layoff.

MOVERS appear to obtain lower wages than stayers. It is possible that the group of workers who move consist of low skilled and returned migrants who are unable to regain their wage rates in alternative jobs.

The regional dummy variables do not seem to have significant effects (except in Kitchener) on the alternative wage. Regional dummies are not significant factors in determining wages in the auto industry since the strong UAW effect tends to synchronize wages across regions.
C. Permanency of Employment Before Job Loss ($p^b$)

The mean values of the explanatory variables and the results of the estimates of the proportion of time employed are presented in Tables 5.3 and 5.4. Column two in the above table presents the estimates of the regression equation for all those workers permanently laid off from the auto industry (adjustment cases). Column three presents the coefficients for the same variables for the non-adjustment cases, while column four presents the estimates for all spells of employment and unemployment in the auto industry.

The coefficients on the SEX variable are positive and significant in all regressions indicating that male workers spend a higher proportion of labour force time in employment than female workers. As mentioned earlier, females' productivity in non-market activities may be higher than for their male counterparts. As a result, this group of workers is expected to spend a smaller fraction of time in employment. The positive sign of the coefficients on the AGE variables are as expected but they are insignificant in explaining the variation in the permanency of employment for the adjustment cases. The dummy variables representing the maximum insured earning indicator, MAXI, have positive coefficients and are statistically significant. This shows that the opportunity cost of unemployment for those workers earning above the maximum
<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Adjustment Cases</th>
<th>Non-Adjustment Cases</th>
<th>All Auto Workers*</th>
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<td>SEX</td>
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<td>.83</td>
<td>.87</td>
</tr>
<tr>
<td>AGE (Years)</td>
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<td>36.35</td>
<td>35.34</td>
</tr>
<tr>
<td>MAX1</td>
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<td>.80</td>
<td>.84</td>
</tr>
<tr>
<td>DEPST</td>
<td>.25</td>
<td>.47</td>
<td>.45</td>
</tr>
<tr>
<td>LESKIL</td>
<td>.90</td>
<td>.80</td>
<td>.92</td>
</tr>
<tr>
<td>SECID1</td>
<td>.47</td>
<td>.72</td>
<td>.85</td>
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<td>.15</td>
<td>.11</td>
<td>.12</td>
</tr>
<tr>
<td>D2</td>
<td>.07</td>
<td>.18</td>
<td>.31</td>
</tr>
<tr>
<td>D3</td>
<td>.18</td>
<td>.27</td>
<td>.18</td>
</tr>
<tr>
<td>D4</td>
<td>.07</td>
<td>.13</td>
<td>.20</td>
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<td>D5</td>
<td>.13</td>
<td>.09</td>
<td>.06</td>
</tr>
<tr>
<td>D6</td>
<td>.12</td>
<td>.05</td>
<td>.03</td>
</tr>
<tr>
<td>D7</td>
<td>.08</td>
<td>.02</td>
<td>.02</td>
</tr>
<tr>
<td>D8</td>
<td>.08</td>
<td>.05</td>
<td>.03</td>
</tr>
</tbody>
</table>

* Includes all employment/unemployment spells experienced by both adjustment and non-adjustment cases in the automobile industry. The number of observations in this category is in the neighbourhood of 4600 spells.
TABLE 5.4

Estimates of Determinants of the Proportion of Time Employed

In the Automobile Industry

<table>
<thead>
<tr>
<th></th>
<th>Adjustment Cases</th>
<th>Non-Adjustment Cases</th>
<th>All Auto Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>.554</td>
<td>.610</td>
<td>.610</td>
</tr>
<tr>
<td>SEX</td>
<td>.068 (1.84)*</td>
<td>.050 (2.43)</td>
<td>.039 (5.39)</td>
</tr>
<tr>
<td>AGE</td>
<td>.003 (1.17)</td>
<td>.003 (5.90)</td>
<td>.003 (17.36)</td>
</tr>
<tr>
<td>MAX1</td>
<td>.022 (.71)</td>
<td>.052 (2.52)</td>
<td>.034 (4.59)</td>
</tr>
<tr>
<td>DEPST</td>
<td>.036 (1.11)</td>
<td>.040 (3.00)</td>
<td>.029 (6.30)</td>
</tr>
<tr>
<td>LESKIL</td>
<td>.039 (1.13)</td>
<td>-.038 (-1.78)</td>
<td>-.014 (-1.80)</td>
</tr>
<tr>
<td>SECD1</td>
<td>.064 (2.14)</td>
<td>.033 (1.91)</td>
<td>.049 (6.57)</td>
</tr>
<tr>
<td>D1 (Toronto)</td>
<td>.010 (.20)</td>
<td>.025 (.88)</td>
<td>.024 (2.09)</td>
</tr>
<tr>
<td>D2 (Oshawa)</td>
<td>.035 (.54)</td>
<td>.018 (.71)</td>
<td>.077 (.64)</td>
</tr>
<tr>
<td>D3 (Windsor)</td>
<td>-.101 (-1.199)</td>
<td>-.071 (-2.94)</td>
<td>-.051 (-4.69)</td>
</tr>
<tr>
<td>D4 (St. Cath.-Niag)</td>
<td>-.015 (-.23)</td>
<td>.002 (.08)</td>
<td>.018 (1.68)</td>
</tr>
<tr>
<td>D5 (London)</td>
<td>.008 (-.15)</td>
<td>-.028 (-.97)</td>
<td>-.003 (-.22)</td>
</tr>
<tr>
<td>D6 (Kitchener)</td>
<td>.010 (.18)</td>
<td>.077 (2.20)</td>
<td>.067 (4.25)</td>
</tr>
<tr>
<td>D7 (Other SW Ont)</td>
<td>-.026 (-.44)</td>
<td>-.195 (-4.20)</td>
<td>-.037 (-1.99)</td>
</tr>
<tr>
<td>D8 (Other)</td>
<td>.090 (1.48)</td>
<td>-.031 (-.88)</td>
<td>-.016 (1.04)</td>
</tr>
</tbody>
</table>

R²            | .12              | .24                  | .19           |
N             | 248              | 685                  | 4600          |

* Figures in parenthesis are t-statistics.
insured earning level, MAXI, is higher since a smaller proportion of the wage is replaced by UI benefits. However, the coefficient for the adjustment cases is not significantly different from zero while they are significant for the non-adjustment and the all auto workers' case.

The dependent status coefficient, DEPST, is positive and significant for the non-adjustment and all auto workers' cases meaning that the presence of dependents is associated with workers spending a higher proportion of time employed. The LESKIL coefficients have the correct negative sign and are significant for the non-adjustment and the auto workers' cases. If LESKIL and lower wages move together then these workers would be expected to have lower opportunity costs while unemployed and this would reduce the proportion of time spent in employment.

The regional dummies seem to have a weak impact (except for Windsor, SW Ont., and Kitchener) on the proportion of time employed. It is interesting to note that the coefficient on D3 (Windsor) is negative and significant in all equations indicating that auto workers in Windsor spend a smaller proportion of time employed as compared to regions in other provinces. This coefficient may be picking up some of the company effects associated with the declining demand for cars produced by Chrysler.
The coefficients on the sectoral dummy variables, SECD1, are positive and significant for all three equations. This suggests that motor vehicle assembly workers spent a higher proportion of time in employment as compared to parts workers before being permanently laid off from the automobile industry. Parts production in Canada largely consists of smaller independent producers who may face greater difficulty in providing steady employment to workers.

D. Probability of Finding Job

The results of the estimation of the interval probabilities of finding work using the probit statistical technique are presented in Table 5.5. The overall specifications are highly significant as indicated by the likelihood ratio although the explained variations in the dependent variable as indicated by the Pseudo-$R^2$ are low in the cases of EMPL2 and EMPL3. In general, the signs on the coefficients are all as expected with only a few exceptions and in some cases they are highly significant.

SEX has a large significant effect only in the second interval, when males found jobs with a higher probability. AGE has a positive and significant effect on the probability of finding employment in EMPL1 but becomes insignificant in all other intervals. Interestingly, this variable changes sign in
TABLE 5.5
Estimates of the Factors Affecting the Probability of Finding
Employment in Different Time Intervals After Layoff from the
Automobile Industry

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EMPL1</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>-.157</td>
</tr>
<tr>
<td></td>
<td>(.128)</td>
</tr>
<tr>
<td></td>
<td>(.013)</td>
</tr>
<tr>
<td></td>
<td>(2.89)</td>
</tr>
<tr>
<td>QUIT</td>
<td>.441</td>
</tr>
<tr>
<td></td>
<td>(4.14)</td>
</tr>
<tr>
<td>OTHER</td>
<td>.047</td>
</tr>
<tr>
<td></td>
<td>(-.48)</td>
</tr>
<tr>
<td>EMPIXA (Employment</td>
<td>.840</td>
</tr>
<tr>
<td>Index</td>
<td>(.368)</td>
</tr>
<tr>
<td>MAX1 (Maximum insured</td>
<td>.254</td>
</tr>
<tr>
<td>earning indicator)</td>
<td>(2.73)</td>
</tr>
<tr>
<td>DEPST</td>
<td>-.0003</td>
</tr>
<tr>
<td></td>
<td>(-.004)</td>
</tr>
<tr>
<td>SVP (Skill level)</td>
<td>-.036</td>
</tr>
<tr>
<td></td>
<td>(-.91)</td>
</tr>
<tr>
<td>BNWKEI (Benefit Week</td>
<td>-.018</td>
</tr>
<tr>
<td>eligibility)</td>
<td>(-.898)</td>
</tr>
<tr>
<td>URATP1 (Prov. unempl.</td>
<td>-.062</td>
</tr>
<tr>
<td>Rate)</td>
<td>(-1.58)</td>
</tr>
<tr>
<td>D1 (Toronto)</td>
<td>-.382</td>
</tr>
<tr>
<td></td>
<td>(-1.93)</td>
</tr>
<tr>
<td>D2 (Oshawa)</td>
<td>.189</td>
</tr>
<tr>
<td></td>
<td>(.97)</td>
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<tr>
<td>D3 (Windsor)</td>
<td>-.245</td>
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<tr>
<td></td>
<td>(-1.30)</td>
</tr>
<tr>
<td>D4 (St. Cath-Niag.)</td>
<td>-.012</td>
</tr>
<tr>
<td></td>
<td>(1.66)</td>
</tr>
<tr>
<td>D5 (London)</td>
<td>.044</td>
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<tr>
<td></td>
<td>(.22)</td>
</tr>
<tr>
<td>D6 (Kitchener)</td>
<td>-.055</td>
</tr>
<tr>
<td></td>
<td>(.25)</td>
</tr>
<tr>
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<td>(-.75)</td>
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<td>D8 (Other Ont.)</td>
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<tr>
<td></td>
<td>(-1.34)</td>
</tr>
<tr>
<td>SECD1 (Motor Vehicles)</td>
<td>.051</td>
</tr>
<tr>
<td></td>
<td>(.16)</td>
</tr>
<tr>
<td>SECD2 (Parts)</td>
<td>-.534</td>
</tr>
<tr>
<td></td>
<td>(-1.34)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>Likelihood Ratio</strong></td>
<td>202.41</td>
</tr>
<tr>
<td><strong>Test (X^2)</strong></td>
<td>21</td>
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<tr>
<td><strong>(Degree of Freedom)</strong></td>
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<tr>
<td><strong>Pseudo R^2</strong></td>
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</tr>
<tr>
<td><strong>Positive Observation</strong></td>
<td>0.529</td>
</tr>
<tr>
<td><strong>Total observation</strong></td>
<td></td>
</tr>
</tbody>
</table>
the third and fourth intervals since job separation indicating that the probability of reemployment decreases with age as the duration of unemployment exceeds 12 weeks.

It is interesting to note the coefficient on the QUIT variable. It switches from being significant and positive in EMPL1 to significant and negative in EMPL4. The first probably represents those workers who quit because they have lined up alternative jobs. The coefficient of OTHER ranges from being negative to positive but they are all statistically insignificant. The employment index, EMPixa, turns out to be positive and significant in the first interval following separation but becomes insignificant in the subsequent intervals. The positive sign on EMPixa in EMPL1 indicates that those who worked a higher proportion of time found subsequent jobs faster.

The variable indicating maximum insured earnings (MAX1) is positive and significant in the first interval and positive and insignificant in the second and third intervals while it turns out to be negative in the fourth interval. When workers are permanently laid off from the auto industry, they are first compensated by both SUB and normal UI benefits, but in subsequent spells they are only compensated by UI benefits. During these spells, a smaller fraction of total income is replaced by UI payments which induces them to find alternative jobs. Contrary to this hypothesis, however, the coefficient on MAX1 becomes negative in the fourth interval.
The coefficient on dependent status (DEPST) is large, positive and significantly different from zero for the fourth interval. AGE is positively correlated with dependent status. This implies that some of the economic pressure that would be expected to be exerted on those with dependents is probably captured in the age variable.

SVP is insignificant (except in the third interval) in affecting the probability of finding subsequent jobs. This suggests that much of the job-related skills in the automobile industry are specific to the firm and are not general training. As expected, the coefficient on benefit week eligibility (BNWKE1) for UI payments is negative and significant. This indicates that the presence of generous UI payments reduces workers' incentive to find alternative jobs because the financial hardship of being unemployed is reduced to a great extent. However, this variable becomes insignificant in EMPL3 and EMPL4 indicating that the work disincentive effect of UI payments declines with the duration of unemployment. This is probably because BNWKE1 decreases as the duration of unemployment lengthens. Therefore, the work disincentive effect of UI payments would be reduced for those workers entering into EMPL3 and EMPL4.

URATPI has a negative coefficient and is significant for the EMPL1 interval as expected indicating that higher unemployment rates would reduce the probability of finding an
alternative job. In general, the regional dummies do not follow any consistent pattern ranging from being negative and significant in EMP1 to positive and significant in EMP3 for Toronto. Coincidentally, the coefficients of D2, D3, D6, D7 and D8 are significant and positive in EMP3. The coefficients on the sectoral dummies are generally insignificant, but they have positive signs whenever significant.*

E. Probability of Losing Job

The results of the estimates of the interval probabilities of losing jobs (LOSE1, LOSE2, LOSE3, and LOSE4) using the probit statistical technique are presented in Table 5.6. The overall specifications are highly significant as shown by the likelihood ratio test and the signs on the majority of the coefficients are as expected.

The coefficient on the SEX variable is positive in all intervals (except in LOSE2) and significant in the third and fourth intervals. This suggests that women in general enjoy a longer duration of employment and are unemployed somewhat less frequently than men.70/ This low turnover for females may

* The coefficient on motor vehicle assembly is positive and significant in the third interval. This appears to be the result of the incentive factor. As time from layoff increases, the UI and SUB compensation is expected to exhaust rapidly, encouraging workers to find alternative jobs more rapidly.
be the result of the anticipated low probability of finding another job.

The coefficient on the AGE variable is positive and significant in LOSE2, LOSE3, and LOSE4 indicating that the probability of losing a job increases with age. The adjustment cases mainly consist of younger workers who might be facing relatively more difficulty in retaining a job. OTHER reasons for job separation are insignificant in affecting the probability of losing jobs (except in LOSE2).

Permanency of previous employment (EMPIXA) is not a dominant explanatory variable. The sign on this variable is negative and significant only in the fourth interval. Permanency of prior employment indicates a higher value to an employer, and hence, there is a low probability of being laid off. It is interesting to notice that the coefficient on the RECALL variable changes sign, being significantly negative in the second interval but significantly positive in the third and fourth intervals. This evidence suggests that a recalled worker may show job stability in the short run but the process of temporary layoff may be repeated in the long run, leading to job instability.
### TABLE 5.6

Estimates of Factors Affecting the Probability of Losing a Job

In Different Time Intervals Since Reemployment

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>Lose1</th>
<th>Lose2</th>
<th>Lose3</th>
<th>Lose4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td></td>
<td>-1.332</td>
<td>-0.836</td>
<td>-1.891</td>
<td>-0.748</td>
</tr>
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<td>0.159</td>
<td>-0.113</td>
<td>0.272</td>
<td>0.500</td>
</tr>
<tr>
<td></td>
<td>1.20</td>
<td>-0.86</td>
<td>1.59</td>
<td>2.36</td>
<td></td>
</tr>
<tr>
<td>AGE</td>
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<td>0.11</td>
<td>0.015</td>
<td>0.036</td>
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</tr>
<tr>
<td>OTHER</td>
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<td>-0.050</td>
<td>0.105</td>
</tr>
<tr>
<td></td>
<td>0.05</td>
<td>-2.09</td>
<td>-0.36</td>
<td>0.56</td>
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</tr>
<tr>
<td>EMPXIA</td>
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<td>-0.303</td>
<td>-0.359</td>
<td>-1.503</td>
</tr>
<tr>
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<td>-0.93</td>
<td>-0.92</td>
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</tr>
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<td>0.504</td>
</tr>
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<td></td>
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<td>-1.75</td>
<td>3.15</td>
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<td>2.80</td>
<td>5.56</td>
<td>4.20</td>
<td>2.04</td>
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<td>0.114</td>
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</tr>
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<td>-4.04</td>
<td>-0.77</td>
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</tr>
<tr>
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<td>4.03</td>
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<td>-0.40</td>
<td>0.02</td>
<td></td>
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<td>0.0004</td>
<td>0.002</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
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<td>0.66</td>
<td>1.97</td>
<td>1.92</td>
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<tr>
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<td>-0.006</td>
<td>-0.002</td>
<td>-0.01</td>
</tr>
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<td>0.108</td>
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</tr>
<tr>
<td></td>
<td>(0.44)</td>
<td>0.63</td>
<td>1.96</td>
<td>1.37</td>
<td></td>
</tr>
<tr>
<td>D (Toronto)</td>
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<td>0.075</td>
<td>0.112</td>
<td>0.447</td>
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<tr>
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<td>0.027</td>
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<td></td>
</tr>
<tr>
<td>D2 (Oshawa)</td>
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<tr>
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<td>0.69</td>
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<td>0.129</td>
<td></td>
</tr>
<tr>
<td>D3 (Windsor)</td>
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<td>-0.350</td>
</tr>
<tr>
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<td>0.16</td>
<td>0.56</td>
<td>0.127</td>
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<td>1.31</td>
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</tr>
<tr>
<td>D5 (London)</td>
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<td>0.328</td>
<td>0.549</td>
<td>-0.767</td>
</tr>
<tr>
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<td>2.19</td>
<td>1.55</td>
<td>2.36</td>
<td>-2.50</td>
<td></td>
</tr>
<tr>
<td>D6 (Kitchener)</td>
<td></td>
<td>0.403</td>
<td>0.073</td>
<td>0.100</td>
<td>-0.488</td>
</tr>
<tr>
<td></td>
<td>1.84</td>
<td>0.32</td>
<td>0.99</td>
<td>-0.87</td>
<td></td>
</tr>
<tr>
<td>D7 (Other SW Ont.)</td>
<td></td>
<td>0.229</td>
<td>0.033</td>
<td>0.101</td>
<td>-0.488</td>
</tr>
<tr>
<td></td>
<td>1.01</td>
<td>0.37</td>
<td>-1.50</td>
<td>0.50</td>
<td></td>
</tr>
<tr>
<td>D8 (Other Ont.)</td>
<td></td>
<td>0.237</td>
<td>0.128</td>
<td>0.253</td>
<td>-0.813</td>
</tr>
<tr>
<td></td>
<td>1.09</td>
<td>0.58</td>
<td>0.97</td>
<td>2.45</td>
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<td>Likelihood Ratio</td>
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</tr>
<tr>
<td>------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Test (X^2)</td>
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<td>96.97</td>
<td>122.68</td>
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<tr>
<td>(Degree of Freedom)</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Pseudo R^2</td>
<td>.049</td>
<td>.133</td>
<td>.181</td>
<td>.340</td>
<td></td>
</tr>
<tr>
<td>Positive Observations</td>
<td>.188</td>
<td>.253</td>
<td>.302</td>
<td>.420</td>
<td></td>
</tr>
<tr>
<td>Total Observations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DEPST has a consistently negative coefficient except for LOSE1 which suggests that the presence of dependents encourages a worker to retain a job. SVP (skill) has the right sign but the regression coefficients are not significantly different from zero.

The coefficient on the provincial unemployment rate (URATP1) is consistently significant and positive as expected. This suggests that there is a greater possibility of losing jobs and experiencing layoffs in times of higher unemployment rates. Workers who resigned (QUIT1) to switch jobs are also expected to be less likely to leave new jobs since they are preferred to the previous job. The coefficient on QUIT1 is consistently negative but only significant for LOSE2 and LOSE4. The positive sign on QUIT2 (for reluctant workers) is understandable but the coefficients are mostly insignificant. The positive and significant sign on BNWKEI for LOSE4 is as expected since higher benefit week eligibility would cushion an employee against financial hardship during periods of subsequent unemployment, and the worker may well be increasing his insured weeks by taking on a short job so that he can re-establish a claim while still unemployed. The coefficients for this variable become negative and insignificant in the first three intervals.

If a worker has some desired long-run proportion of time he wishes to work which is less than one, then given
EMPIXB, the longer his previous employment spell, the more likely he is to choose a shorter job or quit, but for longer previous unemployment spells, the opposite behavior is expected. It can be noticed that the coefficient on the length of previous unemployment, PRUNEM, is negative and significant in all intervals, indicating a lower probability of losing a job for people who experienced longer unemployment spells previously. The length of previous employment, PREEMP, is found to be significant but with the expected sign in only the third and fourth intervals.

The regional dummy variables do not show a very noticeable pattern: in most cases they are insignificant and the coefficients change sign as well. This indicates that the regional effects do not significantly affect the job stability of former automobile workers. However, Windsor and London are exceptions which have positive and significant coefficients indicating a higher probability of job loss in these two areas.

In estimating the main components of income loss model, age appears to have a more important effect on the probability of finding and retaining a job. Wage differentials on the basis of sex is found to be significant and individuals with dependents seem to earn higher wages. The Unemployment benefit weeks remaining and the provincial unemployment have the expected adverse effects on the probability of finding and retaining jobs.
VI. ESTIMATION OF INCOME LOSS

A. Introduction

One of the major objectives of this analysis is to estimate the private and social costs of labour adjustment arising out of indefinite layoffs from the auto industry. A frequently encountered argument for protecting inefficient industries is to guarantee employment and income to workers who would otherwise have lost their jobs. However, such a protectionist policy brings about distortions in production and consumption which lead to a lower welfare level for the community as a whole. If the gains from trade liberalization (i.e., higher production efficiency and consumption possibility), are large enough, the community should, however, be willing to share the burden of adjustment. It may then be important to have a trade adjustment assistance program in order to assist displaced workers. The prerequisite for an adjustment policy to be operative, however, is to know the private and social costs of adjustment. The private costs represent the minimum amount by which the workers must be compensated in order to make them as well off as if no adjustment were required.

Trade liberalization is expected to produce shifts in productive resources between and within industrial activities. The domestic import competing sector may contract in terms of
production levels or changes in product mix within sectors may occur as well while the export sector is expected to expand. These changes in economic activity will bring about long run benefits to Canada through an improvement in the way the resources are employed. Yet the adjustment process will also involve short run costs for the whole economy. Hence, the government must also be concerned about allocative efficiency. To this end, the costs of protection may be compared with the social costs of adjustment. If the former exceeds the latter then it will be prudent for the government to promote trade liberalization. It may also be economically efficient to embark on reemployment promotion programmes instead of maintaining tariff protection. These considerations provide the motivation for the estimates of income loss presented in this section.

B. Worker Characteristics and the Duration of Unemployment and Employment Spells.

The coefficient estimates from the probit analysis can be used to predict the duration of unemployment and employment for a worker with a given set of characteristics. Table 6.1 reports the estimated duration of unemployment and employment for males and females in rows 1 and 2 and for an average worker with a given set of characteristics in the subsequent rows. These predictions indicate that the average duration of employment for females is higher than for males while the average duration of unemployment is slightly lower.
The model also shows the sensitivity of the duration of employment and unemployment to the previous employment history of a worker. It was found that a worker with a previous employment index of 90 percent enjoyed a higher duration of employment (36.5 weeks) while experiencing a shorter unemployment duration (12.2 weeks) than a worker with only a 25 percent employment index. This result is consistent with the general hypothesis that workers with a high previous employment history would be expected to suffer greater income losses after displacement which would induce them to find alternative jobs faster and retain them for a longer time.

An increase in the unemployment rate from 5 percent to 10 percent would increase the average duration of unemployment from 12.5 weeks to 15.5 weeks while reducing the duration of employment from 34.7 weeks to 20 weeks.

The last two rows in Table 6.1 show these predicted durations for two types of workers: those who resigned and those who lost their jobs for other reasons. The average duration of employment for the resignation cases was higher and the average spell of unemployment experienced shorter for these workers as compared to the non-resignation cases.

Table 6.2 provides the simulated duration of unemployment and employment for two broad categories of workers:


<table>
<thead>
<tr>
<th>Characteristics of Workers</th>
<th>Duration of Unemployment</th>
<th>Duration of Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>Male</td>
<td>13.37</td>
<td>3.85</td>
</tr>
<tr>
<td>Female</td>
<td>11.99</td>
<td>3.44</td>
</tr>
<tr>
<td><strong>Average Worker Experiencing:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment Index=.9</td>
<td>12.23</td>
<td>3.45</td>
</tr>
<tr>
<td>Employment Index=.25</td>
<td>17.53</td>
<td>8.54</td>
</tr>
<tr>
<td>Unemployment Rate= 5%</td>
<td>12.51</td>
<td>3.53</td>
</tr>
<tr>
<td>Unemployment Rate= 10%</td>
<td>15.54</td>
<td>6.79</td>
</tr>
<tr>
<td>Resignation = 1</td>
<td>11.39</td>
<td>3.00</td>
</tr>
<tr>
<td>Resignation = 0</td>
<td>13.93</td>
<td>4.21</td>
</tr>
</tbody>
</table>
workers having AGE = 30 years, Skill = .5 years, unemployment rate = 5 percent, UI benefit week eligibility = 15 weeks; and workers with Age = 50 years, skill = 2 years, unemployment rate = 5 percent, UI benefit week eligibility = 15 weeks. These two broad categories are again grouped into: 1) male with a dependent earning above the maximum insured earning limit; 2) male with no dependent earning below the maximum insured earning limit; 3) female with a dependent earning above the maximum insured earning limit; and 4) female with no dependent earning below the insured earning limit.

The simulated values of the duration of unemployment indicate that both males and females with a dependent and earning above the maximum insurable limit (DEP = 1, MAX = 1) experienced a shorter duration of unemployment than those with no dependent and with earnings below the above limit (DEP = 0, MAX = 0). It was also found that females with dependents and earnings exceeding MAX enjoyed the longest duration of employment while males with no dependents and MAX = 0 experienced the shortest spells of employment. Again, females with no dependents and MAX = 0 experienced the longest durations of unemployment while males with dependents and MAX = 1 enjoyed the shortest.
\[
\begin{array}{cccccccc}
\text{Type of Worker} & \text{Unemployment (Weeks)} & \text{Duration of Employment (Weeks)} & \text{Unemployment (Weeks)} & \text{Duration of Employment (Weeks)} \\
\hline
1. \text{Male, Max}=1, \text{Dependent}=1 & 11.32 & 3.43 & 33.77 & 21.95 & 9.91 & 3.03 & 26.26 & 19.55 \\
2. \text{Male, Max}=0, \text{Dependent}=0 & 14.73 & 4.64 & 28.23 & 18.22 & 13.24 & 3.55 & 22.10 & 16.22 \\
3. \text{Female, Max}=1, \text{Dependent}=1 & 11.79 & 3.11 & 42.01 & 28.17 & 10.25 & 2.80 & 32.86 & 21.96 \\
4. \text{Female, Max}=0, \text{Dependent}=0 & 15.65 & 3.68 & 34.78 & 19.94 & 13.97 & 3.21 & 26.67 & 16.74 \\
\end{array}
\]

* 1. Mean
  2. Median
C. Worker Characteristics and the Private Costs of Adjustment

The theoretical income loss models which we described in Section IV have been applied to the workers in our sample in order to estimate the private and social costs of adjustment for different workers’ characteristics and different values for the prime age male unemployment rate. The other independent variables were set at their means for males of 30 and 50 years of age, females of 30 and 50 years of age.

Using the above set of values for the independent variables, main components ($P^b, P^a, W^b, W^a$) of the income loss model were estimated and their values were then substituted into equations (8) and (9) and the results were again substituted in equation (10) to solve for the present value of private income loss.

Table 6.3 provides a summary of the private income loss of the former auto workers. The magnitude of loss depends on both the percentage change in the proportion of time employed and the percentage change in wage rates. In general, younger workers suffer a smaller decline in the proportion of time at work than older workers. This result arises because the seniority rule applies quite rigidly in the automobile industry guaranteeing more stable jobs for senior workers. Given this provision, the senior workers would be expected to lose more in terms of the proportion of time employed after indefinite layoff.
It is also evident that the workers with dependents and earnings exceeding MAX1 suffered a smaller decline in the proportion of time employed. Females in general experienced a smaller decline in the proportion of time employed than males because females enjoyed a relatively longer duration of employment and shorter unemployment spells in the non-auto sectors. While younger workers enjoyed wage gains, the younger males with dependents and MAX = 1 enjoyed the highest percentage increase in wages. Older workers suffer wage losses probably because of the loss of firm specific skill payments and the additional rents they enjoyed because of strong seniority provisions. Males and females with no dependents and MAX = 0 experience the largest wage losses. The present values of income losses were estimated by combining these two effects. It was found that both age and sex played an important role in determining the magnitude of the income loss.

In general, older workers suffered a positive income loss, while the younger workers enjoyed income gains after permanent displacement from the automobile industry. Both the reduction in the proportion of time employed and wage losses generated higher income losses for older workers while for the younger workers, the reduction in the proportion of time employed was offset by wage gains that created net gains in private incomes for these workers.
Across sex categories, males with dependents and MAX = 1, suffered approximately a 29 percent higher income loss than their female counterparts, while males with no dependents and MAX = 0, experienced about a 27 percent higher loss than females. Among the older workers, males and females seem to suffer quite similar reductions in the proportion of time employed in each category, but the loss in terms of wage rates are greater for females than for males. The sensitivity of dependent status and maximum insured earning indicator on wage rates seems to outweigh the negative age effects. The evidence suggests that while males of 50 years of age with dependents and MAX = 1 enjoyed a wage gain of 1.9 percent, the males in the same age category with no dependents and earning below the maximum insured earning suffered a loss of about 16.3 percent of previous wage earnings.

Another indicator of the hardship experienced by the displaced workers is the relative income loss which is expressed as the ratio of cumulative present value of absolute loss in income to the full income that could have been earned if the worker continued to work in the previous job. This proportion is expected to decline as the time since permanent separation from the automobile industry increases. Before indefinite layoffs from their previous jobs, workers receive the net-of-income-tax wage rate when employed, net-of-income-tax unemployment insurance payments plus the value of leisure if they are unemployed for part of the year. The sum of the above
<table>
<thead>
<tr>
<th>Type of Workers</th>
<th>Change in Proport. of Time Employed^a %</th>
<th>Change in Wage Rate^b %</th>
<th>Relative Income Losses Within^c 1 yr. 2 yr. 3 yr. 4 yr. 5 yr.</th>
<th>Losses Within 5 yrs. (1979$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age = 30, Skill = .5, URATP = 5, BNMKEL = 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Male, MAX1 = 0, Dependent=0</td>
<td>-15.80</td>
<td>3.66</td>
<td>2.07 .65 .14 -.12 -.27</td>
<td>-155^e</td>
</tr>
<tr>
<td>3. Female, MAX1 = 1, Dependent=1</td>
<td>.4</td>
<td>18.31</td>
<td>-13.98 -15.91 -16.49 -16.78 -16.95</td>
<td>-6053</td>
</tr>
<tr>
<td>4. Female MAX1 = 0, Dependent=0</td>
<td>-3.3</td>
<td>-3.04</td>
<td>6.43 4.77 4.24 3.97 3.82</td>
<td>1342</td>
</tr>
<tr>
<td>Age = 50, Skill = 2, URATP = 5, BNMKEL = 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Male, MAX1 = 1, Dependent=1</td>
<td>-29.43</td>
<td>1.90</td>
<td>8.96 8.19 7.90 7.75 7.66</td>
<td>5664</td>
</tr>
</tbody>
</table>
### Table 6.3 Cont'd

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MAXI = 1</td>
<td>Dependent = 1</td>
<td>-20.62</td>
<td>-4.40</td>
<td>10.51</td>
<td>9.58</td>
<td>9.26</td>
<td>9.10</td>
<td>9.01</td>
<td>4074</td>
</tr>
<tr>
<td>8. Female</td>
<td>MAXI = 0</td>
<td>Dependent = 0</td>
<td>-26.43</td>
<td>-21.65</td>
<td>26.34</td>
<td>25.72</td>
<td>25.50</td>
<td>25.38</td>
<td>25.31</td>
<td>11168</td>
</tr>
</tbody>
</table>

(a) $\Delta P = (P^a - P^b) / P^b\times 100$
(b) $\Delta W = (W^a - W^b) / W^b \times 100$
(c) This is derived by dividing the cumulative present value of absolute loss in income by the full income that could have been earned if the employment conditions before permanent layoffs were maintained.
(d) The positive effect because of wage gains in the non-auto sector outweighs the negative effect due to the lower proportion of time employed. Workers experienced negative income loss starting in the first year of reemployment.
(e) It took about 14 weeks to reach the maximum income loss. After this time this group of workers started to experience a net gain in income.
components of earnings may be referred to as the workers' full income before layoffs.

When workers are laid off, they are expected to experience an additional amount of unemployed time during the transitional period. Therefore, the relative amount of time spent in employment and unemployment will change leading to a change in full income as well. Through time the proportion of those individuals initially laid off who become employed increases while the proportion of those still unemployed decreases. These proportions are, therefore, a function of time and the changes in them will depend upon the characteristics of workers and other economic factors. For those who find permanent work quickly, their alternative wage net-of-income-tax will determine their private income which may be higher or lower than their pre-layoff income. Our empirical results show that the relative income losses remain fairly high over time for older workers and for workers with no dependents and MAX = 0.

D. Measurement of Social Cost of Adjustment

The social cost of adjustment can be measured by taking the difference between the social value of product (SVP) before layoff and social opportunity cost of labor (SOCL) after
layoff. The first measures the social value of labours' output if their existing jobs were to continue, whereas the second measures what they would be if a layoff takes place. The expected difference in SVP and SOCL is based on a statistical analysis of the determinants of the proportion of the time employed and the wages workers earn both before and after separation from a job. The main determinants of income loss model have been estimated and their values are substituted in equations (11) and (12) in Section IV. The results are again substituted in equation (13) to estimate the social cost of adjustment.

The opportunity cost of any demand imposed on an economy is the value to society of what it foregoes in satisfying the demand. For example, the social cost of producing good X is represented by the alternative output which the resources devoted to X-production would have produced elsewhere. In a competitive and fully employed economy, the price of labor - the wage rate - will equate the minimum monetary inducement necessary to bring forth the marginal unit of labor with its marginal value product. Hence, the social cost of a diverted marginal unit of labor is measured by its market price. 71/

As we move from a fully employed economy to one in which there are underutilized resources, the market price of diverted resources will no longer equal their opportunity cost.
Market prices will provide an overestimate of the social value of the output foregone when resources are diverted. In the extreme situation of very high and consistent unemployment, society need forego no alternative output except the value of non-market time.

The social cost of adjustment depends upon the difference between social value of product prior to layoff (SVP) and the social value of product that could have been produced (SOCL) by the displaced workers in alternative employment if not retained in the declining industry by some means.

The divergence between SVP and SOCL will act through changes in $P^b$, $P^a_t$, $W^b$ and $W^a$. For example, if $P^a_t$ is very high, then the social cost of adjustment will be low given the assumption that $W^b = W^a$. On the other hand, if $P^a_t$ is very low and in the extreme case when $P^a_t = 0$, the social cost of adjustment will be at a maximum.

From the preceding discussion, it is clear that the social costs of adjustment are measured in terms of the economic externalities involved when factors of production are displaced. The value of the economic externality generated by displacing workers is measured as the difference between social value of the output with and without the loss of the job opportunity. The social value of the output of labour (SVP) is the dollar value of all employed and unemployed time of
labour. If a layoff occurs, the SVP in these jobs is lost, but at the same time, changes take place in the amounts of time labour spends employed and unemployed in response to this shock. The social value of this changed labor activity is the SOCL of retaining these workers in these jobs by some means. If workers are not retained in these jobs the economy is worse off in the amount of the difference between SVP and SOCL.

As we have noted in our discussion, SOCL depends on the probability of alternative employment at different points in time and the alternative wage rate. In times of high economic growth and low unemployment and when the characteristics of the labor force are conducive to the possibility of rapid reemployment, this externality should not be a serious problem.

As the time since layoff increases, the probability of workers' being at work also increases, therefore the labor externality decreases. This is shown in the diagram below:

**Figure 6.1**

**Social Cost of Adjustment**

![Social Cost of Adjustment](image-url)
The shaded area illustrates the labor externality. The present value of this shaded area represents the maximum amount the government can pay to retain these jobs if allocative efficiency is its goal.

We have talked about the SOCL and the resulting externality in terms of a partial equilibrium model, i.e., SOCL is based on the unemployment/employment experience of only the workers directly affected by the decline in employment. The general equilibrium model incorporates a second externality (i.e., the bumping effect) that the laid off workers will inflict on the already unemployed in the economy. We expect that the laid off workers would compete with other members of the labor force and thus increase the duration of unemployment of other people. The higher the substitutability between the newly laid off workers and other unemployed persons in the region, the higher will be the bumping effect. The bumping effect will most likely be minimal in the following circumstances:

- If the laid off workers consist of mainly skilled and professional people.
- The age character is such that the majority of the laid off workers belong to older age groups. The assumption is that these people are poor substitutes for the already unemployed and their training and skills are specific to certain jobs.
Table 6.4 presents the social cost of labour adjustment (i.e., the labour externality) of workers with different personal and labour market characteristics. While the value of the lost output to society remains fairly high for all workers, the older workers with no dependents and $MAX = 0$ impose the largest loss to society in terms of foregone output. However, younger workers having dependents and earning above the insured limit in effect experienced net gains in the social value of incomes. Younger males enjoyed about 40 percent larger gains than younger females.

One clearly important result emerges from these income loss estimates. The high income losses among the older workers stem mainly from the large drop in wages. For the older workers in this sample, the loss in union and experience related rents is the likely source of this loss as these workers separated from the industry during the 1974–79 period.

Under the current situation of considerable job contraction in the industry, workers may well be willing to take a cut in wages to save their jobs: evidence, the cut in real wages recently taken by Chrysler and Ford workers. This would
Table 6.4

Social Income Losses From Layoff of Auto Workers

<table>
<thead>
<tr>
<th>Type of Workers</th>
<th>Max. Income Loss within 5 yrs.</th>
<th>Relative Income Loss Within 1 yr.</th>
<th>2 yr.</th>
<th>3 yr.</th>
<th>4 yr.</th>
<th>5 yr.</th>
<th>(1979$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Male, MAX=1, DEP=1</td>
<td>12.61</td>
<td>10.81</td>
<td>10.18</td>
<td>9.87</td>
<td>9.68</td>
<td>4980</td>
<td></td>
</tr>
<tr>
<td>3. Female, MAX=1, DEP=1</td>
<td>14.23</td>
<td>10.91</td>
<td>9.93</td>
<td>9.45</td>
<td>9.16</td>
<td>2665</td>
<td></td>
</tr>
<tr>
<td>4. Female, MAX=0, DEP=0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. AGE = 50 yrs, skill 2 yr, URATP = 5% BNMKL = 15</td>
<td></td>
<td>20.80</td>
<td>20.19</td>
<td>19.94</td>
<td>19.81</td>
<td>19.73</td>
<td>14396</td>
</tr>
<tr>
<td>1. Male, MAX=1, DEP=1</td>
<td>38.87</td>
<td>37.82</td>
<td>37.40</td>
<td>37.19</td>
<td>37.06</td>
<td>26039</td>
<td></td>
</tr>
<tr>
<td>2. Male, MAX=0, DEP=0</td>
<td>20.58</td>
<td>19.55</td>
<td>19.06</td>
<td>18.81</td>
<td>18.67</td>
<td>7697</td>
<td></td>
</tr>
<tr>
<td>3. Female, MAX=1, DEP=1</td>
<td>40.31</td>
<td>38.22</td>
<td>37.47</td>
<td>37.09</td>
<td>36.86</td>
<td>14649</td>
<td></td>
</tr>
</tbody>
</table>
indicate that a layoff would probably generate $W^a$ much closer to $W^b$, and hence, a much lower income loss compared to the income loss that has been estimated here.

E. Private Versus Social Adjustment Costs

The costs of adjustment are perceived differently by various groups: workers, firms and the government. Workers are primarily concerned with the loss of their incomes when they are laid off by declining firms. On purely distributional grounds, workers may demand income compensation and are likely to form a pressure group to maintain protection. The owners of capital may be concerned about the decrease in the value of their equity. If the government is mainly concerned about the efficient allocation of resources, the appropriate policy would be to remove protection if the cost of protection exceeds the gains from trade liberalization.

The private costs of adjustment of the displaced workers are measured by taking the difference between the present value of full income that the workers could earn if their present employment continued and their incomes in alternative jobs. Full income is measured on the basis of the after-tax-wage received during employment and after-tax unemployment insurance receipts plus the value of leisure.
These two components of income (i.e., income during employment and unemployment) must be weighted by the proportion of time spent in each state in the labour market: employed and unemployed. The after-separation income also depends upon the alternative wage as well as the probability of finding and losing jobs. These probabilities themselves are functions of time and depend on many micro and macro-economic variables. The expected change in private full income will measure the private costs of adjustment as indicated by equation (10) in section IV.

The social costs of adjustment are measured by taking the difference between the present social value of labour output with and without layoffs. The social value of workers’ output may be defined as the social value of their employed and unemployed time. The social value of unemployed time is simply the value of leisure. If the worker is permanently employed, the social value of labour output is denoted by the wage bill that the workers receive. When the workers lose their job, the social value of workers’ output is reduced by the extent of the change in the wage bill. However, this reduction in the wage bill is partially offset by additional earnings in alternative jobs and increased leisure time. This latter income is also called the social opportunity cost of labour if the displaced workers are retained in their present employment. The social
costs of adjustment can be calculated by taking the difference between these two income streams as measured by equation (13) in section IV.

The social value of workers' income will differ from the private valuation for the following reasons:

(1) The social value of workers' time consists of the gross-of-tax wage rate while the private valuation is measured in terms of the net-of-tax wage rate.

(2) Unemployment insurance payments do not form a part of the social value of workers' output because they are simply transfers.

F. Social Costs of Adjustment Under Different Macro-economic Scenarios

One interesting exercise is to examine the costs of labour adjustment under different macro-economic scenarios. The labour externality under different employment scenarios can be estimated by using the income loss model. However, the various employment scenarios themselves call for appropriate adjustments that should be made on the main determinants of the above model, mainly previous and after layoff wages \((w^b, w^a)\), the
proportion of time employed prior to layoff \((P^b)\) and the workers' probability of finding and retaining alternative jobs \((P^a)\). The following three employment scenarios are used in the following paragraphs to estimate the labour externality:

1. The observed decline in automotive employment in 1981 from the 1979 level (about a 25 percent employment reduction). In such a situation of a large scale slowdown in the auto industry, all kinds of workers would be affected (i.e., young or old, males or females, skilled or unskilled, etc.). The workers under this massive layoff may be relatively older and more senior workers who may be expected to possess more marketable qualities (i.e., in terms of experience, skill and needs) than the average worker among the adjustment cases. These workers are then expected to have spent a higher proportion of time in their previous jobs before layoffs. However, the auto industry experienced a general downturn during the 1979-81 period which may have been translated into a lower proportion of time employed by an average worker. Again, the more marketable qualities of the laid off workers may help them to find alternative jobs faster but this higher rate of reemployment will be partially offset by an over-supply of unemployed auto workers in the marketplace. During the recession years since 1980, there has been a general tendency on the part of workers to accept cuts in wages in order to keep steady employment. Under these wage concessions, workers' pre-layoff wages \((W^b)\) would be closer to their post layoff wages \((W^a)\).
It may be mentioned here that we are only referring to the direct job losses in the automobile industry. The indirect job losses would also occur in the supplier industries because of reduced spending by both the auto workers and the unemployed auto workers. Here we attempt to estimate the social value of income losses in a partial equilibrium sense in terms of direct job losses alone.

(2) The McDonald study predicts that the employment level in the Canadian automobile industry could conceivably drop to 50-55,000 by 1990. Although this may be overly pessimistic, this gives us an important hint that the auto industry needs a major structural change in order to be competitive and more efficient through the 80’s. At this point it should be mentioned that the McDonald approach to the calculation of the potential number of job losses is static in nature. It ignores the basic fact that the North American producers are gradually restructuring their production processes and producing more smaller and fuel efficient cars in order to cater to the needs of consumers. It also ignores the resurgence of the North American industry which might occur if the world price of oil remains constant. Under these changed economic conditions, the North American car makers may be able to recapture part of the import market.
The recent study by Ross Perry\textsuperscript{73} about the future of Canada's auto industry portrays another dismal picture. The study indicates that the automotive industry in Canada may not enjoy the cost advantages of their counterparts in Japan because of many institutional rigidities and changes in corporate strategies to divert some planned investment expenditures from Canada. The study focuses on the point that the Japanese auto industry has achieved cost advantages on such a scale that the use of traditional instruments to protect the domestic industry is virtually ineffective. Any unilateral imposition of non-tariff barriers would invite retaliation from Japan. Furthermore, there is gradual integration of production facilities between the U.S. and Japanese producers accompanied by cut backs of certain planned expenditures in Canada by corporate headquarters in the U.S.A. If oil prices in Canada continue to rise to the world price level then consumers will also switch to fuel and cost efficient foreign made cars. Finally, Japanese producers are moving gradually to automation and computerization. This is unlikely to occur in Canada within the foreseeable future. All these factors indicate a further downturn in automobile production and employment (about a 60 percent cut in employment). The above study is based on the assumptions that the world fuel prices will continue to rise in the years ahead. However, there is some indication in recent months that world oil prices may have stopped increasing which may bring about higher demand for larger North American type
vehicles. Furthermore, a process of automation and joint Canadian-Japanese ventures are already underway which may partially revitalize the industry.

Table 6.5 presents the social value of income losses for the adjustment cases in our sample. The adjustment cases experienced a larger decline in the proportion of time spent employed after layoffs than changes in relative wages. This result is as expected since the adjustment cases primarily represent the younger, inexperienced workers who do not enjoy seniority and union rents in the automobile industry. Furthermore, the adjustment cases spent a fairly good proportion of time working (76 percent) which may be the result of short unemployment spells. The value of the lost output to society for an average adjustment case remains at $3,289 which should be multiplied by the total number of cases in order to obtain the total value of lost output for all workers. It is not possible to estimate the total value of lost output unless one knows for sure the number of individuals who experienced indefinite layoffs from the automobile industry during 1974-79 (our sample of adjustment cases consists of only 295 individuals). However, it is possible to project the total labour externality under various employment scenarios. The following section presents projection of the labour externality under the three macro-economic scenarios as discussed in the previous paragraphs.
Table 6.5
Social Income Losses from Layoff of Auto Workers
(Adjustment Cases)

<table>
<thead>
<tr>
<th>Proportion of time employed before layoffs ($P^b$)</th>
<th>Proportion of time employed after layoffs ($P^a$)</th>
<th>Change in proportion ($\Delta P(x)$)</th>
<th>Previous Wage ($W^b$)</th>
<th>Alternative Wage ($W^a$)</th>
<th>Change in Wage ($\Delta W(x)$)</th>
<th>Maximum Income Losses within 5 years (1979$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.76</td>
<td>0.66</td>
<td>-13</td>
<td>237</td>
<td>232</td>
<td>-2</td>
<td>$N \sum_{t=1}^{\infty} \frac{(I_{SVLO} - I_{SVLO})}{(1+d)^t}$</td>
</tr>
</tbody>
</table>

$\Sigma$ 3,289
Table 6.6 presents the present value of social income losses for all types of workers in the case of a 25 percent employment cut. Row details in the above table present various determinants of the income loss model under alternative assumptions. The proportion of time employed that an average worker spent during 1974-79 was found to be .80. The average proportion of time spent employed during massive layoffs (25 percent cuts) would be close to that of all workers. However, the period between 1979-81 records a general downward movement of employment in the automobile industry and hence, .75 and .78 are respectively used to measure the average proportion of time employed before layoff ($p^b$). Since the above period is characterized by a general recession in the economy and massive layoffs in the automobile industry in particular, the interval probabilities of finding and losing jobs are adjusted accordingly: probabilities of finding are revised downward and losing upward by 5 percent. First, it is assumed that only the production workers will be affected by this kind of layoff, hence, the average wage of the production workers are used as a proxy for $W^b$ (i.e., §331). Secondly, if all workers are assumed to be affected by massive layoffs, then the average earnings of all employees in the automobile industry should be taken to measure pre-layoff wages (i.e., §356).

The next question arises about $W^b$, the post layoff wages. In the absence of any available data, it is difficult to know for certain what would be the alternative wage for these
Table 6.6

Social Income Losses under First Employment Scenario (25 percent Cut in Employment)

<table>
<thead>
<tr>
<th>p^b</th>
<th>p^a</th>
<th>ΔP(%)</th>
<th>w^b</th>
<th>w^a</th>
<th>ΔW(%)</th>
<th>N t=1^T 1^B (1-SVLO)^-1^d SVLO/(1+d)^T</th>
<th>Absolute Income Losses for all Workers (Million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.75</td>
<td>.64</td>
<td>-14.6</td>
<td>331^a</td>
<td>.255^b</td>
<td>-22.9</td>
<td>16,800</td>
<td>360.9</td>
</tr>
<tr>
<td>.75</td>
<td>.64</td>
<td>-14.6</td>
<td>331</td>
<td>.278^c</td>
<td>-16.0</td>
<td>12,700</td>
<td>276.1</td>
</tr>
<tr>
<td>.75</td>
<td>.64</td>
<td>-14.6</td>
<td>331</td>
<td>.302^d</td>
<td>-8.7</td>
<td>8,719</td>
<td>189.6</td>
</tr>
<tr>
<td>.78</td>
<td>.64</td>
<td>-17.9</td>
<td>356^e</td>
<td>.255</td>
<td>-28.3</td>
<td>22,433</td>
<td>650.6</td>
</tr>
<tr>
<td>.78</td>
<td>.64</td>
<td>-17.9</td>
<td>356</td>
<td>.278</td>
<td>-21.9</td>
<td>18,532</td>
<td>537.4</td>
</tr>
<tr>
<td>.78</td>
<td>.64</td>
<td>-17.9</td>
<td>356</td>
<td>.302</td>
<td>-15.1</td>
<td>14,551</td>
<td>421.9</td>
</tr>
</tbody>
</table>

a. Average auto wages for production workers (1979$)
b. W^a for the adjustment cases increased by 10 percent
c. W^a for the adjustment cases increased by 20 percent
d. W^a for the adjustment cases increased by 30 percent
e. Average auto wages for all employees (1979$)
f. Probabilities of finding reduced by 5 percent and losing increased by 5 percent compared to adjustment cases.
workers. One can assume that these workers are more likely to receive an alternative wage more closely related to their earnings in the automobile industry.

For the purpose of estimating the labour externality, the alternative wages ($W^a$) for the adjustment cases are increased by 10, 20 and 30 percent respectively.

The second last column in Table 6.6 measures the social value of income losses on a per worker basis under the different earnings and proportion of time employed scenarios. The last column in the above table measures the total labour externality for all laid off workers. The first three rows measure the income losses for all production workers while the last three rows measure the income loss for all employees. For example, the actual decline in production employment in 1981 from the 1979 level was 21,740 workers. If we assume a 30 percent increase in $W^a$, then the social value of income losses of production workers would be equal to $189.6$ million. However, this underestimates the total social income losses since it ignores the income losses contributed by other employees. In 1981, the total employment level was found to be 88,200 as compared to 117,200 in 1979, a drop in employment of 29,000. This multiplied by the social value of income loss on a per worker basis gives a labour externality equal to $421.9$ million.
### Table 6.7

Social Income Losses under Second Employment Scenario (50 percent Cut in Employment)

<table>
<thead>
<tr>
<th>pb</th>
<th>pa</th>
<th>ΔP(%)</th>
<th>Wb</th>
<th>Wa</th>
<th>ΔW(%)</th>
<th>(N)</th>
<th>Absolute Income Losses for all Workers (Million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.70</td>
<td>.61</td>
<td>-12.8</td>
<td>356</td>
<td>316</td>
<td>-11.2</td>
<td>9,797</td>
<td>574.1</td>
</tr>
<tr>
<td>.70</td>
<td>.61</td>
<td>-12.8</td>
<td>356</td>
<td>330</td>
<td>-7.3</td>
<td>7,530</td>
<td>441.3</td>
</tr>
<tr>
<td>.70</td>
<td>.61</td>
<td>-12.8</td>
<td>356</td>
<td>284</td>
<td>-20.2</td>
<td>15,036</td>
<td>881.1</td>
</tr>
<tr>
<td>.70</td>
<td>.61</td>
<td>-12.8</td>
<td>356</td>
<td>297</td>
<td>-16.5</td>
<td>12,925</td>
<td>757.4</td>
</tr>
</tbody>
</table>

---

a. Probabilities of finding adjusted downward by 10 percent and losing adjusted upward by 10 percent.
b. Weighted average of production workers' earnings in associated industries: primary metal and metal fabrication, machinery, aircraft, shipbuilding and electrical industries.
c. Weighted average of all workers' earnings in the associated industries.
d. 10 percent reduction in earnings from b and c level.
e. 50 percent of 1979 employment level.
Table 6.7 presents the social value of income losses under the second employment scenario, i.e., a 50 percent cut in employment. This table presents similar information to that of Table 6.6 with the following exceptions and additions:

(1) Both $P^b$ and $P^a$ have been adjusted downwards. A massive layoff like this would result in a gradual reduction in employment time and larger difficulties in obtaining alternative jobs in non-auto sectors. Both of these factors would have a depressing effect on $P^b$ and $P^a$.

(2) It is assumed that all types of workers would be affected in this massive layoff. We, therefore, only used the earnings of all workers in the industry as an indicator of $W^b$ (i.e., $356$).

(3) A weighted average of production workers' earnings in associated industries are used as proxy for $W^a$. The weights are the proportion of employment in the following industries: primary metals, metal fabrication, machinery, aircraft, shipbuilding and electrical industries. First we use the earnings of production workers as well as for all employees in these industries (i.e., $316$ and $330$ respectively). However, because of a lack of experience on new jobs and a general recession in the economy, the workers laid off from the auto industry may not receive compensation equal to that existing in the associated
trades. Hence, the above two earning figures are reduced 10 percent each (i.e., to $284 and $297 respectively). The second last column in Table 6.7 measures the income losses on a per worker basis while the last column is derived by multiplying this income loss by the total number of potential layoff cases (i.e., 58,600 individuals).

Table 6.8 shows the social value of workers' income losses under more drastic employment cuts (i.e., a 60 percent cut in employment). The column details in this table are quite similar to that of the previous ones except for the following differences: the income loss on a per worker basis is estimated by using the earnings level in each individual industry as a measure of \( W \). However, this earnings level corresponding to each industry is reduced by 10 percent before the final calculation is made of the labour externality. This is a realistic approach to approximate \( W \) since workers laid off from the auto industry may be very well willing to reduce their reservation wages. The last item in the last column (i.e., $882.5 million) represents the social value of income losses and is derived by adding all individual items in that column. Out of a total of 70,320 individuals affected under the third macro-economic scenario, about 25 percent of these individuals (i.e., 17,580 individuals) are assumed to be absorbed in the primary metals industry accounting for an income loss of about $135.1 million. Primary metals provide employment to 25 percent
Table 6.8  
Social Income Losses under Third Employment Scenario (60 percent cut in Employment)

<table>
<thead>
<tr>
<th>pb</th>
<th>pa</th>
<th>ΔP(%)</th>
<th>wb</th>
<th>wa</th>
<th>ΔW(%)</th>
<th>( \frac{\sum (I_{SVLO}^b - I_{SVLO}^a)}{(1+d)^t} )</th>
<th>( N )</th>
<th>Absolute Income Losses for all Workers (Million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.70</td>
<td>.61</td>
<td>-12.8</td>
<td>356</td>
<td>329</td>
<td>-7.5</td>
<td>7,686</td>
<td>135.1</td>
<td></td>
</tr>
<tr>
<td>.70</td>
<td>.61</td>
<td>-12.8</td>
<td>356</td>
<td>384</td>
<td>-20.2</td>
<td>15,036</td>
<td>285.5</td>
<td></td>
</tr>
<tr>
<td>.70</td>
<td>.61</td>
<td>-12.8</td>
<td>356</td>
<td>297</td>
<td>-16.5</td>
<td>12,923</td>
<td>136.3</td>
<td></td>
</tr>
<tr>
<td>.70</td>
<td>.61</td>
<td>-12.8</td>
<td>356</td>
<td>302</td>
<td>-15.1</td>
<td>12,065</td>
<td>50.9</td>
<td></td>
</tr>
<tr>
<td>.70</td>
<td>.61</td>
<td>-12.8</td>
<td>356</td>
<td>324</td>
<td>-8.9</td>
<td>8,468</td>
<td>23.8</td>
<td></td>
</tr>
<tr>
<td>.70</td>
<td>.61</td>
<td>-12.8</td>
<td>356</td>
<td>272</td>
<td>-23.5</td>
<td>16,991</td>
<td>280.9/882.5</td>
<td></td>
</tr>
</tbody>
</table>

a. Earnings in the primary metal industry reduced by 10 percent  
b. Earnings in the metal fabrication industry reduced by 10 percent  
c. Earnings in the machinery industry reduced by 10 percent  
d. Earnings in the aircraft industry reduced by 10 percent  
e. Earnings in the ship-building industry reduced by 10 percent  
f. Earnings in the electrical products industry reduced by 10 percent
Table 6.8 cont'd

g. Absolute income losses for all workers

\[ W_1 \cdot E \cdot IL_1 + \ldots + W_6 \cdot E \cdot IL_6 \]

\[ = 0.25 \times 70,320 \times 7,686 + 0.27 \times 70,320 \times 15,036 + 0.15 \times 70,320 \times 12,923 \]
\[ + 0.06 \times 70,320 \times 12,065 + 0.04 \times 70,320 \times 8,468 + 0.21 \times 70,320 \times 16,991 \]
\[ = (135.1 + 285.5 + 136.3 + 50.9 + 23.8 + 250.9) \text{ millions} \]
\[ = \$882.5 \text{ million.} \]

Where \( W_1, W_2, W_3, W_4, W_5, W_6 \) are the appropriate weights: share of each industry's
employment to total employment in all six industries listed above.

\( E \) - projected decline in employment (60 percent cut in employment from 1979 level
\[ = 70,320 \text{ jobs} \]

\( IL_1 \ldots IL_6 \) - maximum income losses in each category listed above.
of all associated industries' workers. For detailed information on this column, see footnote 'g'.

The above analysis indicates the potential labour adjustment problems, particularly in Southern Ontario arising out of projected employment reductions in the automotive industry during the early 1980s. The dimensions of the labour adjustment problem become greater if we consider the effect of such a downturn in a major industry on other supplier industries. These ripple effects, considered in a general equilibrium context, would further add to the labour adjustment costs estimated in the previous tables. The national input–output model of the structure of the Canadian economy as of 1977 indicates that the Canadian automobile industry has an employment multiplier of 1.874. It means that a job loss in the auto industry will be accompanied by almost another job loss in other sectors of the national economy. Under the extreme assumption that SOCL is equal only to the value of non-market time. This high multiplier effect would also be expected to increase the ripple effects which may in turn increase the economic costs of labour adjustment.

In evaluating the social costs of labour adjustment in Tables 6.7 and 6.8, we have implicitly assumed that other associated industries would be able to absorb the laid off workers from the automobile industry. However, some of these industries are already experiencing declining demand because of
the recession and competitive pressures from abroad which may impair their ability to employ the laid off auto workers. As we have indicated earlier, the labour adjustment problem becomes more severe when the laid off workers are concentrated in a particular geographical region. Most auto jobs are found in Ontario, particularly in southern Ontario. In this recession/slow-growth economic situation, the Ontario economy may not be in a position to absorb all displaced auto workers within a short span of time. The rate of absorption depends upon the future employment growth in Ontario. The Task Force on Labour Market Development estimates that employment growth in Ontario will range between 1.4 and 2.0 percent during 1981-85 compared to 3.1 percent during 1972-79.

We have discussed three different employment scenarios and their associated labour adjustment costs. The scenario which deals with the actual decline in auto employment and the labour adjustment cost that it inflicts on society, is the most likely. Under this large layoff when all workers are expected to be affected, displaced workers may possess more marketable characteristics than the general adjustment cases in our sample. Furthermore, UAW representatives have given wage concessions to the auto producers during 1979-82. Both these effects would produce \( W_a \) closer to \( W_b \). It is reasonable to expect that under this general layoff, workers would be receiving higher \( W_a \) than the general adjustment cases.
Table 6.6 presents the social value of labour income losses under the first employment scenario: the range of these estimates is from a low of $190 million to a high of $422 million over five year periods. These different figures for income losses are based upon the estimates for the adjustment cases in which a variety of other adjustments in the main components of income loss have been made. In a massive layoff, it is reasonable to expect that workers previous earnings were close to average automobile earnings and their after layoff wages would be higher than $W$ for the adjustment cases. In the absence of any hard evidence regarding alternative wage rates, the last row in Table 6.6 assumes a 30 percent higher $W$ for these workers than for the adjustment cases. Under this more realistic assumption, the value of the losses to the economy would be approximately equal to $421.9 million. Given the downturn in automobile employment and having measured the social costs of labour adjustment, we now investigate how these costs might be avoided. Our investigation concentrates mainly on various government policies that could affect the speed of layoffs as well as the rate at which the laid off workers are reemployed. The following section presents a brief summary of the study and government policy options in the presence of the labour externality estimated in this thesis.
VII. SUMMARY AND POLICY IMPLICATIONS

A. SUMMARY

Estimation of Labour Adjustment Costs

This thesis has been aimed at the estimation of the labour adjustment costs for permanently laid off automobile workers (i.e. adjustment cases) and, on the basis of these estimates, the projection of the potential labour adjustment problems under more severe layoffs like those experienced during 1979-1981. Given that only part of the present downturn is included in our sample, the estimates presented in this study are perhaps more representative of historical cyclical changes rather than of the major restructuring which is currently underway. Therefore, our estimates of the probability of being reemployed may be biased upward.

Based on the observed characteristics of the adjustment cases, or workers permanently separated from the industry, it is clear that these workers are younger, less likely to have dependents, less senior, less skilled and earning lower wages than the workers that remained in the industry. It is expected therefore, that these adjustment cases will represent the worst possible situation with respect to reemployment rates and may generate higher estimates in
relative income losses compared to what would be expected in situations of complete plant shutdowns where all workers are permanently separated. At the same time, because the adjustment cases are younger and less skilled they will not suffer a large loss in terms of seniority and firm specific rents. This indicates that their alternative wage rates, \( W_a \), will be closer to their prior wage rates, \( W_b \). This underestimation of wage loss will produce a lower estimate in relative income losses compared to the losses resulting from large scale layoffs in the automobile industry during 1979–81.

When estimating the income losses, workers having dependents and earnings above the maximum insured earning limit (MAX = 1) were found to have considerably lower income losses than workers with no dependents and earnings below the limit. This result arises because the workers of the latter type experienced a large drop in both the proportion of time employed, and in wage rates in subsequent jobs, following separation from the automobile industry. Across age categories, the older workers in general suffered larger income losses. Older workers having no dependents, (DEP = 0) and lower wage rates (MAX = 0) were found to be the worst cases in terms of income losses. The larger decline in the proportion of time employed and wage rates in alternative jobs caused these higher income losses for the older workers compared to the younger ones. The greater decrease in wages experienced by older workers arose mainly from loss of seniority, plant specific
skills and union rents in the auto industry. The large drop in wages (ranging from 16.3 to 21.6 percent) experienced by the older workers (DEP = MAX = 0) is mainly responsible for the high income loss over five years (over $11,000 per unemployed worker) estimated for this group.

Our sample period extends only to the end of 1979, and as a consequence, we are not in a position to capture the experiences of the auto workers under massive layoffs (1979-81). However, we attempt to measure the labour externality that could have occurred in such a situation based upon estimates for the adjustment cases. After making adjustments in the main determinants of income loss model, the labour externality has been estimated under three employment scenarios in the automobile industry: an actual decline in employment in 1981 from the 1979 level; a projection of a 50 percent cut in employment and another projection of a 60 percent employment reduction.

One must be cautious in extrapolating the estimates of the adjustment cases to the adjustment problems experienced by the average worker in the automobile industry at other times and under a variety of economic conditions. Principally, the adjustment cases should have work-related characteristics similar to the average worker in the auto industry. This would have been the case if the whole period of downturn had been included in our sample. However, in order to capture a variety
of adjustment situations for auto workers and to estimate the magnitude of the aggregate labour externality (i.e., the social value of income losses), we considered the three above mentioned employment scenarios.

The projection of income losses based upon the observed decline in automobile employment (i.e., the first employment scenario) may provide an insight into the magnitude of economic losses suffered by the Canadian economy. In such a situation, the average wage of the laid off workers would be close to the average wage prevailing in the industry ($W_b$) while their alternative wages would be expected to be higher than those received by the adjustment cases ($W_a$). Under this restrictive condition, the Canadian economy would have suffered an economic loss of an amount in the neighbourhood of $421.9$ million. This loss is based on direct job losses only. If other indirect costs arising out of adjustment costs in the supplier industries are added to the above, the overall income losses inflicted on the economy would be higher than $421.9$ million. These calculations suggest that even a substantial decline in a major industry such as automobiles would imply direct costs as a fraction of G.N.P. of only .001 percent in 1981.

**Estimation Results of the Main Determinants of Income Loss**

**Model**
The cost of labour adjustment depends upon the main determinants of the income loss model. These are: previous wage rates, $W^b$; alternative wage rates, $W^a$; proportion of time previously employed, $P^b$; and the probability of being employed, $P^a$. Workers' characteristics and other macro-economic variables will have an important bearing on the above mentioned determinants. It is then important to summarize the major factors that affect the reemployment path and the earnings potential of workers in both the auto and non-auto situations. The following paragraphs summarize the main findings in this regard.

In estimating the factors that affect the probability of finding and retaining a job among the adjustment cases, older workers seem to find jobs more readily, but only in the first probit interval following permanent separation from the automobile industry. Older workers seem to have greater difficulty in finding a job as the time since layoff increases. Furthermore, these workers have greater difficulty in retaining a job once employed in an alternative situation. Both of these effects would be expected to produce a lower proportion of time employed for these workers in alternative job situations. This indicates that the ability effects of age outweigh the incentive effects of age. The higher wage workers have less incentive to claim benefits or remain on claim if they do collect, given that these benefits replace a lower percentage of their wages. However, the ability effects of the older workers (i.e. less
mobility or retraining becomes less profitable) will have a negative effect on the probability of finding and retaining a job.

Age appears to have a more important effect on the probability of finding and retaining a job than wage rates. The absolute value of the coefficient on the age variable is fairly small in both $W^a$ and $W^b$. However, the coefficient on age is relatively stronger in determining the prior wage than the wage rate in non-auto sectors. The percentage change in $W^b$ for a year increase in age is about .8 while this coefficient declines to .09 for $W^a$.

The number of weeks of UI benefits remaining ($B NW K E L$) for a worker at any point in time has the expected negative effect on becoming reemployed, particularly immediately following job loss. The presence of UI payments reduces the cost of being unemployed and increases the probability of remaining unemployed. It is, however, interesting to note that the absolute value of the coefficients on $B NW K E L$ declines as the intervals from job separations increase. This shows that the work disincentive effect of UI payments decreases with the duration of unemployment.

The sex of a worker (Male = 1, Female = 0) is found to be the single most important variable in determining both the
prior and alternative wage rates. Much of the wage gap between males and females might be explained by lower average investment in human capital. These wage differentials between males and females are higher at the point of job entry, than if a worker has been in the same firm for a long period of time. Our findings indicate that male workers earned about 60 percent more in alternative job situations as compared to about 53 percent more in the automobile industry. The evidence further suggests that while males tend to find jobs faster, females tend to keep them considerably longer. This implies that both males and females may be expected to spend a similar proportion of time employed after layoffs.

The dummy variable indicating that the worker has dependents plays an important role in predicting labour market behaviour. Workers with dependents earned about a 20 percent higher wage and experienced quicker reemployment prospects with relatively more stable jobs.

The variable representing the Ontario provincial unemployment rate (URATP1) is expected to capture the effects of general labour market conditions. In times of high unemployment rates and sluggish labour market conditions, individuals may experience a longer duration of unemployment once unemployed, or may experience job instability once employed. This is particularly important among the adjustment cases. Our sample
of adjustment cases is primarily dominated by younger workers with few years of seniority who would be the first to be let go in a cyclical downturn.

These findings suggest that there are no consistent sectoral or regional effects in predicting the reemployment prospects of the unemployed workers. This result is not surprising in the sense that the sector tends to employ all kinds of workers and the major automobile plants are situated in the central industrial belt of Canada.

Labour Market Experiences of the Automobile Workers

The experience of the auto workers does not seem to support the hypothesis that unemployment is concentrated among a small group of individuals who remain unemployed for an extended period of time. Rather the evidence indicates that about 64 percent of all auto workers experienced one spell of unemployment of at least a one week duration every four years as compared to a relatively lower job instability amongst the members of the Canadian labour force with about 36 percent displaying this turnover rate.76/ About 88 percent of all unemployment spells that occurred in the automobile industry lasted eight weeks or less. The typical duration of unemployment spells is very short: temporary layoffs seem to play a more important role in determining the unemployment in the automotive industry than in other industries.
More than two-thirds of all separations in the auto industry were related to layoffs or injury. An analysis of layoff cases in the automotive industry indicates that about 89 percent of these cases were recalled to their previous jobs as compared to 35 percent in the non-auto sector. Layoffs accounted for about 61 percent of all unemployed time in the automobile industry. This also provides an estimate of the amount of unemployed time covered by SUBs. The auto workers in general did not look for alternative opportunities while on temporary layoffs and awaiting recalls to their previous jobs. The present system of unemployment insurance and supplemental unemployment benefits reduces the incentive to engage in alternative market activities during unemployment spells in the auto industry.

In general, the adjustment cases experienced a higher average duration of unemployment (27 weeks on average) in the initial unemployment experience following a permanent separation from the automobile industry as compared to subsequent unemployment episodes (16 weeks on average). This result might have occurred because of additional disincentives to work provided by the SUB payments in the initial periods after indefinite layoff. The SUB payments are not generally available during subsequent unemployment situations and hence, the workers may be expected to have added financial pressure to look for alternative jobs at lower reservation wages.
The empirical findings further suggest that while there were repeated spells of unemployment in the automobile industry, the total labour force time that a typical worker spent employed was fairly high. Our findings indicate that about 54 percent of the adjustment cases have worked over 80 percent of the time.

B. POLICY

The previous section identifies that there would be short run adjustment costs if factors of production are displaced from their present employment pattern. While the movement of resources between industries will result in long run allocative efficiency gains, the short run adjustment costs arise because the value of the output produced by the newly released workers may be lower than the value of their output in prior employment. The existence of these efficiency losses due to displacement of workers may provide a crude measure of the potential gains that can be obtained by applying appropriate government policy.

In the following section, the rationale for different government policies is examined with particular emphasis placed on the standard of economic efficiency. The efficiency criteria requires an investigation of whether the benefits resulting from government policy exceed costs measured as the opportunity costs
of inputs used in government programs. In the presence of labour adjustment costs, government policy options could be analyzed in a variety of ways. In this thesis, the following four options are analyzed: (1) reliance on private adjustment mechanisms; (2) tariff protection; (3) an employment subsidy; and (4) a retraining programme.

Reliance on Private Adjustment Mechanisms

In this approach, the burden of adjustment is left to the private sector. The adjustment process itself depends upon the socio-economic characteristics of workers, general economic conditions and the various other structural features of the economy. Workers suffer a loss in their incomes while the economy experiences a decline in the value of workers' output during this transitional period. Changes in skill composition and geographical migration of workers will reduce these costs. However, in a situation of under-employed resources and sluggish demand conditions, the newly displaced workers may experience a long duration of unemployment. Furthermore, in this low aggregate demand situation, workers' alternative wage rates may be lower than their prior wages. The displaced workers may have to absorb these costs until the economy recovers.

The social costs of adjustment, in the absence of public assistance, will depend upon the particular
characteristics of workers. Table 6.4 presents these social income losses for different personal and labour market characteristics. These results are derived from actual estimates of the determinants of the income loss model. Table 6.5 shows the present value of the loss in output for an average adjustment case over five year periods. This loss in output for an average worker is $3,289. The total loss that the Canadian economy suffers in the first five years since layoffs is derived by multiplying the above figure by the total number of indefinite layoff cases.

Our sample period, as mentioned before, covered only the 1974-79 period. The major reduction in employment in the Canadian automobile industry actually occurred during the 1979-81 period (about a 25 percent decline in employment). By making appropriate adjustments in the main determinants of the income loss model, we have projected the present value of social income losses in Table 6.6. For example, the last row in that table shows that the Canadian economy suffered a loss in the social value of workers' output of $421.9 millions. This estimate is based upon the assumptions that all types of workers would be affected under this massive layoff and that an average worker may have better earning potential than the adjustment cases in our sample. Tables 6.7 and 6.8 show the social cost of adjustment under more severe employment reductions in the automobile industry.
The private costs of adjustment arise because of the divergence between the full income that workers would have earned had they been employed in the present job and their alternative earnings. This divergence arises because workers may experience either a different employment profile or a different wage profile in alternative jobs as compared to their situations in the automobile industry. This gap, i.e., the difference between the full income on this present employment minus their full income in alternative jobs, implies that there are potential gains from trade between employers and employees. As Coase and many others have argued there is an incentive to internalize the labour externality.

Workers themselves may attempt to internalize this externality by negotiating with employers to retain certain levels of employment in return for wage concessions. Workers will be willing to offer wage concessions or make other payments with a present value equal to that of the present value of the adjustment costs avoided by retaining employment.

The form of monetary payments will depend upon particular circumstances. In some instances, it will take the form of wage concessions. The recent case of wage concessions offered by Chrysler workers is an example in this respect. From an employer point of view, they would be willing to receive payments to keep employment if the divergence between wage rates and the value of marginal product of labour, VMPL, is less
than the payment from the workers. Hence, employment would be kept up to a point where the marginal increase in monetary transfer equals a corresponding divergence between wage rates and $VMP_L$. This should lead to an efficient combination of employment levels and monetary payments.

In a situation of complete plant shutdown, workers have two choices: (a) workers can look for alternative jobs and may have to absorb the costs of adjustment. Workers may minimize these costs by relocating and retraining themselves to improve their employability; (b) circumstances may arise where workers may take over the company ownership and keep it operating. This kind of employee owned and operated company is more probable in a situation of complete plant shutdown and when the perceived adjustment costs are higher. These costs would be higher if the particular plant is situated in a smaller town where it acts as a major employer. The case of the Canadian International Paper Mill (CIP) at Maniwaki, Québec, is an example in this respect. CIP was the only employer in the town, hence, this represents the most severe type of adjustment problem. Workers bought out the ownership of the company when they learned of a plant closure. Since then, the company has been operated and owned by the workers.78/ However, in a situation of partial layoffs, or if the plant is situated in a larger labour market area where alternative employment opportunities are available, then other forms of concessions may be considered instead of buying out.
The above analysis of internalization and workers' buying out the company, assumes the absence of prohibitive transaction costs. If there are high transaction costs, this would mean utilization of real resources in the bargaining process. The costs of these resources should be deducted from the benefits of this kind of employer-employees arrangement. In a situation of very high transaction costs, there may not be any private negotiation. Again, the problem of asymmetric information should not be minimized in a situation of negotiation and monetary transfer payments. In the above analysis, we have implicitly assumed that the workers know their adjustment path and the costs of labour adjustment. On the other hand, it is also assumed that the employers are aware of the value of the marginal product of labour. In the presence of asymmetric informations, the workers may attempt to understate the costs of adjustment while the employers may understate the potential benefit of employment. In this situation of asymmetric information, an agreement between employers and employees may be difficult to work out.

Government Intervention

Tariff Protection

The main economic rationale for removing trade barriers is to improve the allocation of resources. The economy specializes in the production of those goods where the largest comparative advantages exist. The economy benefits from trade
liberalization for two reasons: (1) consumers benefit because of lower prices of imported goods; (2) the newly released resources from the import-competing sector are now more productively utilized in the export producing sector. These consumption and production effects lead to a higher level of economic welfare.

Removal of tariffs brings about a higher welfare level for society while producing adverse employment effects against owners of inputs displaced from the import competing sector. This adjustment cost occurs in the short run during the transitional period. In the long run, all factors readjust and the domestic export sector expands to absorb the newly released resources. Everyone in the society is potentially better off since the gainers can compensate the losers and still be better off.

There is considerable trade theory literature regarding optimum intervention in international trade in the presence of domestic distortions. In the presence of a labour externality which is not internalized, protecting the industry will be equivalent to creating additional jobs. These job creation effects (labour externality) of tariffs may offset the negative effects due to protection.

Figure 7.1 illustrates the effect of tariff policy in the presence of labour externality. $S_s$ represents the social supply curve of the imported commodity, while $S_p$ stands for the
private supply curve. \( S_p \) lies above \( S_s \) because of the presence of the labour externality (i.e. the difference between the earnings the workers receive and their economic opportunity costs). In the absence of any labour externality (i.e. \( S_s = S_p \)), the costs of tariff protection are given by two triangles: \( A \) and \( B \). However, if there is a labour externality, the gain from protection is represented by the cross-hatched area, \( C \), and the costs are represented by the shaded triangle, \( B \). If \( C \) exceeds \( B \), there may be an argument for tariff protection. The above analysis assumes away the process of internalization by private individuals. If workers costlessly internalize this labour externality, free trade would always be a superior policy, i.e. \( S_s = S_p \), as a result of internalization. The above analysis is static and fails to account for the dynamic benefits or costs of freeing trade which were referred to in section II.
Figure 7.1

Protection in the Presence of Labour Externality

\[ t: \text{ Tariff rate} \]
\[ PW: \text{ Foreign supply curve for imports, assumed to be infinitely elastic} \]
\[ D: \text{ Domestic demand curve for imported commodity} \]
\[ Sp: \text{ Domestic private supply curve of imported commodity} \]
\[ Ss: \text{ Domestic social supply curve of imported commodity} \]
Subsidy

An employment subsidy is another form of assistance that the government could provide to protect domestic production and employment, by relating output to the social cost of production. Protecting employment through a subsidy system is a superior policy to tariff protection since it eliminates the consumption distortion.

An employment subsidy could be given to either the original firm (maintaining employment) or to any other firm hiring a worker who has been permanently laid off (creating employment). A policy choice has to be made between these options if there is asymmetry between the economic benefits of creating employment and the economic costs of terminating employment. The Task Force Report seems to indicate the presence of this asymmetry which will have important implications with respect to the federal government's intervention in labour market. The Report states, "Consider two simultaneous occurrences. One firm closes with 1000 employees losing their jobs, while at the same time a second plant opens in the same community employing 1000 workers. Our research suggests that these concurrent happenings result in a significant economic cost". This statement implies that society will incur a cost in a situation of simultaneous opening and closure of a plant. These costs arise because some resources are unemployed temporarily before they are absorbed in new plants or their skills may not be fully transferable.
Subsidy Delays Layoffs for a Fixed Period After Which Workers Retire

A subsidy is usually given for a fixed number of years. Assume that the subsidy continues until time period \( N \) after which it is removed. After this time period, it is assumed that there will be a complete attrition of workers due to retirement. The economic value of labours’ output with delayed layoff would be equal to their full income in these jobs, \( I^b \), for \( N \) time periods and SOCL is the social value of output in their next best alternative. The maximum amount of subsidy to be given to a firm which delays layoffs for \( N \) periods should not exceed the present value of net economic benefits resulting from the postponement of unemployment for the specified time periods. Hence, the maximum amount of subsidy will be determined by the following expression:

\[
\text{Subsidy} \leq \text{Net economic benefits for } N \text{ time periods:}
\]

\[
\sum_{t=1}^{N} \frac{(I_t^b - \text{SOCL}_t) / (1+d)^t}{1}
\]

Subsidy Delays Layoffs for a Fixed Period After Which Workers Experience Unemployment

In this case, government subsidy is assumed to delay layoffs for \( N \) time periods. After this time, these jobs will be lost and the workers would seek alternative employment opportunities. This results in a new adjustment path indicating
Subsidy Delays Layoffs for a Fixed Period After Which Workers Retire

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Subsidy \( \leq \) Net economic benefits for N time periods:

\[
S = \sum_{t=1}^{N} \frac{(I^b_t - SOCL_t)}{(1+d)^t}
\]

Subsidy Delays Layoffs for a Fixed Period After Which Workers Experience Unemployment

In this case, government subsidy is assumed to delay layoffs for N time periods. After this time, these jobs will be lost and the workers would seek alternative employment opportunities. This results in a new adjustment path indicating
the social opportunity costs of labour after $N$ time periods. We assume that the new adjustment path after $N$ time periods will be similar to the present one without the subsidy programme.

The cost of unemployment, however, will not be equal to the value of $C$ as calculated in the previous section. The cost of unemployment $N$ periods from now is:

$$C/(1+d)^N$$

The social benefits from delaying layoffs are measured by the difference in the costs of unemployment at the present time and the costs $N$ periods from now. Therefore, the maximum amount of subsidy that the government would be willing to pay to delay layoffs should not exceed this difference. This can be measured as follows:

$$\text{Maximum subsidy} \leq C \left(1 - \frac{1}{(1+d)^N}\right)$$

In Chapter VI, Table 6.5, we have estimated the costs of adjustment (i.e. $C$ values) for an average adjustment individual in our sample. The cumulative present value of these costs was found to be $3,289 measured over a five year period. Table 6.6 in the same Chapter presents us with the costs of adjustment under more drastic employment reductions. The last row in this table indicates that the social cost of unemployment for an average individual under this massive layoff situation comes out to be
$14,551 over five years. Based on these two sets of calculations, we have calculated the maximum amount of subsidy that could be provided to a firm to postpone layoffs for different time periods. Although our methodology for a subsidy programme calls for a cost calculation of an indefinite time horizon, we used cost figures calculated for the first five years since layoff. We assume that the costs of adjustment will be concentrated in the first few years since layoff.* As the time from the layoff period increases, workers would be expected to recoup most of these costs. Subsidy estimates are presented in Table 7.1. To the extent that some workers would be expected to retire over this interval, the data in Table 7.1 are a lower bound estimate of the appropriate subsidy.

Subsidy to Other Firms

An employment subsidy provided to another firm hiring a worker having been permanently laid off from the automotive industry is somewhat different. This type of programme aims at reducing the economic costs associated with the displacement of workers through the creation of permanent jobs. The gross

* The social costs of adjustment for an average worker among the adjustment cases were estimated to be $1172 for one year; $1759 measured over two years; $2310 over three years; $2820 over four years; and $3289 over five years. These estimates indicate that income loss is the largest in the first year and thereafter the cumulative total increases at a decreasing rate. Based on these estimates, we infer by extrapolation that the maximum income loss will be in the neighbourhood of $4689 measured over 11 years. Hence, our five year estimate of income loss represents approximately 70 percent of the total social income loss. The subsidy estimates in Table 7.1 may therefore be increased by a factor 1.43.
Table 7.1

Estimates of Subsidy Amounts ($ Per Individual)
For Delaying Layoff For Fixed Time Periods

<table>
<thead>
<tr>
<th>NUMBER OF YEARS BY WHICH LAYOFFS ARE DELAYED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>Subsidy for Adjustment Cases</td>
</tr>
<tr>
<td>299</td>
</tr>
<tr>
<td>1324</td>
</tr>
<tr>
<td>Subsidy for Mass Layoff Cases</td>
</tr>
</tbody>
</table>
labour benefits arising from the employment subsidy programme depend upon the probability of finding and keeping a job by the programme participants, as well as, their alternative earnings. Creating more permanent jobs at the old wage rates or at higher wage rates, would indicate higher potential economic benefits that might arise from an employment subsidy programme. Hence, the net economic benefits could be measured as the present value of the full income that workers would receive in alternative jobs and their social opportunity costs without the subsidy programme. This assumes that wage rates in the new jobs accurately reflect the value of output.

The Task Force Report seems to indicate, based on the examination of Canadian experience, that the net gains from permanent employment creation in markets characterized by excess supply of labour may be substantial in the short run. The report states, "In the short run the gains from the incremental creation of permanent jobs can be considerable, particularly in a thin labour market with an over-supply of workers. The creation of new employment opportunities in this case can draw very significantly from the stock of unemployed workers in the local area".* In the long run, with the existence of very substantive in and out-migration, the initial benefits would be eroded as the time since reemployment advances. To obtain a measure of the costs and benefits of temporary job creation would be different from those discussed, above. The Task Force Report found, in the long run, that creating temporary jobs may
make Canadians worse off than if intervention had not occurred. This indirectly implies that the social opportunity costs of workers employed in temporary jobs are higher than their wage bills in those jobs.

The reemployment subsidy programme may be introduced at a time when the industry is experiencing a large scale decline in employment. Table 6.6 in Chapter VI presents us with the calculation of costs of unemployment under massive layoff situations.

We may assume, in the absence of other available information, that workers employed in alternative jobs because of the employment subsidy will be receiving a wage rate which is at least equal to the average wage rate in the automotive industry. The last row in the above table, keeping assumptions regarding reemployment probability and alternative wage earnings without subsidy, indicates that the present value of net economic benefits, by postponing layoffs indefinitely, amounts to $14,551.00 on a per worker basis. This calculation may represent an upper bound estimate of the subsidy to be given to other firms to employ the laid off auto workers. This is because society incurs a cost because of the simultaneous opening and closing of a plant. Hence, the above estimate needs to be adjusted appropriately before it is used as a guide to formulate employment subsidy policy for other firms which intend
to hire laid off workers.

Publicly Provided Training

Training is often suggested as a public policy to help import-affected workers increase their potential for employment in other jobs. This implicitly assumes that workers experiencing a large scale decline in employment could be retrained to explore employment opportunities in other sectors of the economy. The need for such a programme may be more important in the worst case scenario of labour adjustment where mass layoffs are concentrated over a shorter period of time. This type of publicly funded programme would attempt to change the skill composition of labour supply in order to increase the employability and earnings of the laid off workers.

While recognizing the need for publicly provided training to improve the employment prospect of import-affected workers, one questions the necessity of singling out trade-impacted workers from other unemployed individuals. The unemployed workers themselves may engage in training activities to improve their employability and earnings in alternative jobs. The maximum amount that a rational worker would be willing to spend in training depends upon the future pay-off. If job prospects in the auto industry are poor, this amount may be
substantial. Furthermore, in many industrial situations, employers may provide training to the new recruits. This increases the marginal productivity of labour in that firm. The firm may bear some of the costs during the training period. This shared investment is expected to offer mutual benefits to both employers and employees in the form of insurance against future turnover.

While there are incentives in the private sector to engage in training activities, government involvement in training could be addressed in terms of private and social benefits. Benefits from training, as in the case of higher education, may not be completely captured by the prospective trainee or job seeker or by the firm producing the training or the job-matching, while the full costs of training are borne by them. Under this situation, marginal social benefits from training would be higher than marginal private benefits. This would lead to a smaller investment in training activities than socially desirable. Individuals will continue to invest in training until the marginal private benefits equal marginal private costs of training. Assuming there are no external costs of training, (i.e. private marginal cost (MC_p) = social marginal cost (MC_s)), then investment should occur up to the point where marginal social benefits (MB_s) equal marginal social costs (MC_s). This is illustrated in Figure 7.2. The private demand curve for training or the private marginal
$\gamma$: marginal rate of return for each dollar invested in training

$i$: interest rate or the marginal cost of financing for each dollar invested in training
benefit schedule \( (MB_p) \) is assumed to slope downward indicating that marginal benefits decrease as additional training is accumulated. If markets were perfect, it is quite reasonable that the supply curve or the marginal cost curve would be horizontal. Equating \( MB_p = MC_p \) would lead to activity level \( AC_1 \) below the socially optimal given by \( AC_2 \). The socially optimum level of activity is at the quantity of training where \( MB_a = MC_a \). Government provision of funds equal to external benefits per unit of training activity would lead to the socially optimal level of training activity, \( AC_2 \).

This kind of external benefit has been considered by various authors in the economics literature. Hardin\(^81\) notes that employee compensation fails to reflect adequately whatever external economic effects may exist. Thus, even if training enables trainees to produce more output after being trained, this additional output may not be reflected in employee compensation attributable to training. The connection between production and trainee earnings becomes further weakened if we take into account what Borus\(^82\) refers to as the vacuum effect. He believes that some of the training participants will engage in employment which will otherwise remain unfilled, and the jobs which the trainee leaves behind can be easily filled by the unemployed. This means that placement of trainees in training related jobs causes a pure vacuum effect and society should count as gains the entire earnings of the trainees. The
earnings of the trainee, however, will overstate the benefits of training if we ignore the social opportunity costs of resources engaged in training activities. Borus' study indicates that these costs could be measured by the social opportunity costs of unemployed individuals filling in jobs which the trainee holds before training.

The second motivation for government participation in training activities may be found in the public choice model. This is more important when import-impacted workers are singled out for training purposes. In the context of free trade, for example, the benefits of trade liberalization are spread over all consumers across the country. Consumers in general are unlikely to form pressure groups (because of high transaction costs) or lobby for removing tariff protection. The other group of individuals who benefit from free trade are resources in the export sector. Historically, they have not been active in pressing for further trade liberalization. On the other hand, individuals in the import competing sectors form a very strong political lobby for protectionist policy. In the presence of this lobbying group, government is unlikely to make policy changes towards further trade liberalization. The existence of this situation leads to an inefficient allocation of resources in both production and consumption in addition to resources wasted in forming pressure groups.
Training programmes could be viewed as a tool to minimize the political resistance of lobbying groups to policy changes. In the context of trade liberalization, training programmes may be used as a means to allow the reduction of tariff protection in order to achieve higher welfare levels. Under these circumstances, training programmes could be viewed as efficient.

The above analysis attempts to explain the apparent frequency of public sector intervention in training activities. Government intervention may be justified as filling in the economic inefficiency created by the externality as well as a means to make other policy changes. If the training programmes are motivated by externality considerations, we would expect to find them concentrated in those training areas in which the excess of social over private benefits is greatest. If the actual pattern of training does not correspond to this pattern, we might infer the importance of public choice considerations.
In this thesis we have identified the major socio-economic, labour market and other factors that affect individual's ability and incentive in both prior and alternative job situations. In estimating the main components of income loss model, older workers were found to experience greater difficulty in finding and retaining jobs. This lower probability of finding and retaining jobs resulted in the lower proportion of time employed for this group of workers. The sex of an individual (Male=1, Female=0) was found to be an important variable in determining both prior and post layoff wage rates. The wage differentials on the basis of sex was found to be 60 percent and 53 percent in prior and alternative wage rates respectively. The Ontario provincial unemployment and the number of unemployment benefit weeks remaining had negative effects on the probability of finding jobs. Individuals with dependents found jobs quicker and earned about 20 percent higher wage rates than those without dependents.

Based upon the above estimation results and observed individual and labour market characteristics, a measurable estimate of the private and social cost of adjustment were carried out. In general, older and female workers suffered the largest loss in income, while younger workers experienced some gains in income. Inferring, on the basis of the experiences of the adjustment cases, we extrapolate about the likely adjustment costs that would be incurred during the massive layoff situation after 1979. It was found that the social cost of
adjustment may rise as much as $14551. per individual over a five year period. This makes up a total loss of about $421.9 million for the whole Canadian economy.

The existence of adjustment costs and quantifying these costs gives us a crude measurement of the potential gains that can be obtained by applying the appropriate government policy. Four different policy options have been examined with particular emphasis placed on efficiency criteria. Individuals themselves may attempt to internalize these costs by entering into appropriate financial arrangements with their employers. In some instances workers may buy-out the company in order to maintain their jobs. However, if there are domestic distortions, such as labour externality, protecting domestic industry and employment through tariffs may be a superior policy to a free trade condition. Domestic employment could also be maintained through subsidy programmes. If layoff is indefinitely postponed, then the maximum amount of subsidy should not exceed the present value of the social costs of adjustment. Government intervention through training programmes may be justified mainly on externality grounds. However, government involvement in training may not correspond to externality considerations, thus we might infer the importance of training on a public choice model.
FOOTNOTES


6. Materials obtained from the Transportation Industries Branch, Industry, Trade and Commerce.

7. N.B. MacDonald, Labour Needs, Canadian Automobile Industry to 1990, May 1981. This report was prepared for Labour Market Development Task Force, Canadian
Employment and Immigration Commission.


10. U.S.A. has a tariff rate of only 2.9 percent which drops to 2.3 percent by 1987; Canada's tariff rate of 13.6 percent will drop to 9.2 percent by 1987. See Executive Summary, MacDonald Report, op.cit.

11. In certain sectors of the economy the cost of this distorted state is very high as compared to once-and-for-all dislocation cost. See G.P. Jenkins, "Cost and Consequences of the New Protectionism" in North-South Institute-World Bank Volume on Canada in a Developing Economy: Trade or Protection, July 1980.


25. R.J. Wonnacott, *op.cit.*


32. See Beigie, *op.cit.*

33. President Johnson and Prime Minister Pearson signed the agreement on January 16, 1965.

34. Theoretical analysis in this section is similar to that developed by G.P. Jenkins and C. Montmarquette in


37. During periods where no SUBs are available, $I^b$ and $I^a$ are estimated according to the models presented in G. Glenday, "Key Factors in the Income Loss of Laid-Off Workers".

38. This relationship is generally known as Stolper-Samuelson Theorem, see "Protection and Real Wages", by the above authors in *Readings in the Theory of International Trade*, American Economic Association, Philadelphia: Blakiston, 1949.

39. In 1979 the maximum insurable earning was $265 and the maximum SUB that an unemployed worker could claim was $115. Hence,
.60(265) + 115 = \frac{f_1 W^b}{1 - t_a^v} = .60W^b \text{ if } f_1 = 95% \\
f_3 = 80% \\
\text{UB}=159 \\
\text{tav}=20% \\
\text{UB+SUB}=274 \\

In this situation, a worker would be expected to exceed the maximum SUB payment if he earned more than $457 per week in the prior job.


42. The earning differentials can be decomposed in the following way:
\[ R = E + C + U \]

Where,  
- \( R \): Earning differentials
- \( E \): Differential related to endowment differences
- \( C \): Differential related to coefficient difference
- \( U \): Differential related to different constant terms in the male and female earning functions

\[ D = C + U \]  
The portion of differential that is conventionally attributed to discrimination.

The main controversy centres around the interpretation of \( C \); as Polachek argues, the different coefficients in the male and female earning equation don’t necessarily represent market discrimination but different market productivity arising out of investment in human capital.


54. From an employer point of view, the workers are quasi-fixed factors since he has made an initial investment in hiring and training his work force. If the training is firm specific, he will receive part of the rents from training (because of increased productivity of labour). The employer has the incentive to keep these work forces for a long time and at the same time, the employee does not have any incentive to move out since his productivity in terms of other jobs has not increased. The value of the marginal product of the worker is expected to exceed the wage rate in order to cover the cost of training, hiring and other benefit payment (SUB).

\[ \sum_{t=0}^{T} \Delta \text{MPP} \cdot (1+\gamma)^{-t} = \sum_{t=0}^{T} (\text{MPP} - W_t)(1+\gamma)^{-t} \]
where \( \Delta MPP \) increment in the value of marginal product and 
can be termed as periodic rents to the employer. The periodic rent should exceed or at least be equal to the 
total cost of training, hiring and SUB payment. \( \gamma \) 
denotes the rate at which future benefit or cost should 
be discounted. See Walter Y. Oi, "Labour as a 

55. The dummy dependent variable \( Y \) is defined as

\[ Y = 1 \text{ if a person found employment} \]
\[ Y = 0 \text{ otherwise.} \]

Suppose the true regression model is

\[ Y = \beta X + U \]

then in this case the residual can take only two values:

\[ U = 1 - \beta X \text{ for } Y = 1 \]
\[ U = -\beta X \text{ for } Y = 0. \]

As indicated by Maddala, Econometrics, pp. 162-171, we 
can address the problem in a slightly different way. We 
observe only a dummy variable which takes on values 1 if 
\( \beta X + U > 0 \) and 0 if \( \beta X + U < 0. \) Then
Prob(Y_i=0/X_i) = \text{prob}(U_i < -\beta X_i) \\
= \text{prob}(U_i > \beta X_i) \\
\quad \quad -X_i \\
= \int_{\alpha}^1 f(U_i) dU_i = 1 - \phi(\beta X_i)

where \( \phi \) is cumulative density function.

\text{prob}(Y_i=1/X_i) = \text{prob}(U_i > -\beta X_i) = \text{prob}(U_i < \beta X_i).

\int_{\alpha}^{\beta X_i} f(u_i) dU_i = \phi(\beta X_i)

Any sample data may be split into two segments \( Y_i = 0 (i=1 \ldots n_1) \) and \( Y_j = 1 (j=1 \ldots n_2) \). Assuming the underlying linear model is the true relationship between \( Y \) and \( X \), then the likelihood of observing this sample of data is the joint probability of \( n_1 \) observations of \( Y_i = 0 \) given all explanatory variables and \( n_2 \) observations of \( Y_j = 1 \) given all explanatory variables. The joint probability of the \( n_1 \) and \( n_2 \) sample values is given by the likelihood function.

\[
L = \prod_{i=1}^{n_1} \text{prob}(Y_i = 0/X_i) \prod_{j=1}^{n_2} \text{prob}(Y_j = 1/X_j)
\]

\[
= \prod_{i=1}^{n_1} (1 - \phi(\beta X_i)) \prod_{j=1}^{n_2} \phi(\beta X_j)
\]

In the above expression, the first term corresponds to those observations for which \( Y_i = 0 \) and the second term corresponds to those observations for which \( Y_i = 1 \). To obtain the estimator of \( \beta \), we maximize \( L(\beta) \) with respect to \( \beta \). This yields the maximum likelihood estimate of \( \beta \).
The probability of being at work in the first, second, third and fourth intervals after separation are given by $P_1^a$, $P_2^a$, $P_3^a$, and $P_4^a$ respectively. These in effect depend on the interval probabilities of finding and retaining a job. The probabilities of finding a job in successive intervals may be denoted by $P_1$, $P_2$, $P_3$ and $P_4$ and the interval probabilities of retaining a job are given by $R_1$, $R_2$, $R_3$ and $R_4$. Then the probability of being at work after each interval may be expressed by the following formulations:

$$
\begin{align*}
P_1^a &= P_1 \\
P_2^a &= P_1 R_1 + (1-R_1)P_2 \\
P_3^a &= P_1 R_1 R_2 + (1-P_1)P_1 R_2 + (1-P_1)(1-P_2)P_1 + P_1 (1-R_1)P_1 \\
\end{align*}
$$

where $P_1 R_1 + (1-P_1)P_2$ indicates those who found a job in the first interval and continued to retain the job through the second interval ($P_1 R_1$) plus a proportion that did not find in the first interval but found one in the second interval $(1-P_1)P_2$. This process can be applied to any number of time intervals. The procedure used for estimating $P_4^a$ from the interval probabilities of finding


58. On the one hand, it is expected that women's search costs are considerably higher than men's because of more viable non-market activities, and returns from their search would be lower because of discrimination in wage setting behavior and shorter work life expectancy. On the other hand, if search is not a full time activity but can be seen as complementary to nonmarket activity, then women's cost of search could be lower. This may lead them to search longer and increasing their average duration of unemployment. See N. Barrett and R. Morgenstern, "Why Do Blacks and Women Have High Unemployment Rates", Journal of Human Resources, 1974, pp. 452-64.
59. For some home activity, say meal preparation, for every twenty minutes devoted by husband, wife reduces her time by ten minutes. It appears that male spends twice as much time as that of female in this particular house activity. See A. Leibowitz, "Education and Home Production" *American Economic Review* 1974, pp. 243-50.


62. To some extent, age is also an incentive related variable. Senior workers who were earning high wages because of their years of experience, would be expected to find alternative work immediately because of high income loss due to displacement. However, if these older workers were near to retirement age, their pension plans would reduce the costs of displacement and incentive to find subsequent jobs.
63. Given fixed family assets, larger family size would increase the probability of financing consumption with a loan. Hence, searchers with dependents are likely to discount returns from search at a higher rate which would mean shorter search duration. See R.M. Schmidt, "The Determinants of Search Behavior and the Value of Additional Unemployment", Working Paper Series No. 7429, Graduate School of Management, University of Rochester, September 1974. (mimeo)

64. However, the above argument may not hold for a group of workers whose marginal utility arising from leisure and non-market activities is relatively higher. These workers may engage in part-time employment in order to supplement the normal UI benefits which would be expected to reduce the probability of employment.


72. We have ignored the "congestion effect" or "bumping effect" which means that the laid off workers will increase the duration of unemployment of the other unemployed persons in the general labour market. Without this effect, the social cost of adjustment will be under-estimated.


74. See R. Perry, op.cit., p. 77.


78. Workers' owned and operated co-operatives are even
stronger in other countries i.e. U.K., France, Spain etc.
For example in France, there are over a thousand
co-operatives that are managed and run by workers.
Government in France provides mainly two incentives to
form this kind of business: (a) a certain percentage of
government contract is offered to workers' co-operatives
(b) workers are allowed to receive prepaid UI payments
and subsequently invest towards the ownership of the
Company. In other words, government in France offers
monetary payments to workers to invest in the acquisition
of the Company who would otherwise be unemployed. The
Albi Glass Workers, Albi, France is a classic example in
this respect. The plant was closed down and about 650
employees were affected. Workers, with the help of the
Union Movement in France, bought out the Company and
phased out the old equipment. Since that time, the
Company has been enjoying technological edge and
experiencing a high growth rate in Europe. There are
other examples of Workers Co-operatives such as the
TEMPEC case in Temiscaming, Quebec and the Triumph
Motorcycle case in the U.K. However, the last two cases
did not experience high growth rates in the post takeover
period as that of Albi Glass Works.


APPENDIX A

STATISTICAL RECORD OF THE AUTOMOBILE INDUSTRY

The automotive industry constitutes a large component of Canada's manufacturing sector in terms of output and automotive products make up the largest single element in Canada's end product trade. In particular, the performance of the automotive industry is of vital importance to Ontario since it accounts for one in every six manufacturing jobs in the province. It is then important to examine the historical performance of the industry in terms of employment, production and international trade. The following section deals with these issues.

Production

In 1964, vehicle production in the Canadian automotive industry was about 670 thousand units, as Table A.1 shows. The Canadian share of the combined North American total in 1964 was 6.7 percent. Canadian automotive production, as a proportion of North American production, expanded significantly from 1965 through to 1970. This was mainly due to the signing of the Automotive Agreement. The rapid growth in the automotive industry during the 1960s reflected the attractiveness of Canada as a location for labour-intensive fabrication.
By 1977, the Canadian automobile industry had recovered from its low levels of 1975 and had reached a record production level of 1.7 million units. Between 1964 and 1977, motor vehicle production increased in both countries in absolute terms but in relative terms, production increased in Canada by 171% and in the United States by 39%.
TABLE A.1

Canadian Motor Vehicle Production (In Units) and Value of Shipments of Parts Production ($ Millions) for 1964-81

<table>
<thead>
<tr>
<th>Year</th>
<th>Motor vehicle production* (in units)</th>
<th>Value of shipments of parts and accessories** (in $ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964</td>
<td>669,496</td>
<td>627.9</td>
</tr>
<tr>
<td>1965</td>
<td>852,779</td>
<td>755.6</td>
</tr>
<tr>
<td>1966</td>
<td>899,511</td>
<td>860.5</td>
</tr>
<tr>
<td>1967</td>
<td>952,448</td>
<td>912.4</td>
</tr>
<tr>
<td>1968</td>
<td>1,172,903</td>
<td>1,193.8</td>
</tr>
<tr>
<td>1969</td>
<td>1,362,406</td>
<td>1,340.3</td>
</tr>
<tr>
<td>1970</td>
<td>1,191,401</td>
<td>1,271.9</td>
</tr>
<tr>
<td>1971</td>
<td>1,376,033</td>
<td>1,660.5</td>
</tr>
<tr>
<td>1972</td>
<td>1,467,032</td>
<td>1,903.2</td>
</tr>
<tr>
<td>1973</td>
<td>1,578,553</td>
<td>2,304.6</td>
</tr>
<tr>
<td>1974</td>
<td>1,498,889</td>
<td>2,281.1</td>
</tr>
<tr>
<td>1975</td>
<td>1,422,251</td>
<td>2,325.8</td>
</tr>
<tr>
<td>1976</td>
<td>1,646,810</td>
<td>3,112.3</td>
</tr>
<tr>
<td>1977</td>
<td>1,773,131</td>
<td>3,790.2</td>
</tr>
<tr>
<td>1978</td>
<td>1,741,966</td>
<td>4,691.9</td>
</tr>
<tr>
<td>1979</td>
<td>1,625,356</td>
<td>4,473.1</td>
</tr>
<tr>
<td>1980</td>
<td>1,369,410</td>
<td>3,547.7</td>
</tr>
<tr>
<td>1981</td>
<td>1,320,115</td>
<td>4,336.9</td>
</tr>
</tbody>
</table>

* Statistics Canada 42.002.
** Transport Industries Branch, IT&C (Statistics Canada 31-001)
The production of original equipment parts in Canada is determined by the level of motor vehicle assembly in Canada as well as in the United States. The output of original equipment parts production in Canada rose from $1.7 billion in 1971 to an estimated value of $4.5 billion in 1979. However, the above production values will be reduced to $2.4 billion if we adjust for the inflation rate (general CPI). The consumption of original equipment parts in Canada has also risen dramatically since the auto pact. This reflects a substantial increase in the number of motor vehicles that are assembled in Canada. The consumption of original equipment parts by the motor vehicle manufacturers in Canada had risen to an estimated value of $8.1 billion by 1979. Original equipment parts are produced by both motor vehicle manufacturers and independent producers. In Canada, independent producers play a greater role in original equipment production compared to the United States.

Employment

Employment has increased in Canada reflecting the upturn in production. Between 1964 and 1978, employment in the automotive industry increased by 49,000 jobs in Canada as shown in Table A.2 which represents an increment of direct jobs in the automobile sector of 71%. In 1978, 56% of the direct employment in the automobile sector fell under the vehicle assembly category and the remaining percentage was for parts and accessories manufacture.
In 1965, 91% of the automotive workers in North America were employed in the U.S.A. and 9% employed in Canada. In 1978, the United States' share was a little over 88%, and Canada's share was 11.6% which indicates that employment grew slightly faster in Canada.

Table A.1 indicates that Canadian motor vehicle and parts production dropped continuously from its cyclical peak in 1978. The production of motor vehicles in 1981 was about 400,000 units lower than the corresponding production level in 1978. This represents a 24% cut in production of completed motor vehicles in Canada. The real value of parts production also dropped by 31.6% in 1981 from the 1978 level. While the Canadian imports of motor vehicles expressed as a proportion of total consumption remained stable in the 70's, the deficit in the automotive parts trade increased. Table A.5 illustrates that imports from overseas (i.e., mainly from Japan) accounted for about 25% of domestic auto sales. One consequence of the increased import penetration of the Canadian auto market is a reduction in employment in the automobile industry. The employment level reached its peak of 118 thousand employees in 1978, and then declined to a low of about 85 and 88 thousand in 1980 and 1981 respectively. However, it should be noted that the general recession in North America over the same period has also contributed to the decline in employment in the automotive industry.
Trade

Tables A.3 through A.6 show the overall pattern of Canadian and U.S. trade and Canadian and overseas trade in automotive products for 1965 through 1981. As indicated in Table A.3, the volume of Canadian imports from the U.S. has increased from 52,000 in 1965 to about 785,000 in 1979. This increase in the volume of trade was largely contributed by the automotive trade agreement of 1965. Table A.3 also shows the degree of integration of the North American automotive industry since the automotive agreement. In 1965, Canada imported about 6.3% of the total demand for motor vehicles from the U.S.A. In 1979, the U.S. share in the Canadian auto market rose to 56 percent. Table A.4 shows the overseas share (mainly Japanese) in the Canadian auto market (about 25% in 1981). Tables A.5 and A.6 present the overall trade balance in motor vehicles (both passenger and commercial vehicles) and parts. Despite Canada's increasing exports to the U.S.A., Canada has been facing a trade deficit over the years (except for 1970 through 1972). While the overall deficit was shrinking between 1965 through 1969, the deficit in auto parts was increasing while the surplus in completed cars kept on increasing during the same period. In 1970, Canada had a surplus in trade balance for the first time since 1965 and continued to enjoy this surplus though at a deteriorating rate until the end of 1972. The United States had fallen into deficit because the automotive companies made large investments in Canada as a result of the agreement, leading to
### TABLE A.2


<table>
<thead>
<tr>
<th>Year</th>
<th>All Employees</th>
<th></th>
<th></th>
<th>Production Employees*</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assembly</td>
<td>Parts</td>
<td>Total</td>
<td>Assembly</td>
<td>Parts</td>
<td>Total</td>
</tr>
<tr>
<td>1964</td>
<td>38.7</td>
<td>30.3</td>
<td>69.0</td>
<td>29.03</td>
<td>22.73</td>
<td>51.76</td>
</tr>
<tr>
<td>1965</td>
<td>45.5</td>
<td>34.1</td>
<td>79.6</td>
<td>34.13</td>
<td>25.58</td>
<td>59.71</td>
</tr>
<tr>
<td>1966</td>
<td>46.0</td>
<td>38.9</td>
<td>84.9</td>
<td>34.50</td>
<td>29.18</td>
<td>63.68</td>
</tr>
<tr>
<td>1967</td>
<td>47.0</td>
<td>37.1</td>
<td>84.1</td>
<td>35.25</td>
<td>27.83</td>
<td>63.08</td>
</tr>
<tr>
<td>1968</td>
<td>48.0</td>
<td>35.4</td>
<td>83.4</td>
<td>36.00</td>
<td>26.55</td>
<td>62.55</td>
</tr>
<tr>
<td>1969</td>
<td>52.1</td>
<td>38.4</td>
<td>90.5</td>
<td>39.08</td>
<td>28.80</td>
<td>67.88</td>
</tr>
<tr>
<td>1970</td>
<td>47.3</td>
<td>34.7</td>
<td>82.0</td>
<td>35.48</td>
<td>26.03</td>
<td>61.51</td>
</tr>
<tr>
<td>1971</td>
<td>50.9</td>
<td>41.0</td>
<td>91.9</td>
<td>28.18</td>
<td>30.75</td>
<td>68.93</td>
</tr>
<tr>
<td>1972</td>
<td>54.0</td>
<td>43.0</td>
<td>97.0</td>
<td>40.50</td>
<td>32.25</td>
<td>72.75</td>
</tr>
<tr>
<td>1973</td>
<td>60.0</td>
<td>48.5</td>
<td>108.5</td>
<td>45.00</td>
<td>36.38</td>
<td>81.38</td>
</tr>
<tr>
<td>1974</td>
<td>62.3</td>
<td>45.8</td>
<td>108.1</td>
<td>46.73</td>
<td>34.35</td>
<td>81.08</td>
</tr>
<tr>
<td>1975</td>
<td>57.8</td>
<td>41.2</td>
<td>99.0</td>
<td>43.35</td>
<td>30.90</td>
<td>74.25</td>
</tr>
<tr>
<td>1976</td>
<td>60.6</td>
<td>46.2</td>
<td>106.8</td>
<td>45.45</td>
<td>34.65</td>
<td>80.78</td>
</tr>
<tr>
<td>1977</td>
<td>63.1</td>
<td>48.6</td>
<td>111.7</td>
<td>47.33</td>
<td>36.45</td>
<td>83.78</td>
</tr>
<tr>
<td>1978</td>
<td>66.0</td>
<td>52.1</td>
<td>118.1</td>
<td>49.50</td>
<td>39.08</td>
<td>88.58</td>
</tr>
<tr>
<td>1979</td>
<td>67.4</td>
<td>49.8</td>
<td>117.2</td>
<td>50.55</td>
<td>37.35</td>
<td>87.90</td>
</tr>
<tr>
<td>1980</td>
<td>43.9</td>
<td>41.0</td>
<td>84.9</td>
<td>32.92</td>
<td>30.75</td>
<td>63.67</td>
</tr>
<tr>
<td>1981</td>
<td>43.5</td>
<td>44.7</td>
<td>88.2</td>
<td>32.63</td>
<td>33.53</td>
<td>66.16</td>
</tr>
</tbody>
</table>

Source: Employment, earnings and hours, Statistics Canada 72-002.

*Production employment is assumed to be 75 percent of all employment for both assembly and parts.*
<table>
<thead>
<tr>
<th>Year</th>
<th>Canada's Consumption</th>
<th>Canada's imports from U.S.A.</th>
<th>Proportion of Imports (U.S.A.) to Consumption (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
<td>830,995</td>
<td>52,359</td>
<td>6.30</td>
</tr>
<tr>
<td>1966</td>
<td>827,431</td>
<td>134,415</td>
<td>16.24</td>
</tr>
<tr>
<td>1967</td>
<td>815,307</td>
<td>269,722</td>
<td>33.08</td>
</tr>
<tr>
<td>1968</td>
<td>889,453</td>
<td>334,112</td>
<td>37.56</td>
</tr>
<tr>
<td>1969</td>
<td>917,505</td>
<td>361,942</td>
<td>39.45</td>
</tr>
<tr>
<td>1970</td>
<td>774,241</td>
<td>320,846</td>
<td>41.44</td>
</tr>
<tr>
<td>1971</td>
<td>940,332</td>
<td>447,702</td>
<td>47.61</td>
</tr>
<tr>
<td>1972</td>
<td>1,065,621</td>
<td>514,812</td>
<td>48.31</td>
</tr>
<tr>
<td>1973</td>
<td>1,226,698</td>
<td>602,744</td>
<td>49.14</td>
</tr>
<tr>
<td>1974</td>
<td>1,249,304</td>
<td>714,471</td>
<td>57.18</td>
</tr>
<tr>
<td>1975</td>
<td>1,316,629</td>
<td>717,282</td>
<td>54.48</td>
</tr>
<tr>
<td>1976</td>
<td>1,291,463</td>
<td>722,542</td>
<td>55.95</td>
</tr>
<tr>
<td>1977</td>
<td>1,344,959</td>
<td>732,247</td>
<td>54.44</td>
</tr>
<tr>
<td>1978</td>
<td>1,366,544</td>
<td>660,223</td>
<td>48.31</td>
</tr>
<tr>
<td>1979</td>
<td>1,396,414</td>
<td>784,661</td>
<td>56.19</td>
</tr>
<tr>
<td>1980</td>
<td>1,265,807</td>
<td>576,778</td>
<td>45.57</td>
</tr>
<tr>
<td>1981</td>
<td>1,190,952</td>
<td>575,443</td>
<td>48.31</td>
</tr>
</tbody>
</table>

1 Vehicles Manufactured in Canada, U.S.A. and other countries (Transport Ind.)

2 International Trade Commission 1964-78. Figures for 1979-81 are derived. 1978 average motor vehicle prices are inflated 10% every year and the total import values are divided by this price level.
TABLE A.4

Canada's Imports from Other Countries
(Cars and Commercial Vehicles)

<table>
<thead>
<tr>
<th>Year</th>
<th>Imports* Passenger Cars (000 units)</th>
<th>Total Imports from other countries (000 units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>167.6</td>
<td>187.7</td>
</tr>
<tr>
<td>1974</td>
<td>169.7</td>
<td>195.1</td>
</tr>
<tr>
<td>1975</td>
<td>127.8</td>
<td>143.1</td>
</tr>
<tr>
<td>1976</td>
<td>177.5</td>
<td>195.2</td>
</tr>
<tr>
<td>1977</td>
<td>170.0</td>
<td>188.7</td>
</tr>
<tr>
<td>1978</td>
<td>192.4</td>
<td>213.5</td>
</tr>
<tr>
<td>1979</td>
<td>117.8</td>
<td>135.5</td>
</tr>
<tr>
<td>1980</td>
<td>206.7</td>
<td>233.6</td>
</tr>
<tr>
<td>1981</td>
<td>251.4</td>
<td>299.2</td>
</tr>
</tbody>
</table>

* Statistics Canada, Catalogue 11-001E.
<table>
<thead>
<tr>
<th>Year</th>
<th>Imports from other countries (000 units)</th>
<th>Imports as a percentage of consumption</th>
<th>Total Imports from U.S. &amp; Other</th>
<th>Total Exports &amp; Other</th>
<th>Balance (Exports-Imports)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973</td>
<td>187.7</td>
<td>15.3</td>
<td>790.4</td>
<td>1142</td>
<td>351.6</td>
</tr>
<tr>
<td>1974</td>
<td>195.1</td>
<td>15.6</td>
<td>909.6</td>
<td>1159</td>
<td>249.4</td>
</tr>
<tr>
<td>1975</td>
<td>143.1</td>
<td>10.9</td>
<td>860.4</td>
<td>966</td>
<td>105.6</td>
</tr>
<tr>
<td>1976</td>
<td>195.2</td>
<td>15.1</td>
<td>917.7</td>
<td>1273</td>
<td>355.3</td>
</tr>
<tr>
<td>1977</td>
<td>188.7</td>
<td>14.0</td>
<td>920.9</td>
<td>1349</td>
<td>428.1</td>
</tr>
<tr>
<td>1978</td>
<td>213.5</td>
<td>15.6</td>
<td>873.7</td>
<td>1249</td>
<td>375.3</td>
</tr>
<tr>
<td>1979</td>
<td>135.5</td>
<td>9.7</td>
<td>920.2</td>
<td>1149</td>
<td>228.8</td>
</tr>
<tr>
<td>1980</td>
<td>233.5</td>
<td>18.5</td>
<td>810.4</td>
<td>914</td>
<td>103.6</td>
</tr>
<tr>
<td>1981</td>
<td>299.2</td>
<td>25.1</td>
<td>974.6</td>
<td>1004</td>
<td>129.4</td>
</tr>
</tbody>
</table>

* Exports = (Domestic Production + Imports) - Domestic Consumption
### TABLE A.6

**Canadian Trade in Automotive Parts Products**  
(in $ Millions)

<table>
<thead>
<tr>
<th>Year</th>
<th>Exports to U.S.</th>
<th>Imports from U.S.</th>
<th>Exports to other countries</th>
<th>Imports from other countries</th>
<th>Trade balances</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
<td>151</td>
<td>797</td>
<td>32</td>
<td>20</td>
<td>-646</td>
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<tr>
<td>1966</td>
<td>389</td>
<td>1,093</td>
<td>42</td>
<td>33</td>
<td>-695</td>
</tr>
<tr>
<td>1967</td>
<td>512</td>
<td>1,314</td>
<td>53</td>
<td>35</td>
<td>-784</td>
</tr>
<tr>
<td>1968</td>
<td>846</td>
<td>1,820</td>
<td>68</td>
<td>60</td>
<td>-966</td>
</tr>
<tr>
<td>1969</td>
<td>1,037</td>
<td>2,307</td>
<td>91</td>
<td>93</td>
<td>-1272</td>
</tr>
<tr>
<td>1970</td>
<td>1,127</td>
<td>2,107</td>
<td>99</td>
<td>130</td>
<td>-1011</td>
</tr>
<tr>
<td>1971</td>
<td>1,496</td>
<td>2,485</td>
<td>85</td>
<td>133</td>
<td>-1037</td>
</tr>
<tr>
<td>1972</td>
<td>1,778</td>
<td>2,907</td>
<td>88</td>
<td>191</td>
<td>-1232</td>
</tr>
<tr>
<td>1973</td>
<td>2,171</td>
<td>3,553</td>
<td>119</td>
<td>212</td>
<td>-1475</td>
</tr>
<tr>
<td>1974</td>
<td>1,953</td>
<td>3,892</td>
<td>142</td>
<td>260</td>
<td>-2057</td>
</tr>
<tr>
<td>1975</td>
<td>2,045</td>
<td>4,522</td>
<td>180</td>
<td>206</td>
<td>-2503</td>
</tr>
<tr>
<td>1976</td>
<td>2,942</td>
<td>5,473</td>
<td>171</td>
<td>231</td>
<td>-2591</td>
</tr>
<tr>
<td>1977</td>
<td>3,721</td>
<td>6,848</td>
<td>195</td>
<td>235</td>
<td>-3167</td>
</tr>
<tr>
<td>1978</td>
<td>4,752</td>
<td>8,086</td>
<td>314</td>
<td>262</td>
<td>-3282</td>
</tr>
<tr>
<td>1979</td>
<td>4,489</td>
<td>8,666</td>
<td>445</td>
<td>365</td>
<td>-4097</td>
</tr>
<tr>
<td>1980</td>
<td>3,405</td>
<td>7,599</td>
<td>420</td>
<td>355</td>
<td>-4129</td>
</tr>
<tr>
<td>1981</td>
<td>4,151</td>
<td>9,230</td>
<td>554</td>
<td>342</td>
<td>-4867</td>
</tr>
</tbody>
</table>

**Source:** Estimates compiled on the basis of information from Transport Industries Branch, IT&C.
productive capacity in excess of that needed to serve the Canadian market. This expanded capacity, together with an unexpected lack of growth in the Canadian automotive market and significant overseas import penetration led to a gradual erosion of the U.S. surplus until 1969 and eventually to a deficit (1970-1972).

Between 1973 and 1975, the Canadian market for U.S. auto products had strengthened and the deficit started rising until it reached a peak in 1975 when there was a recession in the U.S.A. but the demand in Canada remained high. This increasing deficit was due principally to an increasing deficit in auto parts. By 1979, the deficit in auto parts trade had increased to over $4 billion and the surplus in completed vehicle trade had declined to less than $1 billion. In 1980 and 1981, the degree of Canadian deficit in the auto parts trade showed a further increase and Canadian imports of completed vehicles from overseas countries almost doubled.
APPENDIX B

SAMPLE SELECTION AND SELECTED CHARACTERISTICS OF INDIVIDUALS

(a) Sample Selection

The major problem is to identify those cases who were permanently separated from the auto industry before the end of the sample period. The reemployment rate and earning opportunities in subsequent jobs of these "adjustment cases" allows estimates to be made of the adjustment problems of auto workers.

The major layoffs which attracted public attention began in the middle of 1979. Unfortunately, the data used in this study only include job separations before the end of 1979. The fluctuations in employment during the sample period possibly represent sectoral and modest cyclical changes rather than a serious downturn. Hence, the adjustment cases probably represent the marginal workers in the auto industry, i.e., younger, less skilled and less senior workers, while a complete plant shut-down would include the more skilled, higher seniority workers. Both based on measurable characteristics and on the probability that these adjustment case workers have fewer desirable work-oriented characteristics, and hence, had been let go by the industry, it is expected they represent the worst
cases with respect to reemployment rates and earnings, and hence, generate upper bound estimates of relative losses.

The other group of workers who experienced repeated spells of unemployment, but were not permanently laid off from the auto industry, are the "non-adjustment cases". This group represents the workers with higher seniority, skills and wages. These workers are nevertheless subject to frequent temporary layoffs owing to cyclical down-turns of plant retooling.

The two-state employment/unemployment profile of an individual is depicted in Figure B.1. The two-state model gives us valuable information about the individual's earnings in prior and subsequent jobs, permanency of prior and subsequent jobs and other personal characteristics. Among all the jobs held by an individual during 1974-1979, we need to recognize those in the automobile sector. This may be a string of jobs. We identify his last completed job in the automobile sector during 1974-1979 with an F. We then trace back his employment experience in the automobile sector over time to find when this started. The first job in this string of employment (or "auto string") after January 1974 is marked with an S. One non-automobile sector job is permitted
Figure B.1

Employment-Unemployment Profile
of Auto Workers

E1...E7: Employment experience of those workers who ever experienced unemployment.

U1...U7: Unemployment experiences

A: Auto jobs
NA: Non-auto jobs when workers are on temporary layoffs.
S: Start of individual's employment experience in auto industry.
F: Final job in auto industry
F+1: Next employment/unemployment experiences of adjustment cases.
F-1: Previous employment/unemployment experiences of both adjustment and non-adjustment cases.

Auto-String: Includes all employment/unemployment experiences between S and F.
between any two automobile jobs in a string to allow for a worker taking other employment while on temporary layoff.

For an individual who has just one job in the auto industry, $S$ and $F$ are identical. Individuals who find work elsewhere after indefinite layoff from the auto industry will be potential adjustment cases for whom the subsequent employment and unemployment experiences are analyzed. The workers who are either still employed in the auto sector at the end of the sample period or if separated from an auto job are still unemployed by that time form the potential non-adjustment cases.

It is of interest to analyze the personal characteristics and employment/unemployment experiences of all individuals who ever experienced unemployment in the automotive industry during 1974-79 as well as those of the subgroups that constitute adjustment and non-adjustment cases. For the purpose of adjustment costs, we can compare the earnings of the adjustment cases in the auto industry with their non-auto earnings. In terms of Figure A.1, $F$ is the dividing point. Before $F$ most jobs are auto jobs and after $F$, all jobs represent non-auto experiences. Operationally, if we can identify the same group of individuals experiencing
employment/unemployment episodes before and after F, we would be in a position to estimate the adjustment costs.

We have a sample of 1,222 individuals with 8,631 job separations averaging about 7 separations per individual over the sample period. About 75% of these separations originated from the automotive industry of which 99 percent occurred between S and F. The remaining 25 percent originated from the non-auto sector: 15.8 percent were before "S" and 9 percent were after F. These 9 percent separations were accounted for by 24 percent of workers in this automobile worker sample. Analysis of this data indicates that the adjustment cases have had an average 2.6 spells of unemployment per person after F. The number of non-auto jobs for all workers between S and F is only 90 (or .2% of all jobs) which shows that the vast majority of workers after temporary layoff from the auto industry did not look for alternative jobs elsewhere. It will be shown later that there are very high rates of recall in the auto sector. There were altogether only 87 auto jobs before S which indicates that we have not excluded a large number of auto-separations in constructing the employment/unemployment profile in the auto industry.
(b) **Selected Characteristics of Workers Experiencing Periodic Unemployment in the Automotive Industry**

The major downturn in the auto industry began around the second quarter of 1979. Windsor was particularly affected by the downturn with the volume of indefinite layoffs rising from 252 persons in the last half of 1978 to 599 in the first half of 1979, 2,999 in the second half of 1979 and 3,324 in the first half of 1980.¹ Since our sample covers the period between 1974 and 1979, only a short duration of the downturn was experienced by the unemployed workers in our sample. Hence, the permanently separated cases will most likely represent those workers who were marginally attached to the auto industry. Given that this is the case, it would be interesting to examine how the sample characteristics of the permanently separated or adjustment cases differ from the non-adjustment cases in the automobile industry. It would also be useful to compare the characteristics of the entire automobile sector labour force, where possible, with those of the workers experiencing some unemployment.

In Table B.1, the various socio-economic characteristics are presented for the overall auto sector labour force, all workers experiencing some unemployment, and
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>All Auto Sector Workers</th>
<th>All Auto Workers Experiencing Unempl. (1974-1979)</th>
<th>Adjustment Cases</th>
<th>Non-Adjustment Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Number of individuals</td>
<td>117,000***</td>
<td>1221**</td>
<td>295</td>
<td>926</td>
</tr>
<tr>
<td>2. Age (Years)</td>
<td></td>
<td>35.14</td>
<td>28.48</td>
<td>37.26</td>
</tr>
<tr>
<td>3. Age Distribution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-24 years</td>
<td>14.82***</td>
<td>26.7</td>
<td>44.4</td>
<td>18.7</td>
</tr>
<tr>
<td>25-44 years</td>
<td>56.80</td>
<td>49.1</td>
<td>47.5</td>
<td>51.9</td>
</tr>
<tr>
<td>45-54 years</td>
<td>19.25</td>
<td>13.9</td>
<td>5.7</td>
<td>16.5</td>
</tr>
<tr>
<td>55+</td>
<td>9.13</td>
<td>10.3</td>
<td>2.4</td>
<td>12.9</td>
</tr>
<tr>
<td>4. Sex (proportion of Males)</td>
<td>.88***</td>
<td>.81</td>
<td>.82</td>
<td>.81</td>
</tr>
<tr>
<td>5. DEPST: Proportion of unemployed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>with dependents</td>
<td>.41</td>
<td>.28</td>
<td>.45</td>
<td></td>
</tr>
<tr>
<td>6. MAXI: Proportion of jobs with</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wages above maximum insured earnings****</td>
<td>.72</td>
<td>.46</td>
<td>.80</td>
<td></td>
</tr>
<tr>
<td>7. SVP: Number of years of special</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vocational training</td>
<td>.48</td>
<td>.44</td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>8. SIC: Assembly (%)</td>
<td>44.84***</td>
<td>58.0</td>
<td>31.6</td>
<td>66.5</td>
</tr>
<tr>
<td>Trucks (%)</td>
<td>12.55</td>
<td>7.9</td>
<td>16.9</td>
<td>5.0</td>
</tr>
<tr>
<td>Parts (%)</td>
<td>42.61</td>
<td>34.1</td>
<td>51.5</td>
<td>28.5</td>
</tr>
</tbody>
</table>

* Workers experiencing unemployment are defined as those that have endured at least one spell of unemployment during 1974-79.

** Sample fraction 1/100.

*** Statistics Canada Employment, Hours and Weekly Earnings Catalogue 72.002. All variables refer to 1979 level except sex which is derived by averaging over 1975-79. It is also assumed that an average earning in our sample will be equal to the average weekly earning in the auto labour force. The age distribution is derived from 1971 census data.

**** Maximum insured earnings in 1979 was $265.
the adjustment and non-adjustment cases. Let us first consider the age variable for adjustment and non-adjustment cases. In row 2 of the table, average age is reported. The adjustment cases appear to be 9 years younger than those who remained attached to the automobile industry. This indicates that the company responds to reduced demand for its product by laying off the junior, less experienced workers. This is confirmed by the age distribution of different types of workers which is reported in row 3. The distribution of the adjustment cases shows that a little over 44.4 percent of the adjustment cases are less than 24 years of age as compared to 18.7 percent for the non-adjustment cases.

It appears in row 4 that the proportion of males among the three groups of auto workers who experienced unemployment is very similar. However, the proportion of males among the unemployed in the auto industry is lower by 7 percent than their proportion in the auto labour force. A combination of factors may have produced this result: higher average training level, possible positive discrimination by employers and their position as primary income earners.

It would be valuable to examine information
concerning the relative hardship of auto workers who were permanently laid off from the industry with those that remained attached to it. To this end, a measure of hardship experienced by the unemployed workers may be defined to be the relative size of the labour force with dependents. Generally, workers with dependents have greater financial pressure to maintain their jobs. A comparison of auto workers with dependent status in row 5 indicates that about 28 percent of the adjustment cases from the auto industry had dependents as compared to 45 percent of those who remained in the auto industry.

The maximum insured earnings indicator takes a value of one when a person earns more than the maximum insured earnings otherwise, it takes zero value when the wage rate is below this level. Row 6 shows that over 80 percent of the non-adjustment cases were earning above the maximum insured earnings which are approximately equal to the average industrial earnings, as compared to 46 percent for the adjustment cases. Higher average wage rates of the non-adjustment cases tend to be related to the level of seniority and the skill required by the job. In our sample, the higher-skilled workers (i.e., non-adjustment cases in our sample) with high wage rates tend to have a more stable attachment to the auto industry. In general, however, the
average number of years of specific vocational training is quite low for all auto workers. The non-adjustment cases have a slight edge in this skill index over the adjustment cases. Evidence in Row 8 suggests that a high proportion of parts workers are permanently separated from the auto industry.
APPENDIX C

THE STRUCTURE OF EMPLOYMENT IN THE AUTO INDUSTRY

An important consideration in the design of any sector specific employment policy is to determine the type and the structure of employment provided by the sector. While considerable attention has been focused on the unemployment experience of individuals in the economics literature, relatively little emphasis has been placed on the nature of employment experienced by those who have become unemployed. One measure of employment experience is the proportion of labour force time the auto workers spent in employment. Row 3 of Table D.1 indicates that the average proportion of labour force time that adjustment cases spent employed prior to leaving the automobile industry is 76 percent as compared to 80 percent of the recalled cases.

In panel (a) of Figure C.1, the distribution of the adjustment cases before being permanently laid off from the auto industry is shown according to the proportion of time employed. Panel (b) shows the distribution for the same group of workers except it also includes their employment experiences in the non-auto sectors. Examination of these
Figure C.1
Distribution of Unemployed by
Proportion of Time Employed

(a)

(b)

(c)

% of workers
before
layoff

% of workers
after 12
layoff

% of non-
adjustment
cases

Proportion of time employed (EMPIX)

EMPIX

EMPIX

EMPIX
two figures indicates that about 54 percent of the adjustment cases have worked over 80 percent of the time they have been in the auto labour force in comparison to 29 percent of the same individuals who worked more than 80 percent of the time if employment experiences in the non-auto sectors are also included. It shows that while there are repeated spells of unemployment (turnover effect) in the automotive industry, the total labour force time that a typical worker spends on employment is fairly high. The long duration of unemployment (duration effect) may have caused the employment index to decline in the post layoff labour force time. As a contrast, the relatively short unemployment spells may have raised the employment index in the auto industry. Panel (c) indicates roughly 60 percent of those who remained in the auto industry had worked more than 80 percent of the time.

Overall, it is evident that the auto industry characterizes a situation where the workers experience intermittent spells of unemployment usually of short durations. Once the individuals leave the auto industry and are not on temporary layoff, they take longer (perhaps voluntarily) to find subsequent jobs. On average, a typical worker in the auto industry spends a higher proportion of his time employed as compared to his subsequent employment experiences in the non-auto sector. This high employment index may have resulted from the relatively short duration of unemployment spells in the automotive industry.
APPENDIX D

UNEMPLOYMENT EXPERIENCE

It is important to understand the nature of unemployment and employment for auto industry workers before any sector specific policy to assist the firms and workers is adopted. If we hold the optimistic view that the present setback on employment is temporary and the restructuring currently underway will lead to a resurgence of employment eventually, then the appropriate policy may be to commit budgetary funds to assist the industry. It would then be necessary to know the structure of employment saved by committing such funds. However, if the pessimistic view that the present setback on employment is permanent holds true, it would be valuable to know the kind of unemployment experienced by these workers as compared to their experiences in the auto industry. The concern to know the unemployment experiences is further prompted if the regular unemployment insurance and other employer funded benefits will be exhausted for a large proportion of indefinitely laid off workers.

The rate of unemployment depends on both the number of times a person becomes unemployed and the duration of
unemployment. A short duration effect on unemployment may be partially offset by a higher turnover effect in determining the rate of unemployment. It would be interesting to determine if the auto industry exhibits the unemployment situation where many people with high turnover rates are experiencing unemployment for periods of short duration or if it exhibits a situation where a few people are experiencing long durations of unemployment.

There is an ongoing controversy about the relative importance of the two components in determining the rate of unemployment in the economic literature. One school of economists believe that unemployment primarily represents a situation where many people are experiencing unemployment (high turnover effect) for short durations. In such a situation, unemployment is more or less a random phenomenon.

Another school of economists consider unemployment to be concentrated among a small group of individuals who remain unemployed for an extended period of time (duration effect). In this case, unemployment is not a random phenomenon but may be related to individual characteristics. A previous study by Hall indicates that temporary layoffs are a major source of turnover. This was especially found in a situation when a
worker experienced some period of unemployment between two jobs. His study further indicates that turnover is much higher among workers who have been employed on the current job for a relatively short period. This indirectly means a pattern of declining frequency of unemployment with age and job specific experience. If a worker feels dissatisfied about the job or if the employer is not very pleased with the worker's performance, the job is expected to terminate within the first few months. The probability of layoffs and quits drops rapidly as the time since the start of a job increases. Hall's study also shows that intergroup variation in unemployment can be more adequately explained by a higher turnover rate than by long duration.

The Keynesian theory of unemployment implies that workers who are separated from their jobs when demand declines will be reemployed only if aggregate demand increases again. Both the layoff and the return to work is the involuntary choice of the worker. In contrast, search theory suggests that layoffs are characterized as involuntary while return to work is regarded as the choice of the individual. But the recent work by Feldstein in this subject seems to indicate that in general there is a lack of job search activities by many of the unemployed as well as a high probability of being recalled, i.e., many workers experience frequent spells of unemployment without losing
their jobs. He also concludes that the typical duration of unemployment is very short: temporary layoff is an important aspect of unemployment.

Perry's study tries to break down the published unemployment rates for different demographic groups into various unemployment rates by the frequency and the duration of unemployment. His work reveals that the deteriorating unemployment rates of young workers relative to older ones is associated with an increase in frequency rather than in duration. This emphasizes the importance of temporary but frequent spells of unemployment in explaining the high unemployment rate experienced by a demographic group in the labour market.

Frank and Freeman also tried to assess the contribution of variations in unemployment duration and frequency to variations in individual unemployment. Their results are consistent with the pattern observed in the earlier studies and conclude that much of the intergroup variation in unemployment can be explained by high turnover effect. However, their conclusion is less certain when it is applied to intragroup variation in unemployment. The evidence suggests that for certain high unemployment groups,
the duration of unemployment plays an equally important role in explaining the variation in unemployment.

In a recent study, Clark and Summers\(^9\) indicated that the total time spent unemployed resulted disproportionately from those experiencing long unemployment spells. The main theme of their paper is that most unemployment is characterized by a relatively few persons who experience prolonged unemployment spells. They further show that the normal turnover effect can only account for a small fraction of measured unemployment. If the unemployment is concentrated in a subgroup of workers as hypothesized by Clark and Summers, then Government manpower policy could be directed to reducing unemployment for this group. It is evident from the above discussion that given this ongoing controversy about the relative importance of high turnover and long spells of unemployment in determining the rate of unemployment, it is essential to investigate some employment/unemployment characteristics of the workers in the auto industry experiencing some unemployment. The three labour market experiences of workers which can partially clarify the above controversy are: the average duration of unemployment, the frequency of unemployment and the proportion of time spent employed. These variables are estimated in the following way:
Duration of Unemployment:

\[ WKSUN_F = WKSJTJ_F - WKSNL_F \]

Where \( WKSUN_F \) = Duration of unemployment in the Fth unemployment spell bounded by two employment periods.

\( WKSJTJ_F \) = Total weeks between two jobs in the Fth unemployment spell.

\( WKSNL_F \) = Number of weeks out of labour force between jobs in the Fth separation.

The frequency of unemployment:

\[ T_d = \frac{S_d}{NWKL_d} \quad (52) \]

where \( T_d \) = Frequency of unemployment per year experienced by ith worker.

\( S_d \) = Total number of unemployment spells the ith worker had as of F.

\( NWKL_d \) = Total number of weeks the ith worker was in the labour force as of F.

Proportion of time employed:

\[ EMINDX_d = \frac{E_d}{E_d + U_d} = \frac{E_d}{NWKL_d} \]
where $EMINDX_i$ = proportion of labour force time spent on employment by the $i$th worker as of $F$.

$E_i$ and $U_i$ = Total time (weeks) spent in employment and unemployment by the $i$th worker as of $F$. 
In table D.1, the above estimates for those workers who experienced some unemployment in the automobile industry are reported. The average duration of unemployment is reported in rows 1(a) and 1(b). For all separations in both the auto and non-auto sectors, the average duration of unemployment is somewhat over 7 weeks. This average estimate is biased upward since it also includes the unemployment experiences in the non-auto sector. Row (b) indicates the duration of the unemployment spell when an individual reaches F in his employment/unemployment profile. The average unemployment duration is 26.63 weeks immediately after separation from the automotive industry for the adjustment cases as compared to 9.68 weeks for the non-adjustment cases.

In row 2, the turnover effect is reported. Every auto worker, on average, had .87 unemployment spells of greater than or equal to 1 week duration compared to .94 and .62 spell for the non-adjustment and the adjustment cases respectively. It is interesting to note that the adjustment cases, while in the auto industry, experience .33 spell of unemployment of greater than or equal to 4 weeks as compared to .26 spells for the recalled cases. It appears that auto workers in general experience short but repeated spells of unemployment. A comparison of adjustment and non-adjustment
### Table D.1

**Selected Employment/Unemployment Characteristics of the Unemployed Workers from the Automobile Industry**

<table>
<thead>
<tr>
<th></th>
<th>ALL AUTO WORKERS</th>
<th>ADJUSTMENT CASES</th>
<th>NON-ADJUSTMENT CASES (RECALLED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (a) Average duration of Unemployment spell (over all spells)* (Weeks)</td>
<td>7.38 (19.30)**</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>(b) Average duration of completed unemployment spells after last separation in auto industry (wks)</td>
<td>13.78 (30.88)</td>
<td>26.63 (39.12)</td>
<td>9.68 (26.50)</td>
</tr>
<tr>
<td>2. Turnover (occurrences per year)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Frequency of unemployment spells ≥ 4 wks.</td>
<td>.27 (.29)</td>
<td>.33 (.33)</td>
<td>.26 (.28)</td>
</tr>
<tr>
<td>(b) Frequency of unemployment spells ≥ 1 wk.</td>
<td>.87 (.71)</td>
<td>.62 (.56)</td>
<td>.94 (.74)</td>
</tr>
<tr>
<td>3. Average proportion of time auto workers spent employed as proportion of their time in labour force</td>
<td>.79 (.19)</td>
<td>.76 (.21)</td>
<td>.80 (.19)</td>
</tr>
</tbody>
</table>

* All unemployment spells experienced by the auto workers in both auto and non-auto sectors. About 75% of these spells were associated with the automobile industry.

** Standard deviation.
cases suggests that the former auto workers experienced a considerably longer duration of unemployment before they found their first non-auto job. These workers experienced a higher frequency of longer duration spells while being in the auto labour force as compared to workers who are still associated with the auto industry: the last hired were the first laid off.

The average estimates of duration of unemployment together with the proportion of time employed, and turnover rate may give us a misleading picture about the auto industry as these variables have skewed distributions resulting in the estimates being disproportionately affected by a few cases in the tail of the distribution. It is therefore important to investigate the distribution of these variables for the various types of workers. Furthermore, the labour displacement costs borne by the workers depend on many factors: one important factor is the length of time the workers take to find subsequent jobs. Figure D.1 illustrates the distribution of duration of completed spells of unemployment.

The analysis of the durations of unemployment in both the auto and non-auto sectors indicates that about 81 percent of all separations lasted less than or equal to eight
Figure D.1
Distribution of Duration of Completed Spells of Unemployment

Proportion of Unemployment Spells

Both auto and non-auto sector
Auto sector only

81.1% of all spells
87.8% of auto spells
Remainder 15.3% of all spells
Remainder 9.7% of auto spells

Duration of Unemployment Spells (Weeks)
weeks. About 15.3 percent of spells recorded 12 weeks or more of unemployment. These results suggest that the distribution of the duration of unemployment is skewed to the right which indicates that a very large proportion of the separations ended with short spells and only a small number of separations had a long duration. The average duration of unemployment calculated in the previous section is affected disproportionately by few cases of long duration. This distribution is further skewed to the right if we only consider all separations in the automotive industry. It was found that about 88 percent of all auto separations lasted less than or equal to 8 weeks of unemployment. This confirms the hypothesis that the unemployment associated with the auto industry is mainly due to spells of unemployment of short duration. Only 9.7 percent of the spells ended after 12 or more weeks of unemployment.

Since a given rate of unemployment can be the result of various combinations of turnover and duration effect, it is important to examine the distribution of the frequency of unemployment for the auto workers. This distribution is then compared with the overall distribution for the Canadian labour force in Figure C.2.

It was found that 36 percent of the auto labour force had a value of T less than .25 as compared to
Figure D.2

Distribution of the Turnover Rates of the Canadian and Auto Labour Force

Average frequency of unemployment spells per year in labour force

- - - - Auto Labour Force
----- Canadian Labour Force

Percentage of labour force

.25 .36 .50 .64 .75 100
64 percent for the Canadian labour force. This means that 64 percent of the auto labour force experienced unemployment at least once every four years and the corresponding figure for the Canadian labour force is about 36 percent. Even for the subgroup which experiences unemployment once in the last four years, the frequency of unemployment is unevenly distributed. Given this uneven distribution of the frequency of unemployment, the average unemployment rate which is measured as a percentage of the labour force, would most likely be a poor measure of the unemployment experience of a typical worker.

The adjustment cases experienced a very long duration of unemployment before they found their first alternative jobs in the non-auto sectors. In the formulation of policy regarding unemployment, it would be valuable to know whether this pattern of long duration of unemployment continues over time. The average duration of unemployment spells after F is about 16.25 weeks which is lower than the average duration experienced in the initial period following permanent separation from the auto industry. Figure D.3 indicates that about 33 percent of the non-auto unemployment spells lasted more than 12 weeks as compared to 9.7 percent in the auto industry. This evidence reveals that once an individual leaves the auto industry and subsequently becomes unemployed, it takes considerably less time to find an
Figure D.3

Distribution of Duration of Unemployment Spells in the Non-Auto Sector

Proportion of employment spells

60% of spells

33% of spells

4 8 12
Duration of Unemployment Spells (Weeks)
alternative job than after the initial separation. This result may arise because the workers are entitled to receive SUB payments in the initial period following layoffs from the auto industry. The SUB payments are not generally available during subsequent unemployment situations, and hence, the workers may be expected to look for alternative jobs faster.

Another source of evidence that can assist in explaining the duration of unemployment spells is the reason for separation and recall frequency. In the case of the automobile industry, it was found that about 57 percent of all separations were related to layoffs, compared to 43 percent of all separations in the non-auto sectors. Of those who were laid off in the auto sector, 88.7 percent were recalled to their jobs as compared to 35 percent recalled cases in subsequent non-auto jobs. It was also found that 4 percent of the separations in the auto industry were initiated by the workers themselves (voluntary quits) whereas the quit rate among the former auto workers who experienced unemployment in the non-auto sectors was 29 percent. Clearly, the evidence suggests that layoffs are the major reason for job separations in the automobile industry and a vast majority of these cases are subsequently recalled to
their prior jobs. However, for the adjustment cases, a large proportion of job separations in the non-auto sector were self-initiated.

One indicator of the hardship experienced by unemployed workers is the relative importance of layoff related unemployed time to the total unemployed time experienced by the worker. Most financial compensation (i.e., regular UI and supplemental unemployment benefits) is paid out on this basis as it represents the involuntary choice of a worker to remain unemployed. Hence, it is important to know what proportion of the total unemployed time in the automotive industry is accounted for by layoffs. This proportion has been estimated for all auto separations in the following way:

$$Z = \frac{\sum_{i=1}^{N} WKSUN_{1i}}{\sum_{i=1}^{N} \sum_{j=1}^{8} WKSUN_{ij}}$$

Where $i = 1 ... N$ unemployment spells.

$j = 1 ... 8$ reason for unemployment spell (when $j=1$, it indicates layoff)

$WKSUN_{ij} = \text{duration of } i\text{th separation (weeks) that occurred because of } j\text{th separation reason.}$
The fraction \( Z \) represents the proportion of the total unemployed time in the auto industry that is related to layoffs. Our estimate indicates this proportion to be 0.61. This can be used as an estimate of the proportion of unemployed time experienced by auto-sector workers during which SUB are expected to be collected.
APPENDIX E

ALTERNATIVE ESTIMATION RESULTS

1. Wage Determination

1(a) $\ln W = 4.23 + .449(\text{SEX}) + .031(\text{AGE1}) - .005(\text{AGE2})$
\hspace{1cm} (2.89) \hspace{1cm} (1.03) \hspace{1cm} (-.11)
+ .010(\text{AGE3}) - .013(\text{AGE4}) - .153(\text{LESKIL}) - .557(\text{TIMLF1})
\hspace{1cm} (.20) \hspace{1cm} (-.92) \hspace{1cm} (-1.51) \hspace{1cm} (-1.88)
- .473(\text{TIMLF2}) - .350(\text{TIMLF3})
\hspace{1cm} (-1.62) \hspace{1cm} (-1.22)

Likelihood Ratio Test ($X^2$) \hspace{1cm} 96.63

(Degree of Freedom) \hspace{1cm} 9

Pseudo $R^2$ \hspace{1cm} .43

Where:

If $\text{AGE} < 25$ then $\text{AGE1} = \text{AGE}$ and $\text{AGE2} = \text{AGE3} = \text{AGE4} = 0$

If $25 < \text{AGE} \leq 30$ then $\text{AGE1} = 25$, and $\text{AGE2} = \text{AGE}-25$, and $\text{AGE3} =$
\hspace{1cm} $\text{AGE4} = 0$

If $30 < \text{AGE} \leq 35$ then $\text{AGE1} = 25$, $\text{AGE2} = 5$, $\text{AGE3} = \text{AGE}-30$ and
\hspace{1cm} $\text{AGE4} = 0$

If $\text{AGE} > 35$, then $\text{AGE1} = 25$, $\text{AGE2} = 5$, $\text{AGE3} = .5$ and $\text{AGE4} = \text{AGE}-35$

1(b) $\ln W = 3.27 + .56(\text{SEX}) + .20(\text{DEPST}) + .007(\text{AGE1}) + .017(\text{AGE2})$
\hspace{1cm} (4.63) \hspace{1cm} (1.61) \hspace{1cm} (.67) \hspace{1cm} (.50)
- .005(\text{AGE3}) - .011(\text{AGE4}) - .112(\text{LESKIL}) - .150(\text{SUBSEQ})
\hspace{1cm} (-.10) \hspace{1cm} (-.95) \hspace{1cm} (-1.16) \hspace{1cm} (-1.56)
\hspace{1cm}
- .007(\text{WKSJIT}) + .14(\text{D1}) + .044(\text{D2}) + .102(\text{D3}) - .156(\text{D4})
\hspace{1cm} (-.50) \hspace{1cm} (.40) \hspace{1cm} (.14) \hspace{1cm} (.76) \hspace{1cm} (-.83)
\hspace{1cm}
- .140(\text{D5}) - .413(\text{D6}) - .072(\text{D7}) + .023(\text{D8})
\hspace{1cm} (-.87) \hspace{1cm} (-.245) \hspace{1cm} (-.262) \hspace{1cm} (.143)
\hspace{1cm}
- .222(\text{MOVE}) + .002(\text{SEPWK1}) - .08(\text{QUIT1})
\hspace{1cm} (-1.29) \hspace{1cm} (2.70) \hspace{1cm} (-.73)
\hspace{1cm}
- .04(\text{QUIT2}) - .157(\text{OTHER})
\hspace{1cm} (-.29) \hspace{1cm} (.47)

Likelihood Ratio Test ($X^2$) \hspace{1cm} 232.72

(Degree of Freedom) \hspace{1cm} 22

Pseudo $R^2$ \hspace{1cm} .48
2. Proportion of Time Employed in the Automobile Industry

2(a) Adjustment Cases

\[
EMP\text{X} = 0.375 + 0.083(\text{SEX}) + 0.012(\text{AGE1}) + 0.001(\text{AGE2}) \\
\quad \quad \quad \quad \quad (2.00^*) \\
\quad \quad \quad \quad \quad (1.22) \\
\quad \quad \quad \quad \quad (0.083) \\
\quad \quad \quad \quad \quad (-0.04(\text{AGE3}) - 0.001(\text{AGE4}) + 0.004(\text{MAX1}) + 0.027(\text{DEPST}) \\
\quad \quad \quad \quad \quad (-0.36) \\
\quad \quad \quad \quad \quad (-1.16) \\
\quad \quad \quad \quad \quad (0.13) \\
\quad \quad \quad \quad \quad (0.64) \\
\quad \quad \quad \quad \quad + 0.023(D1) + 0.06(D2) - 0.091(D3) + 0.007(D4) + 0.027(D5) \\
\quad \quad \quad \quad \quad (0.395) \\
\quad \quad \quad \quad \quad (0.732) \\
\quad \quad \quad \quad \quad (-1.54) \\
\quad \quad \quad \quad \quad (0.071) \\
\quad \quad \quad \quad \quad (0.386) \\
\quad \quad \quad \quad \quad + 0.006(D6) - 0.02(D7) + 0.134(D8) - 0.031(\text{LESKIL}) \\
\quad \quad \quad \quad \quad (-0.107) \\
\quad \quad \quad \quad \quad (0.276) \\
\quad \quad \quad \quad \quad (1.37) \\
\quad \quad \quad \quad \quad \quad \quad \quad + 0.053(\text{SECD1}) \\
\quad \quad \quad \quad \quad \quad \quad \quad (1.50)
\]

Likelihood Ratio Test (\(X^2\)) \(32.98\)
(Degree of Freedom) \(17\)
Pseudo R\(^2\) \(0.12\)
Observation \(255\)
Degree of Truncation \(0.10\)

\*t-statistics

2(b) Non-Adjustment Cases

\[
EMP\text{X} = -0.126 + 0.068(\text{SEX}) + 0.033(\text{AGE1}) + 0.004(\text{AGE2}) \\
\quad \quad \quad \quad \quad (3.41) \\
\quad \quad \quad \quad \quad (5.63) \\
\quad \quad \quad \quad \quad (0.94) \\
\quad \quad \quad \quad \quad + 0.006(\text{AGE3}) + 0.0001(\text{AGE4}) + 0.026(\text{MAX1}) + 0.028(\text{DEPST}) \\
\quad \quad \quad \quad \quad (1.51) \\
\quad \quad \quad \quad \quad (-0.04) \\
\quad \quad \quad \quad \quad (1.26) \\
\quad \quad \quad \quad \quad (1.79) \\
\quad \quad \quad \quad \quad + 0.029(D1) + 0.034((D2) - 0.067(D3) + 0.007(D4) - 0.023(D5) \\
\quad \quad \quad \quad \quad (-0.94) \\
\quad \quad \quad \quad \quad (1.12) \\
\quad \quad \quad \quad \quad (-2.44) \\
\quad \quad \quad \quad \quad (0.24) \\
\quad \quad \quad \quad \quad (-0.76) \\
\quad \quad \quad \quad \quad + 0.105(D6) - 0.83(D7) + 0.014(D8) - 0.013(\text{LESKIL}) \\
\quad \quad \quad \quad \quad (2.44) \\
\quad \quad \quad \quad \quad (-4.22) \\
\quad \quad \quad \quad \quad (0.38) \\
\quad \quad \quad \quad \quad (-0.84) \\
\quad \quad \quad \quad \quad \quad \quad \quad + 0.016(\text{SECD1}) \\
\quad \quad \quad \quad \quad \quad \quad \quad (0.92)
\]

Likelihood Ratio Test (\(X^2\)) \(211.20\)
(Degree of Freedom) \(17\)
Pseudo R\(^2\) \(0.75\)
Observation \(695\)
Degree of Truncation \(0.06\)
3. Estimation of Factors Affecting the Probability of
Finding Employment

3(a)  
\[
\text{EMPL1} = -0.422 - 0.044(\text{SEX}) + 0.043(\text{AGE1}) + 0.07(\text{AGE2}) - 0.017(\text{AGE3}) \\
\quad (-2.27) \quad (1.0) \quad (1.55) \quad (-0.36) \\
\quad - 0.004(\text{AGE4}) + 0.517(\text{QUIT}) - 0.180(\text{OTHER}) + 0.126(\text{EMPIXA}) \\
\quad (-0.25) \quad (4.03) \quad (-1.28) \quad (0.41) \\
\quad + 0.15(\text{MAX1}) + 0.09(\text{DEPST}) - 0.002(\text{SVP}) - 0.106(\text{BNWKEL}) \\
\quad (1.23) \quad (0.75) \quad (-0.03) \quad (-9.89) \\
\quad - 0.096(\text{URATP1}) - 0.5(\text{D1}) + 0.38(\text{D2}) - 0.2(\text{D3}) + 0.28(\text{D4}) \\
\quad (-2.05) \quad (-2.29) \quad (1.52) \quad (-0.92) \quad (1.08) \\
\quad + 0.16(\text{D5}) - 0.12(\text{D6}) - 0.08(\text{D7}) + 0.21(\text{D8}) - 0.35(\text{SECD1}) \\
\quad (0.72) \quad (-0.46) \quad (-0.32) \quad (0.87) \quad (-1.75) \\
\quad - 0.21(\text{SECD2}) - 0.46(\text{SECD3}) \\
\quad (-0.85) \quad (-2.81)
\]

Likelihood Ratio Test (\(X^2\)) \(218.28\)

(Degree of Freedom) \(24\)

Pseudo \(R^2\) \(0.35\)

Positive Observation \(0.42\)

Total Observation

3(b) Estimation of Factors Affecting the Probability of Losing
A Job

\[
\text{LOSE1} = -1.88 + 0.31(\text{SEX}) + 0.03(\text{AGE1}) + 0.015(\text{AGE2}) + 0.005(\text{AGE3}) \\
\quad (2.0) \quad (2.27) \quad (0.34) \quad (0.11) \\
\quad - 0.02(\text{AGE4}) + 0.019(\text{OTHER}) - 0.71(\text{EMPIXA}) + 0.16(\text{RECAL}) \\
\quad (-0.97) \quad (0.14) \quad (-2.5) \quad (0.95) \\
\quad - 0.09(\text{DEPST}) - 0.037(\text{SVP}) + 0.45(\text{URATP1}) - 0.12(\text{QUIT1}) \\
\quad (-0.81) \quad (-0.81) \quad (1.44) \quad (-0.66) \\
\quad + 0.05(\text{QUIT2}) + 0.003(\text{BNWKEL}) + 0.0005(\text{PREEMP}) - 0.002(\text{PRUNEM}) \\
\quad (0.33) \quad (0.95) \quad (0.80) \quad (-0.75) \\
\quad - 0.057(\text{SUBSEQ}) - 2.76(\text{D1}) + 0.05(\text{D2}) + 0.14(\text{D3}) + 0.09(\text{D4}) \\
\quad (-0.43) \quad (-0.77) \quad (1.5) \quad (0.46) \quad (0.22) \\
\quad - 0.35(\text{D5}) + 0.31(\text{D6}) + 0.25(\text{D7}) + 0.49(\text{D8}) \\
\quad (-0.84) \quad (0.89) \quad (0.67) \quad (2.5)
\]

Likelihood Ratio Test (\(X^2\)) \(50.87\)

(Degree of Freedom) \(25\)

Pseudo \(R^2\) \(0.095\)

Positive Observation \(0.22\)

Total Observation

2. Historically, most unions incorporated the seniority rule in collective bargaining between themselves and management; the idea being to assign a specific weight to the length of service to determine the order of layoff. Hence, the most senior worker is laid off last, and the data confirm this tendency.

3. Hall (1970), Feldstein (1975), Perry (1972), Clark et al. (1979) are a few examples.


10. The distribution of the frequency of unemployment for Canadian Labour Force has been reproduced from G. Glenday and G.P. Jenkins, "The Unemployment Experience of Individuals", op.cit.
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