

**Testing Discrimination in the Canadian Labour Market:  
French Ethnicity, Theory and Public Policy**

by

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### Abstract

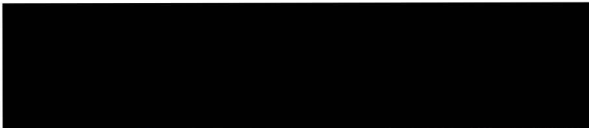
Economic research has explored causes of the Anglophone earnings and wage advantage over the Francophone minority in Canada. This thesis uses rigorous empirical analysis to assess the contribution of wage discrimination to Anglophone-Francophone wage disparities between 1971 and 1986. Four dimensions of discrimination are considered: (i) overall impacts, (ii) contributions of specific wage-determining factors, (iii) differences between the public and private sectors, and (iv) changes across time.

Analysis is based on comparisons of human capital wage equations which are estimated for Anglophones and Francophones. The magnitude of discrimination is estimated using the standard wage decomposition technique, and additional methods are used to determine the statistical significance of discrimination measures.

Statistical results indicate that discrimination is an important source of wage differentials between Anglophones and Francophones in Canada. In the private sector 60 percent of the Anglophone wage advantage in 1971 is attributed to discrimination, but the influence of discrimination declines to 30 percent of the Anglophone wage advantage by 1986. The 1986 measure is statistically insignificant. In the public sector, results indicate that Francophones always benefit from reverse discrimination, and also that reverse discrimination becomes increasingly influential between 1971 and 1986.

The overall changes in discrimination across time are attributed to the introduction of French language policies which were initiated, or which existed in the 1970's and early 1980's. These policies generate considerable improvements in the economic position of Canada's Francophone minority. Attempts to match empirical outcomes with the predictions of three economic theories of discrimination met with mixed results. Thus, the source of discrimination between Anglophones and Francophones remains unclear, as does the mechanism by which French language policies improved the economic circumstances of Francophones.

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## CHAPTER 1

### Introduction

#### 1.1. Canada's French-English Ethnic Cleavage

Tension between Canada's English and French cultures is a prominent theme in Canadian history. Conscription crises, the FLQ Crisis, the Quebec air traffic controllers strike, and the recent failure of the Meech Lake Accord stand as testimony to the sometimes less than amicable relations between these two cultures. The origins of French-English tension have been extensively analyzed, and numerous factors are cited under the broad headings of cultural differences and economic disparity.<sup>1</sup>

Economic studies have contributed to this discussion by analyzing the extent and causes of economic disparity between the English and French.<sup>2</sup> Several inter-related facets of this issue have been addressed, including differences in average earnings, access to high-paying jobs, and returns to human capital (language) investments. A Francophone earnings disadvantage is well-documented. For example, Bloom and Grenier (1991) find that Anglophones receive higher annual earnings, on average, than Francophones in 1971, 1981 and 1986. An Anglophone advantage in average hourly wage rates is also observed. Carliner (1981) finds an Anglophone hourly wage advantage in 1971, even in Quebec (province) and Montreal. Roberts (1992) confirms the persistence of the Francophone wage rate disadvantage; in 1986 Anglophones continued to earn consistently higher wages than Francophones

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<sup>1</sup> Geographic separation of the French and English cultural groups is also cited as a contributing factor, but only insofar as it helps sustain French-English tension.

<sup>2</sup> Some of these studies are reviewed in Chapter 2.

when compared within language skills categories (i.e., bilingual Anglophones always received higher average wages than bilingual Francophones).

Access to high-income jobs has also been a concern for Francophones. Job access is cited as a critical source of the French-English strife in the 1960s and 1970s, a period in which French graduates from Quebec's universities found limited opportunity to apply their skills in an economy dominated by the English minority.<sup>3</sup> A recent report from the Commissioner of Official Languages suggests that limited access to good jobs is a persistent problem. For instance, Francophones have been under-represented in top management positions in the federal public service: only 20.1% of these positions were held by Francophones in 1982, and by 1991 this figure was still only 22.4%, despite the fact that Francophones comprised over 25% of Canada's population [Commissioner of Official Languages (1992), p.57].

Documented earnings disadvantages and barriers to labour force access provide evidence of the economic disparity faced by Canada's Francophones. However, these observations are incidental to the more challenging task of determining the *causes* of French economic disparity. Economic studies frequently approach this issue by focusing on economic returns to language skills [Carliner (1981), Shapiro and Stelcner (1982), Chiswick and Miller (1987), Grenier (1987), Roberts (1992)]. In these studies, disparity is attributed to lower returns to French language skills, which are assumed to result from lower demand for these skills in an English-dominated economy [Carliner (1981), pp.386-387].

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<sup>3</sup> This idea has achieved wide currency in the political science literature. See, for example, Whitaker (1984).

A potential cause of earnings disparity which has been largely overlooked is overt wage discrimination. Although discrimination is frequently mentioned by researchers [such as Boulet (1980), Chiswick and Miller (1988), Shapiro and Stelcner (1982), Roberts (1992)], no studies have rigorously analyzed its contribution to disparities. Discrimination is an important issue from an economic standpoint because its existence implies labour market inefficiency. By definition, wage discrimination implies systematic differences in wages paid to equally-skilled workers across socio-economic groups. When this occurs, labour resources are under-utilized and labour market distortions constrain the overall productive capacity of the economy.<sup>4</sup> It is of economic interest, on an aggregate level, to eliminate discrimination as a means of increasing national income.

A second oversight in the economic literature is lack of rigorous analysis of the economic impacts of "French language policies" which were initiated, in part, to solve the problems of economic disparity between Canada's English and French workers. Most of these policies were introduced in the 1960's and 1970's by the federal and Quebec governments, with the stated intention of promoting the French language. The means of achieving these objectives, however, entailed directives and incentives which likely affected economic outcomes. In particular, predicted outcomes of these policies include increased numbers and improved positions of French employees in

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<sup>4</sup> Labour is considered to be under-utilized because the group that is discriminated against responds to lower earning opportunities by reducing the quantity and/or quality of its labour supply. The assumed complementariness of labour and capital suggests that capital will also be used below its potential.

both the public and private sectors.<sup>5</sup> Researchers acknowledge the potential labour market impacts of these policies [Carliner (1981), Grenier (1987), Shapiro and Stelcner (1982), and Roberts (1992)], but usually do not adopt the time series approach required to draw conclusions. Two recent economic studies partially rectify the inattention to language policies by addressing changes in the economic position of Francophones across time. Chiswick and Miller (1988) assess changes between 1971 and 1981, but refrain from concluding that language laws caused the relative decline in disparities facing Francophones.<sup>6</sup> Bloom and Grenier (1991) also observe a relative improvement in the economic position of Canada's Francophones across time (using three Census years: 1971, 1981 and 1986). Though they attribute this trend to language policies, they do not discuss the particular components of these laws nor, consequently, the mechanisms by which language laws might influence markets for French language skills. Despite the acknowledged *possibility* that language policies may have generated changes in earnings disparities between French and English workers, predicted economic impacts of language policies do not receive detailed consideration in either study.

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<sup>5</sup> There are four main French language policies: Quebec Bills 22 (1974) and 101 (1977), and the federal Official Languages Act (1968) and Charter of Rights and Freedoms (1982). Details of these laws are provided in Appendix B, and are discussed in Chapter 3.

<sup>6</sup> Chiswick and Miller find a substantial improvement between 1971 and 1981 in the economic well-being of Francophones, but they do not offer a rationale for this outcome. Their reluctance to attribute declining French-English earnings differentials to language policies is likely due to the availability of only one "before-policy" case (1971) and one "after-policy" case (1981). Without additional data points across time, it is difficult to determine whether the observed changes represent a random fluctuation or a trend.

## 1.2. Purpose

The main objective of this thesis is to both measure and statistically test wage discrimination between Anglophones and Francophones in the Canadian labour market. Justification for the study comes from results in previous economic research which are consistent with the existence of discrimination. Consideration is also given to economic theories of discrimination and their application to the Canadian labour market. The key empirical question is whether or not the wage determination process differs for Anglophones and Francophones.

Differences in Anglophone and Francophone wage determination processes are assessed in two stages. First, separate human capital wage equations are estimated for Anglophones and Francophones. Second, the wage equations are compared to determine whether observed wage differences are due to differences in human capital endowments or to discrimination. The comparison is based on the standard wage decomposition technique, and additional methods are used to test the statistical significance of the endowment and discrimination effect estimates [See chapter 5]. For statistical purposes, the null hypothesis is that discrimination has *not* contributed to wage disparities ( $H_0$ : discrimination=0). This formulation is consistent with observations in Chapter 2 which indicate that discrimination *may* exist, and it also allows for possible reverse discrimination against Anglophones.<sup>7</sup>

The secondary objective of this thesis is to consider economic impacts of French language policies. This issue could form a suitable basis for a separate study, but language policies and wage discrimination are sufficiently linked to make a joint

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<sup>7</sup> In this case, Francophones are over-rewarded for their human capital investments compared to equally-skilled Anglophones.

analysis more interesting. In particular, it is shown that an expected outcome of language policies is the reduction of discrimination over time, given that discrimination exists. This conclusion stems from the theoretical role for government intervention posited by economic theories of discrimination. Inferences on the impacts of French language policies are drawn by comparing the estimates of discrimination across time (1971, 1981 and 1986), using 1971 as the comparative basis (before the introduction of major language legislation).<sup>8</sup> The predicted effects of language policies are conditioned on the existence of wage discrimination, and so the null hypothesis is that discrimination will decrease over time (or reverse discrimination will increase), given that discrimination is present. In the absence of discrimination, no a priori predictions are made.

The uneven application of French language policies across the public and private sectors suggests that a further source of wage differences may be an individual's sector of employment. To account for this possibility, separate wage equations are estimated for the public and private sectors. Again, the null hypothesis is that there are no differences across sectors.<sup>9</sup>

In sum, this thesis tests the possibility that wage rates are determined differently for Anglophones and Francophones, and that there may be additional differences across the public and private sectors. Different wage determination

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<sup>8</sup> The use of 1971 as a "pre-policy" comparative base is justified on the grounds that policies introduced before this time were of relatively narrow scope compared to the policies introduced in the mid-1970's.

<sup>9</sup> This hypothesis has been tested extensively in previous studies [see Simpson (1986), and Shapiro & Stelcner (1989)], and is only briefly considered in this thesis in order to keep the study manageable. Attention is mainly given to differences within sectors across time.

processes imply wage discrimination. The possibility that French language policies may have influenced these wage determination processes, and consequently, may have altered levels of discrimination across time is also considered.

### **1.3 Organization**

The analysis of wage discrimination in this thesis is arranged into six chapters (including the introduction). Chapter 2 reviews earlier studies of economic disparity facing Francophones, and draws attention to results which admit the possibility of discrimination. Chapter 3 provides the theoretical foundations by outlining economic theories of discrimination, examining roles for government intervention, and reviewing French language policies. The chapter concludes with a refinement of the predicted empirical outcomes. Chapter 4 details the model which is used in the thesis, addresses a number of statistical issues, and presents the descriptive statistics and estimated wage equations (regressions). Chapter 5 outlines the discrimination testing procedure and presents the results. Chapter 6 is the conclusion.

## CHAPTER 2

### Literature Review and Motivation for the Study

#### **2.1. Survey of Literature**

This section reviews economic studies of earnings or wage disparities between language groups. Human capital theory provides the foundation for almost all of the studies. Under this theory emphasis is placed on comparing similarly-skilled workers, which implies that comparisons are made holding constant important wage-determining factors such as education, experience, and language skills. Canadian studies of French-English economic disparity are the main focus of this chapter, but a few studies of economic disparity facing Hispanic Americans are also included to draw attention to similarities in the economic problems faced by minority language groups.

##### **2.1.1. Canadian Studies**

Studies of the comparative economic situations facing Anglophones and Francophones in Canada consistently find that among male workers, the French receive lower wages and incomes compared to the English. This disadvantage is observed from 1961 to 1986, though there is concurrence that the disparity has declined over time. For example Boulet (1981), using Canadian Census data, finds that Anglophones in Montreal have a 51 percent earnings advantage in 1961 compared to Francophones, but that this advantage is only 32 percent in 1971. Using an alternative data source, he finds that the Anglophone advantage declines to 15 percent by 1977. Carliner (1981) also observes pervasive advantages for Anglophones

in 1971. He finds that Anglophone wage rates are always higher than Francophone wage rates in all of his subsamples including Quebec<sup>10</sup> and Montreal. Interestingly, he finds the greatest Anglophone advantage in Montreal. Chiswick and Miller (1988) similarly find a national annual income advantage for Anglophones using 1981 Census data, and Roberts (1992) reports general wage advantages for Anglophones in 1986, though Francophones in the public sector in Quebec and Montreal are better-paid than Anglophones.

Income or wages comparisons across language skills categories consistently show that bilingual workers have an advantage over monolingual workers within language groups. Boulet (1981) finds the income advantage to be small in Montreal for 1961 and 1971, but by 1977 the advantage was 22 percent in favour of English bilinguals over English monolinguals. Carliner (1981) finds similar results for 1971 wage rates, though notably monolingual Anglophones have a small advantage over bilingual Anglophones *in Montreal*. Roberts (1992) finds a bilingual wage advantage over monolinguals in 1986 in all of his sub-samples, and across both the private and public sectors.

Comparisons across language groups *and* language skills categories yield some unexpected observations. In particular, monolingual Anglophones are often found to have a wage or earnings advantage over bilingual Francophones, both inside and outside of Quebec. Boulet (1981) finds that in Montreal, monolingual Anglophones have a 37 percent earnings advantage over bilingual Francophones in 1961, and a 17 percent advantage in 1971. By 1977, this is reversed to a 10 percent *disadvantage* for

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<sup>10</sup> Throughout this study Quebec refers to the Province of Quebec, and not Quebec City. No studies to date have looked at the impacts of economic disparity in Quebec City.

monolingual Anglophones. Carliner (1981) also finds that in 1971 monolingual Anglophones receive higher wage rates than bilingual Francophones in all sub-samples, especially Montreal. This tendency is still evident in 1986; Roberts (1992) finds that monolingual Anglophones receive higher wages than bilingual Francophones everywhere but in the public sector in Quebec.

These general observations are noteworthy, but are difficult to compare because they fail to account for differences in important wage-determining factors between Anglophone and Francophone workers. Many studies have addressed this problem using human capital wage equations (regressions) which hold differences in education, experience, etc., constant [see Carliner (1981), Shapiro and Stelcner (1982), Grenier (1987), Chiswick and Miller (1988)<sup>11</sup>, and Roberts (1992)]. There are two general conclusions from these studies: first, the relative position of Francophones improved considerably between the 1970's and the 1980's, and second, numerous explanations for the existence of Francophone disparity have been proposed.

Carliner (1981) cites different supply and demand conditions for language skills as the source of French-English earnings differentials. Using 1971 Census data, his human capital equations confirm a Francophone disadvantage due to language skills in four geographical regions (Canada, Montreal, Quebec, and English Canada). This disadvantage, compared to monolingual Anglophones, ranges from 1.5 to 7.5 percent for bilingual Francophones, and from 12.3 to 17.3 percent for monolingual

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<sup>11</sup> Chiswick and Miller's study is difficult to compare with other economic studies because their human capital equations use bilinguals as the reference group, effectively constraining returns to bilingualism to be equal for Anglophones and Francophones. This is difficult to rationalize, since their primary focus is on earnings differences due to ethnicity. Their results are not discussed here, though the study provides an otherwise comprehensive look at ethnicity and earnings in Canada.

Francophones, depending on the particular geographical sample [Carliner (1981), p.392].

Carliner's theoretical framework is applied by Grenier (1987) to residents of Quebec in 1981. Grenier estimates separate earnings equations for Anglophones and Francophones, and adjusts for non-random out-migration of Quebec residents during the late 1970's which he attributes to the introduction of French language policies. He finds that bilingualism generates a 12 percent earnings advantage for Anglophones and a 4.3 percent earnings advantage for Francophones, when compared to monolinguals from their respective language groups.

These results contradict Grenier's expectation of greater returns to bilingualism for Francophones which stems from the observation that the ratio of mean earnings of bilinguals to monolinguals was higher for Francophones than for Anglophones. Grenier suggests that the higher returns to bilingualism for Anglophones reflects migration adjustments in the late 1970's. In particular, Anglophone "stayers" likely held higher-earnings jobs than did "leavers" and "stayers" were more likely to be bilingual, implying that: (i) proportionately fewer monolingual Anglophones remained in Quebec in 1981 than in the early 1970's, and (ii) those monolingual Anglophones who remained in Quebec were likely well-paid. Consequently the earnings gap between monolingual and bilingual Anglophones was smaller than that between monolingual and bilingual Francophones. Further, the bilingual Anglophones remaining in Quebec were highly rewarded for their language skills compared to Francophones, but these individuals may have stayed in Quebec *because* they were well rewarded for their ability to speak French.

Also within Carliner's theoretical framework is Roberts (1992), who considers whether differences in language returns between English and French vary across the public and private sectors for 1986. Based on comparisons with monolingual Anglophones, he finds the following: (i) monolingual Francophones always receive negative language returns in the private sector and in the English Canadian public sector, but receive positive returns in the public sector in Quebec and Montreal, (ii) bilingual Francophones receive negative returns to language skills everywhere except in Quebec, but are highly rewarded in the Quebec and Montreal public sector samples, and (iii) bilingual Anglophones essentially receive no returns on their French skills in the private sector, but receive positive returns in the public sector. Roberts concludes that French language policies may be creating a substantial benefit for Francophones and bilingual Anglophones in the public sector, but that they have been ineffective in the private sector.

Bloom and Grenier (1991) extend Carliner's theory of returns to language skills by emphasizing the importance of supply and demand interaction within local labour markets. In the Canadian context, Francophones can potentially benefit from geographical isolation since the demand for French in the local (i.e., Quebec) labour and product markets will generally increase with the proportion of Francophones in that market. It is indeterminate a priori whether increased concentration of Francophones in Quebec would increase or decrease their relative earnings over time because the supply and demand effects work in opposite directions (Francophone earnings fall with increased supply of Francophones, but rise with increased demand for Francophones). Under this theoretical framework, Bloom and Grenier find that earnings differentials between Anglophones and Francophones narrowed considerably

between 1971 and 1986, and thus conclude that the impacts of increased demand for Francophone labour outweighed the impacts of increased (relative) supply of Francophones over this period. Further, when a number of earnings-determining factors are held constant the Anglophone earning advantage remains significant in 1971, but is inconsequential in the 1981 and 1986 Census years.

Shapiro and Stelcner (1982) find similar results to Carliner, using 1971 Census data. In particular, they find that in Quebec, English skills always yield a positive return but this is not sufficient to bring Francophones up to the earnings level of Anglophones. They conclude that, "[t]hese results, no doubt, reflect a greater demand for English, but the fact that Francophones...who speak English are relatively disadvantaged suggests that other factors [besides differences in supply and demand conditions] are at work." [Shapiro and Stelcner (1982), p.370].

Shapiro and Stelcner (1982) look at two alternative factors to explain French-English disparities. First, they consider whether discrimination exists against French, where language skills signal ethnicity. Their results show that the earnings gap between English and French widens with increased education (in favour of Anglophones). This suggests that discrimination may be precluding Francophones from high-paying jobs, or alternatively, that highly skilled Francophones are underpaid compared to equally-skilled Anglophones.<sup>12</sup> Second, they consider whether the Anglophone earnings advantage results from recruitment of Anglophones from outside Quebec into high-paying jobs inside Quebec. This phenomenon is attributed to the prominence of English-owned branch operations in Quebec. Shapiro

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<sup>12</sup> Although Shapiro and Stelcner test the existence of discrimination, they do not rigorously measure it.

and Stelcner find the coefficient on their internal migration variable (from other provinces) to be positive, suggesting that this explanation may also hold some merit.

The finding that French-English earnings disparities are positively related to income levels is also observed by Boulet (1980) in his study of the Montreal labour market. An anomaly of this study is the rejection of the human capital framework in favour of comparisons across earnings quintiles. The wider disparity within each successive quintile is found in 1961, 1971 and 1977, though disparities decreased each year. This finding leads Boulet to conclude that the primary cause of English-French earnings differentials is under-representation of Francophones in upper earnings brackets. He also observes that the closing gaps are partly due to rising levels of human capital (notably education) in the French population.

In sum, Canadian studies reveal that Francophones have been disadvantaged by lower earnings and/or wages until as recently as 1986. Human capital wage equations support this observation, though comparisons across time and across sectors (public and private) suggest that the disparity has been declining.

### **2.1.2. U.S. Studies**

There are a number of distinctions between Francophone Canadians and Hispanic Americans: Francophones are not generally an immigrant group, they are geographically concentrated, and French is an official language in Canada. None of these observations is true for American Hispanics. A similarity between the two groups is that their mother tongues (generally) are not the dominant language of economic activity in North America (English). English deficiencies are believed to adversely affect the economic conditions facing Francophone workers in Canada and

Hispanic workers in the United States.

Bloom and Grenier (1991) compare the relative economic position of Hispanic Americans in 1970 and 1980. They find that Spanish speaking Americans became less well-off over time compared to white English-speaking Americans, particularly in regions where Hispanics were most concentrated. This trend is also observed after salient wage-determining factors are held constant. Bloom and Grenier conclude that this outcome is due to the relatively large influx of Hispanic immigrants over the 1970-1980 period. A notable contrast here is that the relative economic situation facing Francophones improved over the same period.

Grenier (1984) studies the role of language skills as a determinant of the economic status of Hispanic American males. He finds that the observed earnings difference between Hispanics and white non-Hispanic in 1976 is almost entirely due to endowment factors. Of this Hispanic endowment deficit, 10 percent is due to English deficiencies and 17.5 percent is due to education deficiencies. Further, discrimination actually works in favour of Hispanics, but the effect is small and is not statistically tested. Another interesting result of this study is that Hispanic wages increase if the individual usually speaks English. Grenier suggests that this may be due to increased likelihood of being part of the English job information network.<sup>13</sup>

An aspect of language group wage differentials not found in Canadian studies is the impact of language proficiency (generally due to insufficiency of Census data). Rivera-Batiz (1990) uses a 1985 data set which includes a reading achievement score to measure the language proficiency of young, mostly Hispanic U.S. immigrants. He finds that English proficiency has a significant impact on the earnings of Hispanics.

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<sup>13</sup> Information networks are discussed in Chapter 3 of this thesis.

## 2.2. Motivation for the Study

Results from the studies in the literature review suggest that French-English earnings differentials are not completely explained by differences in supply and demand conditions for language skills. As was discussed in the introduction (Chapter 1), relatively little attention has been given to the role of discrimination in creating these differentials. This section discusses results from earlier studies which are consistent with the existence of discrimination, and which consequently motivate and justify further study of the issue.

First, both Boulet (1981) and Shapiro and Stelcner (1982) find that the earnings gap between English and French workers increases with the earnings level. Boulet finds this in Montreal for 1961, 1971 and 1977, and concludes that earnings differentials are due to under-representation of Francophones in higher earnings brackets. He also notes that the disparity declined during each successive year in his study. Shapiro and Stelcner reach similar conclusions for Quebec in 1971, but also note that their empirical results are consistent with discrimination against Francophones which increases with skill (education) levels. In either case, under-representation of Francophones in high-income positions may be attributable to discrimination. Further, wage discrimination may also affect highly-skilled Francophones. Neither study attempts to quantify these impacts.

Second, Shapiro and Stelcner (1982) find that in Quebec in 1971, earnings are positively influenced by in-migration from other provinces. Since most of the population outside of Quebec is Anglophone, it is reasonable to predict that those who moved into Quebec to take jobs with above-average earnings were Anglophones. This in-migration does not in itself constitute discrimination, but it may indicate that

hiring decision for good jobs in Quebec may take place outside of Quebec, and consequently, Francophones may be subjected to discrimination as a result of not being able to get information needed to find these jobs [see Chapter 3].

Third, results from several studies which explain earnings differentials in terms of different supply and demand conditions for language skills suggest that discrimination may exist. Under the human capital hypothesis, language skills generally enhance productivity since better language skills (quality and/or quantity) imply better communication. Chiswick and Miller (1988, p.193) note that:

To the extent that bilingualism means fluency in both English and French it would be anticipated that, other things the same, bilinguals could not be at any earnings disadvantage compared to equally fluent monolingual English or French speakers. If anything, having the additional skill of fluency in a second language may enhance earnings since bilinguals can operate effectively in either the English or French labor markets, serve as a bridge between them, or be employed in jobs that require bilingualism.

This human capital prediction is contradicted by results in Carliner (1981), Shapiro and Stelcner (1982), and Roberts (1992). Carliner and Shapiro & Stelcner both observe that in 1971 bilingual Francophones were at an earnings disadvantage compared to monolingual Anglophones, both inside and outside of Quebec. Roberts finds similar results in 1986: bilingual Francophones are disadvantaged compared to monolingual Anglophones in English Canada (public and private sectors) and in Montreal (private sector). These contradictions to human capital theory are consistent with discrimination, since workers with equal skills (assuming that bilingual Francophones are interchangeable with Anglophones) receive different wage rates.

The observations made above suggest that discrimination may have contributed, and may continue to contribute, to the earning disadvantages faced by Canada's Francophones. The remainder of this thesis reviews the theoretical

foundations of discrimination and extensively measures and tests its impacts.

## CHAPTER 3

### Theoretical Foundations

The previous chapters provide two reasons to undertake a study of wage discrimination between Anglophone and Francophone workers in the Canadian labour market: first, results of earlier studies suggest that discrimination may have contributed to Francophone-Anglophone earnings disparities, and second, a rigorous study of economic discrimination between English and French workers has not yet been done. It was also noted that disparities between English and French workers appear to be declining over time, and this suggests that other labour market trends may also exist, including trends in discrimination. To incorporate this possibility, discrimination is measured and compared for 1971, 1981 and 1986, an interval which includes the periods before and after the introduction of the most influential pro-French government policies.

This chapter sets the foundations for the study in two stages. First, discrimination theories are reviewed to provide an economic rationale for the causes of discrimination, and to predict human capital outcomes when discrimination is present. Attention is also given to potential roles for anti-discriminatory government intervention under each theory. Second, the expected impacts on discrimination of French language policies are discussed. The predictions in this chapter: (i) provide guidance in the construction of the empirical model discussed in section 4.1, and (ii) provide focus for the empirical results presented in sections 4.3, 4.4 and in Chapter 5. The empirical results will indicate possible sources of discrimination by either contradicting or supporting the predictions under each theory.

### 3.1 Theories of Discrimination

The theories presented in this section define wage discrimination as the case in which workers of equal skill receive different wage rates in competitive labour markets [Cain (1986), p.695]. There are two key points implicit in this definition. First, the wage differences are persistent and are not attributed to short-run labour market fluctuations. Second, the assessment of "equal skills" is with respect to observable human capital traits such as education and experience, but also with respect to less observable traits such as willingness to work and ability to utilize technology.<sup>14</sup>

Notably, the wage discrimination defined above will not necessarily be found where two groups receive different wages because of segregation into high-wage and low-wage occupations. Segregation does not necessarily imply discrimination because the segregation may be due to differences in skills. In other words, a low-skilled group may be segregated into a low-wage occupation, but the same wage rate determination process may be applied to all workers within this occupation. In this case, wage discrimination does not exist, though there is cause to question why a group with presumably equal "productive capacity" is consistently underskilled. This problem is often referred to as pre-market discrimination, and is not addressed in this

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<sup>14</sup> Cain (1986), p.698. It is also generally assumed that preferences are the same across each group, and that both groups possess equal "productive capacity". These assumptions effectively neutralize potential differences on the supply side of the labour market and consequently focus attention on the demand side.

thesis.<sup>15</sup>

Although the wage discrimination defined above will not be found when there is perfect segregation of the labour force<sup>16</sup>, it will be found when a socio-economic group is over-represented and over-skilled in a low-wage occupation compared to another group.<sup>17</sup> This outcome may arise if barriers to labour mobility, etc., consistently preclude members of a particular group from obtaining jobs which fully utilize their skill levels (i.e., to the same degree as the "majority" group's skills are utilized). In sum, the definition of discrimination used throughout this paper may or may not be accompanied by segregation.

It is acknowledged from the outset that many discrimination theories exist, and this thesis does not endorse a particular theory. The intention is to illustrate possible sources of economic discrimination to motivate the discussion of empirical results. Three theories of discrimination are considered: "tastes" theory, information networks theory, and language theory. These theories are considered because they

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<sup>15</sup> It is possible that wage discrimination causes individuals to acquire human capital below their capacity, but empirical estimation of "capacity" presents obvious difficulties.

<sup>16</sup> Cain (1986), p.700. In this context, perfect segregation is an equilibrium condition in which one group consistently acquires less human capital than another group. Nadeau, Walsh and Wetton (1991) find a degree of segregation of male and female employees into different occupations at a public sector employer, but no wage discrimination (overall). This finding only holds for the overall measure of discrimination, however, since wage discrimination does arise from particular subsets of variables in their model.

<sup>17</sup> It is also true that a group can be under-represented and over-skilled, particularly in high-wage occupations. These outcomes are also consistent with differences in reservation wages between groups. However, it is generally assumed that the groups have similar preferences and consequently have similar reservation wages.

are most amenable with a study of the economic treatment of French and English workers in Canada, and also because they are based, in whole or in part, in neoclassical economics. Three key aspects of each theory focus the discussion. First, attention is given to each theory's explanation for the existence of discrimination, particularly in the context of Francophone-Anglophone earning disparities. Second, the persistence of discrimination predicted by each theory is considered. This second aspect is addressed in the appropriate historical context of the Canadian labour market. Third, the potential for government policies to reduce discrimination is considered for each theory.

### **3.1.1. Tastes Theory**

Gary Becker (1971) redefined the term "prejudice" into the concept of a "taste for discrimination". This definition has the benefits of being continuous, since economic agents can have varying preferences ("tastes"), and of being observable [Cain (1986), p.710]. The thrust of Becker's argument is that discriminating economic agents demand compensation for the disutility resulting from contact with the minority group. This would be evidenced by higher wage demands by discriminatory workers, willingness of discriminatory consumers to pay a premium to avoid contact with the minority, or lower wage offers to minorities by discriminatory employers [Becker (1971), p.14].

Attention is limited to Becker's theory of employer-based discrimination which argues that discriminatory employers will only hire minority workers if these workers

can be contracted at a lower wage which compensates the employer's disutility.<sup>18</sup> Thus, minority workers are at a wage disadvantage compared to majority workers because the discriminating employer perceives a "cost" of employing them [Becker (1971), p.39]. Discrimination, however, imposes a cost on the employer as well, since it results in foregone profits. For example, in a competitive market where employers have varying discriminatory intensities, less discriminatory employers will hire equally productive minority workers at their lower wage rate. Hence, being less discriminatory will reduce production costs, and will consequently increase profits.

This example of discrimination in competitive markets raises a limitation of Becker's theory which he acknowledges in part: "The firm with the smallest DC [discrimination coefficient] would produce the total [market] output, since it could undersell all others; therefore, the equilibrium DC would equal this firm's DC." [Becker, p.44]. Although Becker recognizes that competitive markets will be dominated by *less* discriminatory employers, he does not conclude that free mobility of capital in the long run will lead to the existence of *only* non-discriminators as they move into profitable markets. Thus, taste-based discrimination is not sustainable in competitive markets because less discriminatory employers will initiate a ratcheting-down of discrimination. Arguments have also been proposed which suggest that Becker's form of discrimination is unstable in other less competitive market structures

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<sup>18</sup> The three major agents of discrimination in Becker's theory are employers, workers, and consumers. Attention is focused on the role of employers for two reasons: first, discrimination by employers is expected to have widespread impacts, and second, arguments suggest that discrimination by consumers and workers will not have much impact on minority earnings. These arguments are outlined in Cain (1986), who suggests that both these sources of discrimination are more likely to generate segregation than wage discrimination.

including monopoly and monopsony.<sup>19</sup>

Application of Becker's theory to the present study is as follows: Anglophones comprise the economic majority in Canada and may engage in discrimination against the Francophone minority. Although it is predicted that discrimination will disappear in the long run, the length of time required for this to happen is indeterminate. It remains conceivable that employer-based discrimination *may* have contributed to French earning disadvantages between 1970 and 1985, the period of interest. This is made plausible by the fact that Quebec, the province in which the majority of Francophones live, only began to actively integrate into the North American economy in the early 1960's, which is relatively close to the period of study.<sup>20</sup> The expected outcome of discrimination is that Francophones will realize smaller returns than Anglophones on their human capital endowments.

Although discrimination is self-correcting in the long-run, this may be *too* long from the perspective of pro-equality lobbies. Government is capable of hastening the process by adopting integration policies which force contact between the two groups. The success of this approach depends on whether the propensity to discriminate is attributable to ingrained but erroneous beliefs about the minority<sup>21</sup>. If this is the case, then integration causes discriminators to revise their beliefs and, hence, reduces

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<sup>19</sup> See Cain (1986), pp. 717-719.

<sup>20</sup> Changes in the Quebec economy in the 1960's are noted in section 3.2.

<sup>21</sup> This is a euphemism for "prejudice".

wage discrimination.<sup>22</sup>

### 3.1.2. Information Networks Theory

The theory of information networks is based on three propositions. First, hiring and promotion decisions impose search costs on both employers and candidate employees, because employers must acquire information on each candidate's abilities, while candidates must acquire information on which jobs are available. Both parties seek to minimize their search costs.

Second, search costs are not equal across different types of jobs. Boulet (1980) observes that the amount of information required by both parties, and consequently the search cost, increases with the status of the position to be filled.<sup>23</sup> Employers face increasing costs because the number of suitable candidates declines as the degree of specialization in a particular job increases, and also because it is increasingly necessary to assess a candidate's less measurable skills which are not conveyed through a resume. Candidates face increasing costs because they must provide information which will secure the employer's confidence.

Third, information networks provide an efficient way to reduce search costs. The network is characterized by relatively close contact of its members, through word-

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<sup>22</sup> Lang (1986) briefly discusses the impacts of desegregation in reducing anti-black sentiments in the U.S., and in creating higher regard for women in the workplace.

<sup>23</sup> Boulet states that: "Jobs involving participation in the decision-making process will...be filled by individuals in whom management has confidence. The standards for evaluating applicants for these positions will accordingly be stricter and more personal.", p.13.

of-mouth exchanges, memos, etc. It reduces the employer's search costs by providing either more direct observation of a candidate's less measurable skills, or by providing contact with trusted sources who could help assess the candidate's abilities.

Networks also reduce candidates' search costs by placing them in closer contact with sources of job information. The implication of the efficiency proposition is that the marginal cost of acquiring information is lower within an information network than it is across networks.

In Canada, it is argued that English and French workers operate in different information networks.<sup>24</sup> This is problematic for Francophones because the English network is considered to be more lucrative than the French network (i.e., controls more high-income jobs).<sup>25</sup> This problem is exacerbated by the fact that the English network extends outside of Quebec, which often results in Quebec's high-wage positions being filled by Anglophones from English-speaking provinces.<sup>26</sup> Insofar as Francophones are excluded from the English information network, and assuming that this network controls a greater number of high-paying jobs, it is predicted that Francophones will receive lower returns on their human capital investments. This discrimination is caused by the under-representation of qualified Francophones in

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<sup>24</sup> See Jean-Luc Migué, "Le nationalisme, l'unité nationale et la théorie économique de l'information", *Canadian Journal of Economics*, 3(2), 1970, pp.183-198. Migué argues that information networks are often established by English-owned firms outside of French Canada, and consequently, both English and French networks exist in the Montreal labour market. [This French language source is cited in Boulet (1980), p.14]

<sup>25</sup> The economic dominance of Anglophones in Canada, including Quebec, is well documented. See: Coleman (1981), p.472; Whitaker (1984), p.38.

<sup>26</sup> Shapiro & Stelcner (1982), p.367.

high-income jobs. Thus, the degree of discrimination is expected to increase with the status of the job.

The persistence of discrimination due to information network access depends on the resistance of English networks to the integration of Francophones. If the English networks are resistant to integration in the long run, then human capital theory predicts that Francophones will revise their earnings expectations downwards, and will reduce their human capital investments to match these expectations. Segregation of Francophones into low-wage sectors will occur, but it will not be accompanied by wage discrimination. Even in this case, the supposition forwarded for Becker's theory can also be applied here; the period under study may be less than the time required for Francophones to make long run human capital adjustments. Hence, this form of discrimination may also be observed because of Quebec's belated economic integration.

Under this theory, government can reduce discrimination by promoting integration of French and English in the workplace. Integration will provide Francophones with greater access to English job information networks.

### 3.1.3. Language Theory

The "Language Theory of Discrimination" (Lang, 1986) proposes that discrimination results from differences in verbal or non-verbal languages between "speech communities".<sup>27</sup> These language differences impose a barrier to trade which cannot be overcome without incurring the transaction costs of learning the second

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<sup>27</sup> Lang defines "language" to include all verbal and nonverbal means of transmitting information (p.364). The distinction between speech communities can be quite subtle (i.e., between English speaking males and females).

language. The behavioural assumption which drives the model is that economic agents seek to minimize transaction costs. The simplifying assumptions used to generate Lang's results are as follows:

1. There are two groups (say E and F) which are unable to communicate unless at least one person (an interpreter) learns to speak both languages;
2. The two groups must communicate in order to conduct trade;
3. All individuals are equally able to learn the second language, and may do so at a constant positive cost ( $\lambda$ ). The second language is strictly productive and does not generate utility independent of its impact on earnings;
4. Both groups have identical tastes and production sets (i.e. equal productive capacity);
5. Exchange between the two groups occurs because group E has relatively more capital than group F.<sup>28</sup> This implies that group E will be net employers of F workers. For the purposes of exposition all employers are assumed to come from E;
6. The E employers are indifferent between two "bundles" of workers if and only if the marginal costs are equal across the bundles.

Two of Lang's cases provide particularly useful insights.<sup>29</sup> First, a limited case is developed in which E employers require two grades of workers, supervisors (S) and labourers (L) in a fixed proportion of  $L/S=n$ . Under the assumption that workers need to communicate, employers will not hire a mixed labour force (i.e., labourers will not come from both E and F). The cost-minimizing solutions are characterized by matched workforces consisting of either all-English workers or all-French workers. However, employers are indifferent between these options only if

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<sup>28</sup> The author does not provide the rationale behind this assumption, but it can be recognized as the Heckscher-Ohlin theorem from international trade theory. See, for example, Ethier (1988: ch.3).

<sup>29</sup> In order to maintain the flow of the discussion, the mathematics underlying Lang's results are presented in Appendix A.

they can pay a lower base wage to Francophones. The equilibrium relative wage rates in this case are:

$$w_{FL} = w_{EL} - \frac{\lambda}{(n+1)} \quad (1)$$

and

$$w_{FS} = w_{ES} + \frac{n\lambda}{(n+1)} \quad (2)$$

where  $w_{EL}$  is comparative base wage paid to Anglophone labourers, and  $w_{ES}$  is the Anglophone supervisor wage rate, which includes the Anglophone base wage  $w_{EL}$  plus the cost of managerial training ( $\mu$ ).

This case yields four important insights. First, Francophone labourers (FL) are paid less than their Anglophone counterparts (EL), despite the fact that both groups have the same human capital endowments (neither group is bilingual). Thus, discrimination reduces the wages of French labourers. Second, Francophone supervisors actually earn more than Anglophone supervisors. This result is tempered by the observation that they are still paid less than Anglophones with the same level of education. In particular, an Anglophone supervisor who spent an equal amount of time acquiring human capital (at a cost of  $\lambda$ ) would receive

$$w'_{ES} = w_{ES} + \lambda \quad (3)$$

which is more than a Francophone supervisor earns with the same total investment. Thus, the model is also consistent with discrimination against Francophone supervisors. These relative wages occur in equilibrium, so the observed discrimination will be sustained. Third, because the spread between labourer and supervisor wages is greater for Francophones, they realize greater returns to education

than do Anglophones. This conclusion depends on the assumption that language skills are acquired in schools. Fourth, the minimization of transaction costs leads to segregation because employers will hire either Anglophones or Francophones, given the equilibrium wages in equations 1 and 2.

The second and third points in the previous paragraph are potentially confusing since they suggest offsetting impacts on the returns to education for Francophones. However, both assertions are correct within Lang's model; Francophones generally receive lower returns than Anglophones on human capital investments except on investments in education. This outcome is attributable to two factors: first, the wage gap between Francophone supervisors and labourers is always larger than that between Anglophone supervisors and labourers, *even if* Anglophone supervisors have the same levels of education as Francophone supervisors, and second, the wider wage gap is directly attributable to language education. Discrimination arising from the lower Francophone base wage<sup>30</sup> is not sufficiently strong to offset the higher returns to education.

Lang's second case is more general: the two types of workers, supervisors (S) and labourers (L) are used in varying ratios across industries. The outcome in this case is that an industry hires a Francophone workforce when its L/S ratio is relatively high, and hires Anglophones when it is relatively low. Francophones, then, will be segregated into relatively labour-intensive occupations while Anglophones are segregated into relatively capital-intensive occupations. The economic intuition behind this result is that Francophone supervisors are relatively more expensive than

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<sup>30</sup> The base wage includes the returns to all human capital investments except for investments in managerial and language skills. The lower Francophone base wage implies lower returns on average to Francophone human capital.

Anglophone supervisors (relative to labourers from their respective language groups), and hence employers tend to substitute away from the relatively expensive Francophone supervisors when the S/L ratio is high.<sup>31</sup>

The language theory proposes two possible roles for government policy. In the short run (static case), government can reduce discrimination by promoting "French capitalism" [Lang (1986), pp.377-378]. This will reduce discrimination by equalizing the relative proportions of labour and capital across the two communities, thus reducing the need to trade, and consequently, reducing transaction costs. This approach generates complete segregation since Francophone labour would only be combined with Francophone capital, and Anglophone labour would only be combined with Anglophone capital. Thus, labour markets would be competitive but separate. In the long run, it is argued that complete segregation is not as desirable as a competitive and integrated outcome. Integration can be achieved by reducing the language barrier and, according to Lang, government can expedite the integration process via affirmative action-type policies.<sup>32</sup>

### 3.1.4. Conclusions on Discrimination Theories

The three theories outlined above provide a number of interesting and testable predictions. Although this thesis does not intend to verify a particular theory, it is worthwhile to determine whether their predictions are supported by statistical

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<sup>31</sup> Alternatively, Francophone workforces are more expensive when the L/S ratio is low. This outcome is detailed in Appendix A.

<sup>32</sup> Lang (1986), p.378-379. This prescription relies on the assumption that languages tend to converge over time.

evidence in order to indicate possible sources of wage discrimination, should it exist. Attention is limited to predictions which are testable under the model presented in the following chapter.

There are numerous short-run predictions. First, all three theories predict that the minority, Francophones, will be relatively under-compensated compared to equally-skilled Anglophones. This will be evidenced by lower returns to human capital investments for Francophones, at least on average. Second, the information networks and language theories predict that Francophone workers will tend to be segregated into lower-status occupations (fewer managers, etc.). This segregation may be accompanied by lower levels of human capital endowments among Francophones, since they will adjust their investments to reflect lower expected earnings. Third, Lang's model predicts that Francophones will have a tendency to learn English, but Anglophones will not tend to learn French. And finally, Lang's model also predicts that Francophones will receive higher returns to education than will Anglophones, assuming that language skills are acquired through schooling.

The long-run predictions are relatively few. Becker's model predicts the elimination of wage discrimination and complete labour market integration of Francophones. The network theory prediction is that discrimination will disappear, but it is uncertain whether this will occur because of integration or segregation. Lang's theory, however, makes the same predictions in the long-run as in the short-run (as in the previous paragraph).

All three theories indicate that wage discrimination may be reduced by promoting integration of the French and English communities. Lang's theory also proposes that promoting French capitalism will reduce discrimination in the short run.

### 3.2 French Language Policies and Discrimination

It is clear that government has the *capacity* to sanction labour market activities. Examples of government policies which affect labour market outcomes include minimum wage laws, equal opportunity policies, and unemployment provisions. In this study, an important question is whether government policies served to either create, reduce, or increase discrimination between Francophones and Anglophones in the Canadian labour market. Although many factors may have affected earnings differentials and/or discrimination, attention is limited to federal and provincial French language policies since they most directly address the problem of Francophone-Anglophone economic disparities.

In the previous section it was argued that discrimination could be reduced by promoting integration of the French and English communities. This section determines whether French language policies could have had this impact. The discussion centers on three factors: components of Canada's various language laws, the predicted impacts on the supply and demand conditions facing Francophones, and the extent to which supply and demand impacts might promote integration.

The conclusion of this discussion of language laws revises the static discrimination theory predictions and emphasizes the importance of treating the public and private sectors differently. Throughout this section, it is assumed that changes in the demand for French language skills are strongly correlated with changes in the demand for Francophones. This assumption follows from the observations that most language policies were centred in Quebec where Francophones

comprise a large majority of the population<sup>33</sup>, and also that Francophones are generally more bilingual than Anglophones<sup>34</sup>. Hence, any increased demand for French language skills was likely filled by Francophones since they possessed the majority of French skills (and/or bilingualism), and also because they lived in the province where the demand changes were greatest. Also, changes in the supply of French language skills are assumed to affect Francophone wages by changing the supply of "substitutable" labour services in the market (i.e., French speakers and Francophones are assumed to be substitutable goods).

### 3.2.1. Canadian Language Policies

A number of French language policies existed between 1970 and 1985. Six pieces of legislation are considered: Bill 60 (1964, Quebec), the Official Languages Act (1968, Canada), Bill 63 (1969, Quebec), Bill 22 (1974, Quebec), Bill 101 (Charter of the French Language, 1977, Quebec), and the Charter of Rights and Freedoms (1982, Canada).<sup>35</sup> This section briefly discusses the components and economic implications of these laws in three main areas: education, language use in the public sector, and

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<sup>33</sup> Francophones (defined by mother tongue) comprised 27% of Canada's population in 1971, but 84% of Francophones lived in Quebec. Within Quebec, 80% of the 1971 population was Francophone, while Anglophones made up only 13%. Outside of Quebec only 6% of the population is Francophone. Source: Beaujot (1979), p.21.

<sup>34</sup> In the samples used in this study (see Chapter 4) bilingualism is observed in 7-13 percent of Anglophones and 53-74 percent of Francophones, depending on the particular year (1971, 1981, or 1986) and sector (public or private).

<sup>35</sup> References for the policies discussed in this section are included in Appendix B: "A Chronology of Canadian Language Policies".

language use in the private sector.

Education is a key issue in five of the six pieces of legislation. There are two themes: promotion of French language education and formalization of rights to education in English or French. The most important piece of education-related legislation is Bill 60 (1964, Quebec), which profoundly changed Quebec's education system. This bill transferred control over education from the Catholic Church to the state, and consequently increased the technical and business content of the curriculum [VanLoon and Whittington (1987), p.81]. This restructuring of the education system increased the supply of Francophones with technical-skills in sciences, engineering and business.<sup>36</sup> In addition to the shifting focus of Quebec's education system, Quebec's public sector also became more technical and interventionist in the early 1960's [Whitaker (1984), p.40]. Bill 60 gave Francophones access to the skills needed in an increasingly technical economic environment, and changes in the public sector provided a market for at least some of these skills.

Secularization of Quebec's education system came at a cost; enrolment in English schools increased in the 1960's, creating concern about the fate of French in Canada.<sup>37</sup> This trend motivated counteractive legislation which imposed eligibility restrictions on English-school attendance. For example, under Bill 22 (1974) only children with "sufficient" knowledge of English could enrol in English schools. This restriction was strengthened in Bill 101 (1977), and the objective was achieved:

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<sup>36</sup> *ibid.*, p.81. and also Whitaker (1984), p.40.

<sup>37</sup> Coleman (1981), p.467. This problem was exacerbated by Bill 63 (1969, Quebec) which gave parents unrestricted right to have their children educated in either English or French.

enrolment in Quebec's English language schools declined [Coleman (1981), pp.470-471]. Restricted access to English schooling, particularly after 1977, undoubtedly increased the number of French speakers. It is likely that the supply of French language skills was also increased by the requirement that high school graduates have a sufficient knowledge of French.

The Official Languages Act (1968) promoted the use of French in the federal public sector. This law increased the use of French by making the federal public service bilingual, by emphasizing bilingualism in recruitment programs, and by providing French training for federal public servants. The first two components of this law likely increased the demand for Francophones in the public sector. The Charter of Rights and Freedoms (1982) likely added to this demand by declaring Canada and New Brunswick officially bilingual.<sup>38</sup> The provision of French language training in the federal public service probably did not have much impact on Francophone labour markets, since the majority of the new bilinguals would be Anglophone incumbents in public servant jobs.

Quebec also adopted a number of public sector pro-French policies. Bill 22 (1974) made the Quebec public service unilingual French, guaranteed service in both English and French, and placed language restrictions on municipalities, school boards, and health and social services institutions. The restrictions were tightened in Bill 101 (1977). Specific restrictions on public institutions included mandatory use of French in all official documents, mandatory use of French in communications between institutions, and a prohibition on hiring, promoting or transferring employees who

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<sup>38</sup> Although Canada is officially bilingual, New Brunswick is the only officially bilingual province. In effect, official bilingualism in Canada is limited to the federal public service.

lacked "appropriate" knowledge of French. These changes likely increased the demand for Francophones, particularly in Quebec's public service.

Language policies also applied to the private sector. Bill 22 (1974) introduced measures to increase the use of French in the workplace and marketplace. These measures included restrictions on communications between employers and employees, mandatory proficiency in French for professionals, and directives to give French priority over English in advertising, product labels and signs. Bill 101 (1977) strengthened the restrictions on the use of English in advertising and on the shop floor. Both laws also promoted "francization" programs designed to increase the use of French at all levels within a firm. Adopting these programs was optional under Bill 22 (1974), but under Bill 101 (1977) adherence was mandatory for firms with more than fifty employees. In either case compliance with francization programs was prerequisite to securing government contracts or financial support. These policies likely increased the demand for Francophones, particularly in marketing and middle management jobs. Increased demand for Francophones probably also arose as firms worked to meet the "francization" requirements.

An important indirect impact of French language policies is cited by Grenier (1987): many Anglophones emigrated out of Quebec during the late 1970's. This is attributed to the anti-English signals sent by Quebec language laws. Although this emigration increased the *relative* supply of Francophones in Quebec, putting downward pressure on wages in French language or bilingual jobs, the most important impact was that Anglophones in administrative, managerial, and other

related occupations were more likely to leave.<sup>39</sup> Thus, emigration and the resulting increase in job vacancies in Quebec likely increased the demand for labour in general, though Boulet (1980) suggests that the majority of these vacancies were filled by Francophones [Boulet (1981), p.43].

Two general observations on French language policies stand out. First, attempts to increase the use of French and to include Francophones in the economy have been pursued by the federal, Quebec, and New Brunswick governments. This suggests that language policies apply to a relatively large proportion of the population, warranting the prediction that they had at least some impact on Canadian labour markets. Further, the greatest efforts were made in Quebec, the domicile of the majority of Canada's French population. Second, promotion of French was largely a public sector pursuit, and only limited direct policies were applied to the private sector. This suggests that an analysis of the impacts of language policies should account for the possibility that the impacts might differ between the public and private sectors. A more rigorous analysis of language policies, incorporating judicial rulings, etc., would allow stronger hypotheses to be made on the relative impacts across sectors, but this exceeds the scope of this thesis.<sup>40</sup>

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<sup>39</sup> A large proportion (19 percent) of Quebec's Anglophone minority emigrated between 1976 and 1981, while the vast majority of Francophones remained in Quebec [Grenier (1987), p.781].

<sup>40</sup> The uneven application of language laws across the public and private sectors is a sufficient condition for delineating workers according to their sector of employment. Substantial research exists on systematic differences in wage determination processes between sectors, but these differences are not critical to this study.

Two economic predictions also arise from language policies. First, it is uncertain whether Francophones' average earnings will increase or decrease relative to Anglophones. The uncertainty results from the expectation that language policies increase both the supply *and* demand for French speakers. Concurrent increases in supply and demand put both upward and downward pressure on wages, so the direction of change in average earnings is indeterminate.<sup>41</sup>

However, there is evidence suggesting that the supply-side impacts of language policies were negligible. For example, the actual impact of education restrictions is unknown, but Coleman (1981) observes that Bill 101 (1977, Quebec) promoted an increase in the number of bilingual schools. This suggests that there may have been ways to contravene the language of education restrictions. The other key supply factor, French training for federal public servants, likely did not have much direct impact on Francophones either since it would have been provided to Anglophone incumbents in public sector jobs. Bloom and Grenier (1991) concur that the demand for French speakers increased more quickly than the supply of French speakers over the 1971-1986 period. If it is true that the supply side impacts were small, then the increased demand for Francophones should increase their earnings, particularly in Quebec.<sup>42</sup>

Second, there is justification to predict a decline in discrimination over the

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<sup>41</sup> Increased demand for Francophones would increase the expected average wage, but increased supply of Francophones would reduce it. The outcome cannot be predicted a priori.

<sup>42</sup> This expected increase in Francophone earnings might be more accurately described as a "relative" increase, compared to Anglophone earnings. This latter prediction sidesteps the issue of labour market impacts that affect both groups.

1970-1985 period (or an increase in reverse discrimination). This prediction arises from the expectation that language policies promoted increased integration of French and English in the workplace. There are a number of reasons to believe that language policies increased the level of French-English integration in the workplace. The most compelling of these reasons is that the emigration of Anglophones from Quebec, particularly from high-income positions, provided an access point for high-skilled Francophones into English-dominated management circles. Also, increased use of French in the federal and Quebec public service likely created demand for Francophones across a range of skill levels, and consequently, would have increased integration. In fact, all policy components which were predicted to increase the demand for Francophones (French) are expected to increase the level of integration. This follows from the fact that the greatest increases in demand for French were concentrated in Quebec, and that Francophones comprise the vast majority of Quebeckers.

Other researchers find that Quebec's language policies promoted integration. Dyck (1986) concludes that Quebec's Bill 101 significantly increased the use of French in the workplace and also increased the representation of Francophones in private sector management positions [Dyck (1986), p.232]. Coleman (1981) agrees with this observation, but emphasizes that Francophones were still under-represented at the top of the economic hierarchy.<sup>43</sup>

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<sup>43</sup> Coleman (1981), pp.481-82. This problem is attributed to the importance of English skills in many top positions which often require extensive and effective interaction with the economic community outside of Quebec. See VanLoon and Whittington (1987), p.103.

### 3.3 Summary of Predicted Outcomes

Section 1.2. (Purpose) stated that the null hypothesis is that discrimination did not contribute to French-English earnings differentials between 1971 and 1986. Subsequent discussion (Chapter 2) suggests that discrimination was possible, given the results of previous economic studies. This chapter presents some economic theories of discrimination and discusses their implications for observable outcomes. In order to reorient the reader with these predictions, this section summarizes the discussion of discrimination theories and language policies under the assumption that discrimination exists (or existed). The static predictions from discrimination theories are summarized first, and are followed by the predictions that arose from the discussion of French language policies.

If discrimination is attributable to Anglophone employers' dislike for Francophones (Tastes theory), then Francophone workers will be undercompensated for their human capital endowments. There is no expectation of occupational segregation under this theory because discrimination arises on an employer-by-employer basis, and there is no reason to believe that discriminatory employers are more likely to be found in one occupation/industry/sector, etc. than in another.

If discrimination is due to barriers to job information faced by Francophones (Information Networks theory), then Francophones are expected to receive lower returns than Anglophones on their human capital. It is also predicted that occupational segregation will exist, and will be evidenced by lower proportions of Francophones in higher-status jobs such as managerial positions.

If discrimination is caused by transaction costs arising from language

differences (Language theory), then Francophones are expected to be undercompensated for their human capital endowments on average. Francophones, however, are expected to receive higher returns to education because the wage differential between French managers and labourers (denoting high-status and low-status jobs in general) is expected to exceed the wage differentials among English workers. It is also expected that occupational segregation will exist, and that this will be evidenced by lower proportions of Francophones in higher-status jobs such as managerial positions. Further, there is a predicted tendency for Francophones to learn English, but not for Anglophones to learn French.

Each of these theories suggests that government (or any suitably influential agent) can reduce discrimination by promoting workplace integration of Anglophones and Francophones. The discussion of French language policies in 3.2 concludes that the level of integration likely increased because the relative demand for Francophones increased, particularly in Quebec. Given this conclusion, it is predicted that if discrimination existed in 1971, then it would decrease in subsequent years as a result of French language policies. It also remains possible that language policies promoted reverse discrimination (in favour of Francophones) if discrimination did not exist in 1971, principally as a result of the increase in relative demand for Francophones.

The dynamic prediction is refined somewhat by further predicting that the changes in discrimination will differ between the public and private sectors as a result of the uneven application of language laws across these two groups.

## CHAPTER 4

### Empirical Model, Descriptive Statistics and Wage Equation Estimates

#### 4.1 Statistical Model

Empirical measurement of discrimination, using the human capital framework, requires the estimation of wage equations. This section provides the theoretical underpinnings of human capital wage equations, and describes the particular equation used in this thesis. It is assumed that an individual's wage rate is determined by a number of inter-related factors, both internal and external to the individual. The internal factors are classified as "human capital", and external factors are classified under the general heading "controls".

Human capital endowments are assumed to determine an individual's labour market productivity. These endowments consist of factors such as specific job training, ability to learn, motivation, and general skills such as language proficiency and diplomacy. In the absence of external factors (see below), the productivity which results from human capital is the main determinant of an individual's wage rate.<sup>44</sup> The human capital factors listed above are internal to the individual and are not directly observable. Because human capital cannot be directly observed, proxy variables are used to conduct empirical analysis.

The model employed in this study includes a number of human capital factors. These factors possess varying degrees of abstraction and, consequently, it is presumed

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<sup>44</sup> There is an exogeneity assumption in this formulation: earnings are determined by human capital investments, but human capital investments are not determined *by* earnings.

that there is variability in the strength of the relationships between the true factors and their proxies. The human capital traits which are presumed to have relatively accurate proxies include an individual's level of training, as proxied by years of education and job experience, and an individual's language proficiency, as proxied by ability to speak Canada's official languages. The highly abstract human capital traits used in this study are proxied by marital status and immigration status. These proxies are assumed to be correlated with human capital factors such as reliability, motivation, and social integration. Although these factors are obviously important in an individual's labour market success, their links to readily observable phenomena are only weakly understood. Further details on each of the human capital proxies is provided below when the variables in the model are defined.

In addition to productivity factors (human capital), there are aspects of the individual's job which influence wage rates. These job factors may include the need to live in an urban centre, workplace dangers, employment instability, prestige, etc. Workers receive net payments (positive or negative) for accepting these factors, and the payment associated with each factor is a "compensating wage". It is difficult to anticipate the overall compensating payment for a given job since it is composed of a number of potentially offsetting factors. In this study compensating factors are accounted for using control variables for the individual's occupation, region of residence, and urban residence. Controlling for compensating factors allows better estimation of the economic returns to human capital endowments.

The general relationship between the relevant variables described above is expressed in the following function:

$$Y = f(HK, C) \quad (4)$$

where:

Y = Measure of Income (hourly wage rate)  
 HK = Human Capital  
 C = Controls for Factors External to the Individual

A semi-logarithmic equation is used to estimate this functional relationship. This particular functional form is chosen because its theoretical foundations are well established and because it is used in the vast majority of previous wage-based studies.<sup>45</sup> The semi-logarithmic function is expressed as:

$$\ln Y = \beta_1 + \beta_2 x_2 + \dots + \beta_K x_K + \epsilon \quad (5)$$

where the dependent variable is the natural logarithm of the hourly wage rate, and the explanatory variables  $x_j$  ( $j=2, \dots, K$ ) include human capital and control factors. The coefficients  $\beta_j$  ( $j=2, \dots, K$ ) are interpreted as the percentage change in the hourly wage rate due to a unit change in the associated factor  $x_j$ . The coefficient  $\beta_1$  is the intercept (logarithmic constant wage). It is also assumed that the error term is distributed as:

$$\epsilon \sim N[0, \sigma^2] \quad (6)$$

This assumption facilitates statistical tests on the regression results.

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<sup>45</sup> The rationale underlying this functional form is attributed to Jacob Mincer. The semilogarithmic equation arises from the wealth maximization assumption underlying Mincer's model; individuals choose the level of schooling which maximizes the present value of their lifetime income streams. In this model, the education coefficient reflects compensation for the opportunity cost of an additional year of schooling. Further details and derivations are presented in Willis (1986), pp.541-544.

Further refinement of the specification is required to meet the objectives set in the previous chapter. Since the objective of this paper is to determine the degree of wage discrimination between Anglophones and Francophones, separate wage equations need to be estimated for each language group.<sup>46</sup> Also, the uneven application of French language policies across the public and private sectors warrants further delineation of language groups into sectoral groups. Thus, the model used in this thesis consists of four equations; each equation represents one of the four possible combinations of ethnicity (French or English) and sector of employment (public or private). This system of equations is estimated for each year of the study (1971, 1981, and 1986), and is represented as follows:

$$\begin{aligned}
 y_{EP} &= X_{EP}\beta_{EP} + e_{EP} \\
 y_{EG} &= X_{EG}\beta_{EG} + e_{EG} \\
 y_{FP} &= X_{FP}\beta_{FP} + e_{FP} \\
 y_{FG} &= X_{FG}\beta_{FG} + e_{FG}
 \end{aligned}
 \tag{7}$$

where

$y = \ln(Y)$  = natural log of the hourly wage rate  
 $E$  = English,  $F$  = French  
 $G$  = public (government) sector  
 $P$  = private sector.

The following discussion provides the definitions and theoretical justifications for each of the variables included in the model.

#### 4.1.1. Data

The model in equation (7) is estimated using the Canadian Census data provided on the Individual Files of the Public Use Sample Tapes (PUST) for 1971,

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<sup>46</sup> This requirement arises from the discrimination measurement procedure presented in Chapter 5.

1981 and 1986. These tapes represent a 1 percent sample (of the Canadian population) for 1971 and a 2 percent sample for 1981 and 1986. There are two key issues which affect the comparability of these data sources across time. First, the method of data collection changed between 1971 and the two later years. The full Census questionnaire was given to one in three households (1/3 sampling rate) in 1971, but to only one in five households (1/5 sampling rate) in 1981 and 1986.

Extrapolation of the sample results to the entire population creates sampling bias in the individual data items. In general, the 1971 individual data items are presumed to be more reliable because of the higher sampling rate, though Statistics Canada uses procedures to minimize sampling bias in all Census years.

Second, the degree of censoring of PUST data varies across the Census years. Examples include the greater degree of "grouping" of responses on the individual's number of weeks worked in 1971 compared to 1981 and 1986, and the larger number of Census Metropolitan Areas in 1981 and 1986 compared to 1971. Efforts are made to minimize the effects of censoring by ensuring consistency across Census years in the definition of the variables used in equation (7). Censoring may adversely affect the comparability across time of the education variable (and consequently the experience-related variables), and the urbanization variable.<sup>47</sup> Censoring in hours and weeks worked may also adversely affect the comparability of the dependent variable, particularly between 1971 and the two later years. It is worth noting that the 1971 PUST data set is the only source of incompatibility, while the 1981 and 1986 PUST data sets are entirely compatible for the purposes of the statistical analysis in this study.

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<sup>47</sup> Variable definitions are provided in section 4.1.2.

#### 4.1.2. Variable Definitions

##### Dependent Variable

The dependent variable in each equation is the natural logarithm of the estimated hourly wage rate.<sup>48</sup> Individuals are delineated into French and English as defined by mother tongue (the individual's first language spoken and still understood) to reflect the association between culture and language.<sup>49</sup> These two groups are further delineated into public and private sector workers to reflect the uneven application of French language policies across sectors and to highlight differential impacts of these policies across time between sectors.

This study follows the heritage of most previous studies on language group wage differentials by focusing only on male workers. This approach is justified on the grounds that peculiarities of the female labour market may confound the objectives of this study. For example, if women face discrimination in the labour market, then the measurement of language-based discrimination is complicated by the presence of gender-based discrimination. Further, other well-documented differences in the labour market situations faced by men and women warrant separate studies. For example, women are believed to be less attached to the labour force than men are,

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<sup>48</sup> The term "estimated" is used because the Census data used in this thesis does not include the individual's wage rate. It is estimated from annual earnings, hours worked per week and weeks worked per year.

<sup>49</sup> Ethnic origin is also a potential source of discrimination, but discrimination across language groups is the prominent issue in Canada. The impact of ethnicity on earnings is addressed in Boulet (1981) and Chiswick and Miller (1988).

and hence make their labour supply decisions under different constraints.<sup>50</sup>

Additionally, the samples are limited to workers between the ages of 25 and 65 who derived their incomes from wages and salaries. The data set used in this study comes from the Canadian Census Public Use Sample Tapes for 1971, 1981, and 1986.

### Explanatory Variables

#### **Human Capital Variables**

(a) *Education* (EDUC)

This is a measure of general human capital accumulation, as proxied by the individual's number of years of education. The coefficient on this variable is expected to be positive, reflecting a presumed positive relation between wages and skill.

(b) *Experience* (EXPER)

This variable proxies the job-specific human capital acquired by the individual. It is calculated using  $EXPER = (Age - (EDUC + 6))$ , and its coefficient is expected to be positive.

(c) *Experience Squared* (EXPSQR)

EXPSQR is used to allow for quadratic behaviour of returns to experience. The quadratic process is assumed to be concave, and generally reflects two things; first, the decreased incentive for employers to train aging workers (or for aging workers to invest in re-training) because of the shorter time over which to amortize training costs,

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<sup>50</sup> A review of female labour market issues is found in Gunderson and Riddell (1988), chapter 23. A language-based study which includes females is Shapiro and Stelcner (1982).

and second, the depreciation of previously acquired experience over time. The concavity of this relation implies a negative coefficient on this variable.

(d) *Education times Experience* (EDxEXP)

This variable captures the interaction between schooling and years of workforce experience. No a priori predictions are made on the sign on this variable because it is influenced by two offsetting effects. Insofar as education and experience are mutually reinforcing, the coefficient on this variable would be positive. At the same time the negative correlation between the amount of schooling and the amount of experience acquired implies a negative coefficient. The sign of the interactive education and experience variable depends on the relative strengths of these two effects.

(e) *Bilingualism* (BILING, HIBILING)

There are two language variables in the model which reflect the rates of return on linguistic human capital. BILING takes a value of one if the individual speaks both of Canada's official languages, and captures the basic rate of return on linguistic human capital. HIBILING is an interactive term with BILING which reflects the adjustment to language returns which arise if the individual is bilingual *and* speaks the second official language at home. This definition captures returns to superior proficiency in the second language.

Assuming that: (i) there is economic advantage to knowing a second language, (ii) second languages are not costlessly acquired, and (iii) the rate of return on language skills is positively associated with proficiency, it is thus expected that both of these coefficients will be positive. The language reference group includes those

who speak only one of Canada's official languages.

(f) *Social and Economic Integration* (NEWIMM, OLDIMM)

These variables proxy two human capital attributes; first, the immigrant's human capital acquisition specific to the Canadian labour market, and second, the individual's degree of social integration in Canada. Since the study includes only those who have either English or French as their mother tongue, immigrants generally come from English and French cultures, suggesting that integration into the Canadian labour force will be relatively rapid. Two dichotomous variables are included; NEWIMM reflects the earnings impacts for very recent immigrants (within the past six years), and OLDIMM reflects the earnings impacts for those who have been in Canada more than six but less than eleven years. Since recent immigrants are expected to be at a wage disadvantage, the coefficients on both of these variables are expected to be negative, and the NEWIMM variable is expected to be larger (in absolute value) than the OLDIMM variable. The integration reference group includes all Canadian-born individuals, as well as those who immigrated to Canada more than eleven years ago. The choice of a six-year range for NEWIMM and a five-year range for OLDIMM was dictated by censoring in the 1971, 1981, and 1986 Census Public Use Sample Tapes.<sup>51</sup>

(g) *Marital Status* (DIVORC, MARRY)

Korenman and Nuemark (1991) survey recent literature on the effects of marital status on male earnings. Although they note the robustness of the strong advantage found for married men, they are reluctant to offer an explanation for its

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<sup>51</sup> The original intention was to use two five-year periods.

existence. They do, however, provide a number of observations based on their regression results from a company personnel file. In particular, they note that married workers tend to receive higher performance ratings from their supervisors, and hence are more likely to be promoted, and this effect results in a faster growth of earnings for married men. This suggests that a superior specification of a marriage variable would account for the number of years married, but because of limitations in the Census PUST database it is only possible to include marriage effects through a qualitative variable. The DIVORC variable takes a value of one if the individual was either separated or divorced in the Census year, while the MARRY variable takes a value of 1 if the individual was married or widowed. These groupings reflect differences in levels of commitment, which may signal the individual's reliability, reduced likelihood of quitting, etc. The reference group includes those who were single in the reference year.

In comparison to the reference group, it is expected that the signs on both of these variables will be positive, and also that DIVORC will be smaller than MARRY. The rationale behind this prediction is that earnings advantages due to marital status continue to accrue to those who are presently married, but those who *were* married will have only received a portion of this benefit stream.

### **Control Variables**

- (h) *Occupation* (SME, SOCSCI, TEACH, HEALTH, SALES, SERV, FARM, PRIM, MANUF, CONST, TRANSP, OTHER)

This set of variables controls for differing compensating wages across occupations which are not captured in the human capital variables. These

differentials may be due to differences in safety standards, physical discomfort, responsibility, job security, etc., between occupations.<sup>52</sup> Because of the complex balances of relative advantages, no sign predictions are made for the coefficients on these variables. The reference category is managerial and administrative workers (See Table I, pp.47-48 for definitions of occupational categories).

(i) *Region* (MARIT, QUEB, ONT, PRAIR, ALTA, BC)

There are notable inter-regional wage differences which may be due to peculiarities of demographics, distribution of industries, and differences in economic conditions. These effects will be captured across six regions, where Ontario is used as the reference region. Since the conditions which generate inter-regional differences in wages structures are complex and may change over time, no predictions is made on the signs of the coefficients.

(j) *Urbanization* (CMA)

Compensating wages are paid to those who live in urban centers. This may reflect the higher cost of living in cities, or a lack of monopsony power in large labour markets. It is predicted that the coefficient on this variable will be positive.

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<sup>52</sup> Occupational variables are allocated to the "Control" category to simplify subsequent discussion. This distinction is somewhat artificial since occupational variables capture certain human capital effects not captured by other variables in the model. In particular, they undoubtedly reflect endowments of strength, charisma, and other factors which may be important wage determinants in particular occupations, but which may not be acquired through education, experience, etc.

**Table I**  
**Summary of Statistical Model**

<b>Dependent Variable:</b>	In (Hourly Wage Rate)
Basic Characteristics:	Males Aged 25 - 65 Paid Worker Income Derived from Wages and Salaries
Classified into Four Groups:	English Private Sector    French Private Sector English Public Sector    French Public Sector
Calculation:	Wages and Salaries Earned in Census Year divided by (Number of Weeks Worked in Census Year) x (Number of Hours Worked in Reference Week, or Average Annual Hours (1971 Census))
For Census Years:	1971, 1981, 1986

**Explanatory Variables:**

<b>(A) Human Capital Variables</b>	<i>Definition</i>
Education	EDUC Number of Years of Formal Education
Experience	EXPER (Age - Education - 6)
Experience Squared	EXPSQR Square of Experience Value
Educ. x Exper.	EDxEXP Education x Experience
Language Skills	Reference Those Who Speak Only 1 Official Language BILING = 1 if both official languages are spoken, but the second official language is not spoken as the Home Language = 0 otherwise HIBILING = 1 if both official languages spoken; one as Mother Tongue, other as Home Language = 0 otherwise
Integration	Reference Those who Immigrated More Than 11 Years Ago, or Who are Canadian Born NEWIMM = 1 if Immigrated within Past 6 Years = 0 otherwise OLDIMM = 1 if Immigrated Between 7 and 11 Yrs Ago = 0 otherwise
Marital Status	Reference Never Married (Single) DIVORC = 1 if Divorced or Separated = 0 otherwise MARRY = 1 if Married or Widowed = 0 otherwise

(B) Control Variables	Definition
Occupation	Reference Managerial and Administration SME = 1 if Natural Science, Math, Engineering = 0 otherwise SOCSCI = 1 if Social Science = 0 otherwise TEACH = 1 if Teaching = 0 otherwise HEALTH = 1 if Medicine, Health = 0 otherwise SALES = 1 if Sales = 0 otherwise SERV = 1 if Service = 0 otherwise FARM = 1 if Farming = 0 otherwise PRIM = 1 if Other Primary = 0 otherwise MANUF = 1 if Processing, Machining = 0 otherwise CONST = 1 if Construction = 0 otherwise TRANSP = 1 if Transport Equipment Operating = 0 otherwise OTHER = 1 if Other = 0 otherwise
Region	Reference Ontario MARIT = 1 if Nfld., N.B., P.E.I., N.S. = 0 otherwise QUEB = 1 if Quebec = 0 otherwise PRAIR = 1 if Manitoba, Saskatchewan = 0 otherwise ALTA = 1 if Alberta = 0 otherwise BC = 1 if British Columbia = 0 otherwise
Urbanization	CMA = 1 if Residence is in a Census Metropolitan Area = 0 otherwise

## 4.2 Statistical Issues

### 4.2.1. Heteroskedasticity

Heteroskedasticity is known to be a problem in estimations of earnings functions, since the amount of variation often increases with earnings. Roberts (1992), for example, finds heteroskedasticity to be present in his study of returns to language skills. The presence of heteroskedasticity causes the OLS parameter estimates to be inefficient, even though they are unbiased. Since the estimated standard errors are biased (direction indeterminate), the associated t-statistics are also biased and may lead to erroneous conclusions. To avoid this problem, heteroskedasticity is tested for in each equation, and the appropriate statistical corrections are made.

White's general test is used to determine the existence of heteroskedasticity. This test is based on the coefficient of determination from the regression of the square of the estimated residuals ( $e^2$ ) on all of the unique regressors in  $\mathbf{x} \otimes \mathbf{x}$ .<sup>53</sup> The hypothesis is:

$$\begin{aligned} H_0: \sigma_i^2 &= \sigma^2 \quad (i=1, \dots, n) \\ H_1: H_0 &\text{ is false} \end{aligned}$$

and the test statistic is:

$$nR^2 \rightarrow \chi_{P-1}^2 \quad (8)$$

The null hypothesis is rejected if the statistic  $nR^2$  exceeds the critical value  $\chi_{P-1, .05}^2$ , which in this case is 67.22 (P=71).

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<sup>53</sup> This test is described in Greene (1990), pp. 419-420. The Kronecker product multiplies  $\mathbf{x}$  by itself, where  $\mathbf{x}$  is a row vector of the 28 explanatory variables in the model [EDUC, EXPER, ..., BC, CMA]. This yields 329 unique variables [EDUC, EDUC<sup>2</sup>, ..., CMA, CMA<sup>2</sup>]. A condensed version of this model was used, but this reduction was not problematic.

Heteroskedasticity is found in all twelve regression equations.<sup>54</sup> Efficient estimation of the regression model parameters could proceed using Feasible GLS (FGLS - Feasible Generalized Least Squares). FGLS can be problematic though if the heteroskedasticity-generating process is incorrectly specified and it is possible for the FGLS estimates to be less efficient than the unadjusted OLS estimates. In this study an alternative procedure is used to correct the regression results for heteroskedasticity. The unbiased OLS coefficient estimates are retained, but the standard error estimates are revised using a consistent estimator of the heteroskedastic variance-covariance matrix.<sup>55</sup> The matrix is calculated as:

$$\text{Var} [\hat{\beta}_{OLS}] = (X'X)^{-1} \left[ \sum_i e_i x_i x_i' \right] (X'X)^{-1} \quad . \quad (9)$$

Since the sample sizes are quite large in each of the twelve equations, this correction should provide a close approximation to the correct covariance matrix. The revised standard errors and t-statistics are presented with the regression results in section 4.4.

#### 4.2.2. Adjustments for Price Level Changes

The regression results presented in Chapter 5 are standardized into 1981 dollars to facilitate comparisons across years. Due to the specific functional form of the model, this standardization only shifts the estimated fixed wage (intercept).

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<sup>54</sup> The test statistics are presented with the regression results in section 4.4.

<sup>55</sup> See Greene (1990), p.420.

### 4.2.3. Sample Selection Bias

The sample selection problem is characterized by individuals self-selecting into the employment situation which best rewards their abilities. The problem arises when distinct groups are compared using separate regression equations. The self-selection process implies that observations are not randomly distributed across samples and hence that the two comparison groups differ in a systematic fashion. Ultimately, sample selection bias adversely affects the regression coefficient estimates.

Sample selection bias has been cited in studies which compare the public and private sectors, language groups, or union-non-union workers [for example: Simpson (1986), Grenier (1987), Belman & Heywood (1989), Roberts (1992)]. Methods have been developed to correct the bias and, arguably, these methods represent the status quo in econometric studies which compare labour market groups such as those mentioned above. The prominent correction method is Heckman's (1979) "two-step" procedure, though alternate methods have been used (see Grant, Swidinsky & Vanderkamp 1987).

In the present study there are two potential sources of selectivity bias. First, it is possible that one of the language groups (English or French) is less attached to the labour force than the other group. For example, if Francophones face consistently lower earning opportunities than Anglophones, possibly because of discrimination, they may be less motivated to enter the labour force. If this is true for a large proportion of Francophones, then the observed data will be truncated and the sample moments of the truncated data set will not be representative of the moments in the population. In this case the self-selection is with respect to entering or not entering the labour force. Second, it is possible that workers' choices between employment in

the public and private sectors is nonrandom. In this instance, workers are presumed to self-select into the sector which rewards them most favourably.

This study does not statistically account for sample selectivity bias, despite its possible existence. This decision is motivated by two factors. First, the labour force participation rates of Anglophones and Francophones are assumed to be equal. Since there is no a priori information suggesting differences in participation rates, the assumed equality follows from the human capital theory assumptions discussed in section 3.1 and it also accords with the null hypotheses of no discrimination. Potential effects of this source of bias are minimized by including only older workers (ages 25 to 65) in the sample sets. This older cohort likely exhibits strong attachment to the labour force, regardless of language group.<sup>56</sup>

Second, attempts to correct for choice of sector selectivity bias may generate highly inefficient regression estimates. This expectation is attributed to (i) a high probability of misspecifying the sector choice process, and (ii) limitations of Canadian Census data. Inclusion of a selectivity control variable (or variables) will ensure unbiased regression coefficient estimates, but these estimates will be highly inefficient if the selectivity variable is badly measured. Previous studies which divide workers between public and private sector samples have modelling selection choices between the two sectors [Belman and Heywood (1989), Roberts (1992)]. However, it remains unclear whether individuals choose between sectors or between other factors such as occupation<sup>57</sup> or union membership<sup>58</sup>. The uncertainty regarding choice factors

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<sup>56</sup> This method of reducing selectivity bias is used by Grenier (1984).

<sup>57</sup> The descriptive statistics presented in section 4.3 show considerable variation in occupational mix between the public and private sectors.

suggests that controlling for sector selection may not capture the most salient determinants of workers' choices. Consequently, the selection variable estimates will poorly measure the true selection variable. Additionally, the available data, notably the Canadian Census data used in many Canadian studies, may not include the key variables needed to adequately model selection processes.<sup>59</sup> For example, an individual will likely have a greater probability of working within his/her information network (as defined in section 3.1.2), or of working in occupations similar to his/her parents' occupations. Census data is unable to account for these possibilities. Because of the strong likelihood that the selection process will be misspecified, this study accepts a degree of bias in the regression estimates but receives more efficient coefficient estimates in exchange.

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<sup>58</sup> Simpson (1986) finds the incidence of union membership to be higher in the public sector. Unionization is found to compress skill differentials so that low-skilled workers receive a net earnings advantage while high-skilled workers receive a net disadvantage in the public sector. These differences may imply different choice patterns across skill levels, since high-skill workers may prefer private sector employment, etc.

<sup>59</sup> Shapiro & Stelcner (1989) also adopt this stance in their study of earnings differential between public and private sector workers.

### 4.3 Empirical Results: Descriptive Statistics

The key descriptive statistics are presented in Tables II-A to II-C which appear on pages 64-66. Variable definitions are summarized in Table I on pages 54-55. The focus of the discussion is on systematic differences between language groups within particular years, differences between the public and private sectors, and changes across time. Attention is also given to the discrimination theory predictions outlined in Chapter 3.

#### 4.3.1. Labour Supply and Earnings

Francophones in the private sector always have the lowest annual earnings, while Anglophones in the public sector always receive the highest annual earnings. Comparisons within sectors show that Francophones always have lower average annual earnings than Anglophones, while comparisons across sectors show that the public sector is always better paid than the private sector with respect to both average annual earnings and average hourly wages. The annual earnings results are consistent with previous studies that observe a reduction in the Francophone earnings disadvantage between 1971 and 1986. Within the private sector Francophone relative earnings are 80.5 percent of Anglophone earnings in 1971, but this increases to approximately 88 percent in 1981 and 1986. The earnings gap has always been smaller in the public sector; in 1971 Francophones earnings are 92.3 percent of Anglophone earnings, in 1981 this increases to 99 percent, and in 1986 it is 94 percent. It is unclear why the differential is smallest in 1981, although this may reflect in part the relaxation of some Quebec regulations governing the use of French in hospitals

and social service agencies between 1981 and 1986.<sup>60</sup>

Another earnings trend is the changes in earnings differentials across the public and private sectors. Among Anglophones, public sector workers have a four percent earnings advantage in 1971, a 6.7 percent advantage in 1981, and an 11.7 percent advantage in 1986. Conversely, the relative advantage for public sector Francophones over their private sector counterparts is quite stable, remaining at roughly 20 percent in all three years of the study.

Although Francophones generally have lower average earnings than Anglophones, this is not always true for average wage rates. In the private sector, average Francophone wages are always lower than Anglophone wages though the gap narrows considerably from 15.5 percent in 1971 to 5.5 percent in 1986. In the public sector, Francophones receive higher average wages than Anglophones in both 1971 and 1981, though the advantage is small (2.2 percent in 1971 and 4.9 percent in 1981). In 1986 Francophones and Anglophones in the public sector receive similar hourly wages on average.

Lower average earnings for Francophones undoubtedly reflects their lower hours of work in a year. In all samples Francophones worked fewer weeks on average, and in all but one case (private sector, 1971) they worked less average hours per week.

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<sup>60</sup> See Appendix B: Review of Bill 101.

### 4.3.2. Human Capital

#### (a) *Education*

The most educated group, on average, is public sector Anglophones, and the least educated group is private sector Francophones. Within language groups, public sector workers are always more educated than private sector workers, and the largest differentials are between Anglophones and Francophones in the private sector. As is found for earnings, the education gap narrows in both sectors: private sector Francophones have 1.8 years less education in 1971 and approximately one year less in 1986, while public sector Francophones have approximately one year less education in 1971 and about four months less education in 1986.

#### (b) *Experience*

Experience levels declined in both language groups and across both sectors in each successive year of the study. The decline in experience between 1971 and 1986 is considerable in each case, ranging from four to five years. This is likely due to increased levels of education, since education and experience tend to be inversely related.

In the private sector Francophones are always more experienced than Anglophones, and this gap widens slightly from roughly six months in 1971 to 1.2 years in 1986. In the public sector Francophones have six months more experience than Anglophones in 1971. By 1981 the Francophone experience advantage is only about three months, and in 1986 both groups are almost equally experienced.

**Table II - A**  
**Sample Means: 1971**

	Private Sector		Public Sector	
	English	French	English	French
<b>Labour Supply and Earnings</b>				
Hours Worked per Week	41.71	41.92	40.11	38.63
Weeks Worked per Year	46.91	45.32	49.25	47.63
Annual Income	8559.94	6888.40	8905.72	8219.58
Hourly Wage	4.56	3.86	4.60	4.70
<b>Human Capital Variables</b>				
EDUC (Yrs. of Education)	11.25	9.47	11.69	10.71
EXPER (Yrs. of Experience)	24.56	24.95	24.44	24.94
BILING (English & French)	0.0935	0.5879	0.0868	0.7358
HIBILING (2nd. Lang. at Home)	0.0084	0.0776	0.0087	0.0980
NEWIMM (Past 6 Yrs.)	0.0436	0.0111	0.0192	0.0054
OLDIMM (7-11 Yrs.)	0.0176	0.0065	0.0051	0.0023
DIVORC (Divorced & Separated)	0.0490	0.0356	0.0445	0.0276
MARRY (Married & Widowed)	0.8494	0.8408	0.8709	0.8652
<b>Control Variables</b>				
Managerial (Reference)	0.0932	0.0554	0.1641	0.1493
SME (Science, Math, Engineer)	0.0566	0.0268	0.0857	0.0582
SOCSCI (Social Scientist)	0.0082	0.0073	0.0235	0.0322
TEACH (Teacher)	0.0429	0.0331	0.0094	0.0038
HEALTH (Medicine & Health)	0.0109	0.0157	0.0083	0.0084
SALES (Sales)	0.1355	0.0991	0.0065	0.0123
SERVE (Service Sector)	0.1563	0.1581	0.4859	0.4747
FARM (Farming)	0.0142	0.0092	0.0152	0.0138
PRIM (Primary Sector)	0.0208	0.0310	0.0076	0.0107
MANUF (Processing/Machining)	0.1927	0.2531	0.0394	0.0368
CONST (Construction)	0.0924	0.1156	0.0477	0.0681
TRANSP (Transportation)	0.0775	0.0927	0.0409	0.0459
OTHER Occupations	0.0988	0.1028	0.0658	0.0858
MARIT (PEI, NB, NS, NFLD)	0.0948	0.0301	0.1551	0.0329
QUEB (Quebec)	0.1038	0.8653	0.0448	0.8538
PRAIR (Sask,Man)	0.0660	0.0112	0.0929	0.0115
ALTA (Alberta)	0.0685	0.0069	0.0907	0.0069
BC (British Columbia)	0.1190	0.0076	0.1150	0.0069
CMA (City Dweller)	0.1916	0.2693	0.1208	0.2412

**Table II - B**  
**Sample Means: 1981**

	Private Sector		Public Sector	
	English	French	English	French
<b>Labour Supply and Earnings</b>				
Hours Worked per Week	42.86	41.65	41.56	38.61
Weeks Worked per Year	47.94	46.63	49.34	49.26
Annual Income	21243.73	18656.15	22668.52	22431.76
Hourly Wage	11.12	10.38	12.15	12.75
<b>Human Capital Variables</b>				
EDUC (Yrs. of Education)	11.93	10.66	14.05	13.51
EXPER (Yrs. of Experience)	21.46	22.74	20.74	20.46
BILING (English & French)	0.0812	0.5349	0.1304	0.6241
HIBILING (2nd. Lang. at Home)	0.0095	0.0877	0.0107	0.0766
NEWIMM (Past 6 Yrs.)	0.0154	0.0041	0.0093	0.0022
OLDIMM (7-11 Yrs.)	0.0294	0.0066	0.0201	0.0048
DIVORC (Divorced & Separated)	0.0627	0.0465	0.0557	0.0434
MARRY (Married & Widowed)	0.8147	0.8373	0.8287	0.8081
<b>Control Variables</b>				
Managerial (Reference)	0.1315	0.0975	0.1666	0.1743
SME (Science, Math, Engineer)	0.0690	0.0405	0.0647	0.0525
SOCSCI (Social Scientist)	0.0062	0.0045	0.0480	0.0393
TEACH (Teacher)	0.0017	0.0023	0.2126	0.1886
HEALTH (Medicine & Health)	0.0038	0.0028	0.0460	0.0621
SALES (Sales)	0.1284	0.1146	0.0027	0.0022
SERVE (Service Sector)	0.1203	0.1343	0.2809	0.3080
FARM (Farming)	0.0135	0.0121	0.0130	0.0087
PRIM (Primary Sector)	0.0264	0.0332	0.0022	0.0020
MANUF (Processing/Machining)	0.2278	0.2797	0.0267	0.0306
CONST (Construction)	0.1066	0.1165	0.0363	0.0471
TRANSP (Transportation)	0.0807	0.0916	0.0259	0.0215
OTHER Occupations	0.0841	0.0704	0.0743	0.0632
MARIT (PEI, NB, NS, NFLD)	0.1045	0.0376	0.1415	0.0397
QUEB (Quebec)	0.0507	0.8363	0.0426	0.8455
PRAIR (Sask,Man)	0.0798	0.0119	0.1028	0.0126
ALTA (Alberta)	0.1242	0.0131	0.1167	0.0109
BC (British Columbia)	0.1537	0.0109	0.1469	0.0067
CMA (City Dweller)	0.5196	0.4861	0.5063	0.5967

**Table II - C**  
**Sample Means: 1986**

	Private Sector		Public Sector	
	English	French	English	French
<b>Labour Supply and Earnings</b>				
Hours Worked per Week	43.43	41.79	41.36	38.80
Weeks Worked per Year	47.50	46.42	49.16	48.93
Annual Income	29251.71	25700.00	32682.07	30758.24
Hourly Wage	15.34	14.48	17.46	17.38
<b>Human Capital Variables</b>				
EDUC (Yrs. of Education)	12.42	11.43	14.47	14.11
EXPER (Yrs. of Experience)	20.41	21.61	20.11	20.04
BILING (English & French)	0.0720	0.5277	0.1266	0.6300
HIBILING (2nd. Lang. at Home)	0.0040	0.0577	0.0038	0.0632
NEWIMM (Past 6 Yrs.)	0.0085	0.0018	0.0043	0.0011
OLDIMM (7-11 Yrs.)	0.0146	0.0039	0.0094	0.0009
DIVORC (Divorced & Separated)	0.0668	0.0535	0.0637	0.0614
MARRY (Married & Widowed)	0.7847	0.8106	0.8047	0.7929
<b>Control Variables</b>				
Managerial (Reference)	0.1372	0.1020	0.1794	0.2015
SME (Science, Math, Engineer)	0.0696	0.0508	0.0731	0.0576
SOCSCI (Social Scientist)	0.0069	0.0049	0.0534	0.0465
TEACH (Teacher)	0.0020	0.0009	0.2083	0.1828
HEALTH (Medicine & Health)	0.0041	0.0027	0.0457	0.0760
SALES (Sales)	0.1280	0.1153	0.0024	0.0018
SERVE (Service Sector)	0.1198	0.1290	0.2917	0.2996
FARM (Farming)	0.0175	0.0160	0.0133	0.0056
PRIM (Primary Sector)	0.0254	0.0307	0.0021	0.0022
MANUF (Processing/Machining)	0.2174	0.2664	0.0273	0.0230
CONST (Construction)	0.0961	0.1108	0.0316	0.0353
TRANSP (Transportation)	0.0801	0.0851	0.0208	0.0154
OTHER Occupations	0.0961	0.0853	0.0507	0.0527
MARIT (PEI, NB, NS, NFLD)	0.1046	0.0372	0.1496	0.0436
QUEB (Quebec)	0.0381	0.8539	0.0309	0.8450
PRAIR (Sask,Man)	0.0859	0.0107	0.1054	0.0159
ALTA (Alberta)	0.1242	0.0097	0.1222	0.0080
BC (British Columbia)	0.1455	0.0075	0.1405	0.0083
CMA (City Dweller)	0.5245	0.4178	0.4930	0.4386

(c) *Language Skills* (BILING, HIBILING)

Francophones are much more bilingual than Anglophones. Among Francophones the percentage of bilinguals ranges from 53 to 74, while among Anglophones it ranges from 7 to 13. For both language groups public sector workers are usually more bilingual, except for Anglophones in 1971. An unexpected trend across the survey years is that bilingualism consistently declines in the private sector for both language groups. Between 1971 and 1986, the percentage of bilingual Anglophones in the private sector falls from 9.4 to 7.2 percent, and the percentage of bilingual private sector Francophones falls from 58.8 to 52.8 percent. Further, the proportion of bilingual Francophones in the public sector declines between 1971 and 1981, though the percentages remain similar between 1981 and 1986. The only incidence of increased bilingualism is among public sector Anglophones, where the percentage rises from 8.7 to 13 percent between 1971 and 1981 and remains similar between 1981 and 1986.

The observation of declining bilingualism, except among Anglophones in the public sector, is surprising since it is predicted in Chapter 3 that language policies would promote integration of the English and French speech communities. Although it is not explicitly predicted that bilingualism will increase, it is reasonable to assume that increased integration of language groups will be accompanied by increased bilingualism. This does not appear to be the case. The results on the BILING variable *do* meet the expectation that Francophones will be more bilingual (proportionately) than Anglophones. This is predicted under the Language theory of discrimination [see section 3.1.3].

A subset of the group of bilingual workers is the "language transfer" group

which speaks their second language at home (HIBILING in the Tables). These individuals are relatively uncommon among Anglophones, seldom comprising more than one percent of the sample, but among Francophones language transfers comprise between 5.8 and 9.8 percent of the sample depending on the year and sector. The obvious trend in this variable is the declining percentage of language transfers in the public sector in each year and in both language groups (as a percentage of bilinguals). No pattern is apparent among private sector workers, though the percentages are noticeably lower in 1986 than in 1971, despite an increase between 1971 and 1981 for both language groups.

(d) *Marital Status*

Across both sectors and both language groups, the percentage of married and/or widowed individuals declines during each successive sample year. These differences are compensated by consistent increases in the percentages of divorced and/or separated individuals and increases in the percentage of singles.

(e) *Immigration*

In general, the percentage of very recent immigrants (NEWIMM) in each sample declines during each year in the study. The percentage of more established immigrants (OLDIMM) peaks in 1981 in all samples, but generally declines overall between 1971 and 1986 (except for public sector Anglophones).

### 4.3.3. Control Variables

#### (a) *Occupation*

Changes in the occupation variable deserve considerable attention because it is hypothesized in Chapter 3 that if discrimination is a factor in French-English earnings differentials, then Francophones will be proportionately under-represented in managerial positions and in occupations with low labour-supervisor ratios (under Information Networks Theory and Language Theory). A general observation is that the mix of occupations differs across sectors, with certain occupations being more likely in one sector than the other. For instance, a higher proportion of social scientists, teachers and health workers are employed in the public sector, while proportionately more workers in sales, primary resources, manufacturing, construction and transportation are employed in the private sector.

As is predicted by the discrimination theories, there is a clear pattern of under-representation of Francophones in managerial jobs and in low labour-supervisor ratio fields such as SME's (scientists, mathematicians and engineers) and social sciences.

Within managerial (and administrative) jobs there are three interesting patterns. First, the proportion of managers is always higher in the public sector. Second, the proportion of Francophone managers is always smaller than the proportion of Anglophone managers in the private sector. In 1971 the proportion of Francophone managers is only 60 percent of the Anglophone proportion, though the gap narrows to 74.3 percent by 1986. Third, in the public sector Francophones are under-represented in management in 1971 (91 percent of the Anglophone proportion), but in 1981 and 1986 there are actually higher proportions of Francophone than Anglophone managers (112 percent of Anglophone proportion, 1986).

Within the SME and social sciences categories the patterns are equally clear: there is always a higher percentage of Anglophones than Francophones in these occupations (up to twice the Francophone proportion). The only exception is in the public sector in 1971 where there is a higher percentage of Francophones in social sciences jobs.

The converse of the prediction that Francophones will be under-represented in low labour-supervisor ratio jobs is that they will be over-represented where labour-supervisor ratios are high. In the model used for this study an occupation which is expected to match this criterion is "construction". Again, there is a clear pattern; a higher percentage of Francophones is observed in construction jobs. However, the differential diminishes between 1971 and 1986, particularly in the public sector.

(b) *Region and Urbanization*

Most Francophones live in Quebec. Within each Francophone sample used for this study, the percentage of individuals living in Quebec is highly stable at roughly 85 percent. An interesting observation on Anglophone dispersion patterns is that a large percentage of Anglophones *left* Quebec between 1971 and 1986. This trend is strongest in the private sector, particularly between 1971 and 1981. During this period the percentage of private sector Anglophones in Quebec declines by almost half, and in the 1981 to 1986 period there is a further 20 percent decline (about 60 percent decline between 1971 and 1986). There is also an exodus of public sector Anglophones from Quebec, but the effects are less powerful, amounting to about 25 percent of the 1971 proportion. These out-migration trends are also observed by Grenier (1987), and are attributed to the anti-English climate in Quebec which was bolstered by the mid-1970's French language policies.

The only interesting feature of the urbanization variable is that the percentages are quite low for 1971, reflecting censoring of the Census data. In 1971 only Toronto and Montreal are classified as urban centers, and in subsequent years the Census Metropolitan Area definitions are considerably expanded.

#### **4.3.4. Summary of Descriptive Statistics Results**

There are a number of interesting changes in the descriptive statistics across time. The Francophone-Anglophone annual earnings gap narrows in both sectors between 1971 and 1986, though it remains considerable in the private sector in 1986 (12 percent lower earnings for Francophones). It is suggested in Chapter 3 that the earnings gap might narrow as a result of French language policies, though no strong prediction is made. In any case the relative earnings disparity faced by Francophones declined appreciably. It is also noted that the earnings gap between public and private sector workers widens for Anglophones, generating a 12 percent advantage for public sector workers by 1986, but it remains quite stable among Francophones at roughly 20 percent in each year. Narrowing wage gaps are also observed, though this is manifested by increasing Francophone wages in the private sector and decreasing wages in the public sector (relative to Anglophones).

Average educational attainments also moved towards convergence between 1971 and 1986 in both sectors, and this appears to be at the expense of experience levels. In general, experience levels decline by four to five years on average within each group.

In terms of the predictions presented in section 3.3, there are four interesting outcomes. First, the under-representation of Francophones in particular high-status

jobs is observed in all years in the private sector, and in 1971 in the public sector.<sup>61</sup> This is predicted by the Information Networks and the Language theories of discrimination. Second, the levels of under-representation clearly decline in both sectors between 1971 and 1986. This outcome suggests that some degree of integration occurred in the labour market.

Third, Francophones are much more bilingual, on average, than Anglophones. This is predicted by the Language theory of discrimination. Fourth, trends in bilingualism and region of residence suggest that integration may *not* have progressed. Bilingualism declines considerably among Francophones, particularly in the public sector, and between 1971 and 1986 the proportion of Anglophones living in Quebec declines enormously. These observations indicate that segregation, rather than integration, may have been a factor in the changes in earnings between 1971 and 1986.

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<sup>61</sup> In the SME (Science, Math, and Engineering) occupations this observation holds in both sectors across all three Census years.

#### 4.4 Empirical Results: Wage Equations

The regression results (wage equations) are presented in Tables III-A to III-C which appear on pages 75-80. Table I on pages 54-55 summarizes the model to give readers a quick reference for variable definitions. The focus of the discussion is on systematic differences across language groups in particular years, differences between the public and private sectors, and changes across time. Attention is also given to the discrimination theory predictions outlined in Chapter 3.

##### 4.4.1 General Comparisons of Wage Equations

The regression results generally conform to expectations and are statistically significant overall. The explanatory power of the equations ( $R^2$ ) is comparable to other studies of wage determination processes [Carliner (1981), Grenier (1984)].

Tests are performed on various combinations of equations to determine whether the equations: (i) change over time, (ii) differ across sectors within language groups, and (iii) differ across language groups within sectors.<sup>62</sup> These tests are performed to indicate patterns of similarity between particular sets of equations.

The first tests compare the estimated equations for a particular language-sector group (i.e., English private sector workers) between 1971 and 1981, and between 1981 and 1986 (the 1971 and 1986 equations are not compared). Differences are observed within all four language-sector groups across time. Changes over time may be due to a wide variety of exogenous factors such as changes in demand for certain skills or

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<sup>62</sup>

These tests are performed with a Wald statistic, which is described in Greene (1990). The test determines whether the coefficients are similar across comparison equations. Results are presented in Appendix C.

changes in general prosperity across regions.

The second tests compare public and private sector equations for each language group and across each year. For example, in each year the English public sector equation is compared to the English private sector equation. Results show that there are systematic differences between the public and private sectors, regardless of language group. This thesis does not attempt to explain these differences, since they are not an integral part of the theoretical framework in Chapter 3. The third tests compare English and French equations within a particular sector. For example, in each year the English private sector equation is compared to the French private sector equation. Results show that there are consistent differences in the wage determination process between language groups within sectors.<sup>63</sup>

In sum, the wage determination processes estimated by each equation are all distinct. They have changed over time, they differ across sectors, and they differ across language groups.

#### 4.4.2 Comparisons of Wage Equations: Human Capital

##### (a) Education

The education coefficients are all correctly signed and highly significant. The rate of return on an additional year of schooling is generally between four and six percent. There are two interesting patterns in the education coefficients: first, the returns to education *decline* for Anglophones in the private sector between 1971 and 1986, and second, the returns to education *increase* for Francophones in the private

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<sup>63</sup> This particular set of tests is important in the discrimination testing procedure in Chapter 5 so these results are presented with the discrimination statistics rather than in Appendix C.

Table III-A  
1971 Regression Results

	Private Sector		Public Sector	
	English	French	English	French
Constant	1.399 (10.01)	1.323 (6.34)	1.196 (3.43)	1.541 (4.01)
EDUC	0.053 (15.36)	0.044 (8.98)	0.062 (9.61)	0.040 (3.85)
EXPER	0.031 (10.80)	0.030 (7.66)	0.033 (5.59)	0.005 (0.56)
EXPSQR	-0.00044 (-12.84)	-0.00043 (-8.94)	-0.00049 (-6.93)	-0.00009 (-0.78)
EDxEXP	-0.00040 (-3.20)	-0.00047 (-2.61)	-0.00040 (-1.52)	0.00052 (1.22)
BILING	-0.003 (-0.17)	0.125 (10.57)	0.024 (0.78)	0.042 (1.30)
HIBILING	-0.188 (-3.22)	0.023 (1.06)	0.156 (1.10)	0.145 (2.76)
NEWIMM	-0.113 (-5.42)	-0.162 (-2.12)	-0.191 (-3.11)	-0.165 (-1.06)
OLDIMM	-0.079 (-2.98)	0.000 (-0.0001)	0.076 (0.98)	0.107 (1.09)
DIVORC	0.127 (5.15)	0.188 (5.49)	0.138 (2.53)	0.005 (0.03)
MARRY	0.229 (14.71)	0.244 (12.17)	0.206 (6.10)	0.133 (3.02)
SME	-0.158 (-9.10)	-0.063 (-1.88)	-0.043 (-1.71)	0.034 (0.54)
SOCSCI	-0.298 (-6.11)	-0.030 (-0.42)	-0.110 (-1.76)	-0.147 (-1.17)
TEACH	-0.204 (-8.77)	0.038 (1.02)	-0.175 -2.10	-0.076 (-0.70)
HEALTH	-0.411 (-10.70)	-0.246 (-4.51)	0.091 (1.20)	0.142 (0.73)
SALES	-0.371 (-22.23)	-0.317 (-12.02)	-0.136 (-1.88)	-0.247 (-2.55)
SERV	-0.484 (-30.81)	-0.413 (-16.91)	-0.193 (-9.54)	-0.129 (-3.13)

Table III-A, ...Continued  
1971 Regression Results

	Private Sector		Public Sector	
	English	French	English	French
FARM	-0.991 (-19.66)	-0.739 (-8.12)	-0.461 (-6.23)	-0.204 (-1.52)
PRIM	-0.329 (-10.28)	-0.191 (-5.27)	-0.432 (-5.71)	-0.087 (-0.76)
MANUF	-0.348 (-23.40)	-0.250 (-10.82)	-0.170 (-4.11)	-0.166 (-2.73)
CONST	-0.264 (-14.98)	-0.117 (-4.64)	-0.275 (-5.91)	-0.184 (-2.48)
TRANSP	-0.429 (-21.61)	-0.379 (-13.65)	-0.204 (-4.50)	-0.199 (-2.67)
OTHER	-0.361 (-19.69)	-0.249 (-8.94)	-0.265 (-7.05)	-0.241 (-3.28)
MARIT	-0.261 (-18.81)	-0.354 (-8.97)	-0.105 (-4.86)	-0.238 (-2.01)
QUEB	0.014 (0.92)	-0.083 (-3.95)	-0.051 (-0.95)	0.009 (0.19)
PRAIR	-0.188 (-10.79)	-0.229 (-4.30)	-0.110 (-4.08)	-0.170 (-1.21)
ALTA	-0.079 (-4.93)	-0.049 (-0.92)	-0.095 (-3.96)	0.001 (0.005)
BC	0.058 (4.73)	0.122 (1.72)	-0.038 (-1.66)	-0.195 (-1.92)
CMA	0.049 (4.99)	0.037 (3.27)	0.054 (2.16)	0.101 (3.55)
Sample	21580	10988	2766	1306
R-Squared	0.2227	0.1769	0.3133	0.2134
Adj. R-Sqr.	0.2217	0.1748	0.3063	0.1961
F-Statistic	220.52	84.12	37.21	12.37
White's Stat	347.65	276.13	179.87	87.11

\* t-Statistics in Brackets

**Table III-B**  
**1981 Regression Results**

	Private Sector		Public Sector	
	English	French	English	French
Constant	1.265 (25.82)	1.184 (14.89)	1.229 (11.3)	1.149 (9.59)
EDUC	0.049 (17.3)	0.052 (11.52)	0.043 (7.5)	0.049 (7.77)
EXPER	0.036 (14.86)	0.039 (9.56)	0.033 (6.94)	0.039 (6.19)
EXPSQR	-0.00050 (-17.01)	-0.00051 (-10.56)	-0.00049 (-8.57)	-0.00057 (-7.53)
EDxEXP	-0.00039 (-3.69)	-0.00053 (-3.05)	-0.00008 (-0.41)	-0.00054 (-2.17)
BILING	0.020 (1.41)	0.051 (4.74)	0.030 (1.66)	0.061 (3.84)
HIBILING	-0.054 (-1.51)	0.010 (0.45)	-0.030 (-0.44)	-0.016 (-0.53)
NEWIMM	-0.191 (-6.55)	-0.147 (-2.14)	-0.378 (-4.4)	0.036 (0.19)
OLDIMM	-0.157 (-7.78)	-0.244 (-4.34)	-0.084 (-2.09)	-0.105 (-1.25)
DIVORC	0.076 (4.23)	0.085 (2.8)	0.174 (4.41)	0.244 (5.85)
MARRY	0.186 (16.22)	0.205 (12.07)	0.272 (9.74)	0.282 (10.7)
SME	-0.052 (-4.17)	-0.002 (-0.1)	-0.057 (-2.98)	-0.085 (-2.86)
SOCSCI	-0.297 (-6.49)	-0.092 (-1.23)	-0.162 (-5.52)	-0.054 (-1.18)
TEACH	-0.117 (-2.03)	-0.016 (-0.18)	-0.040 (-2.4)	-0.047 (-2.09)
HEALTH	-0.300 (-7.68)	-0.218 (-2.54)	-0.263 (-8.79)	-0.276 (-7.59)
SALES	-0.250 (-19.35)	-0.289 (-15.19)	-0.312 (-2.81)	-0.473 (-2.09)
SERV	-0.411 (-31.48)	-0.389 (-20.87)	-0.230 (-13.27)	-0.280 (-12.66)

Table III-B, ...Continued  
1981 Regression Results

	Private Sector		Public Sector	
	English	French	English	French
FARM	-0.825 (-22.63)	-0.564 (-10.16)	-0.367 (-9.76)	-0.314 (-4.67)
PRIM	-0.082 (-3.44)	-0.016 (-0.51)	-0.353 (-3.68)	-0.326 (-2.68)
MANUF	-0.214 (-18.58)	-0.205 (-12.85)	-0.347 (-6.39)	-0.297 (-7.38)
CONST	-0.169 (-12.46)	-0.047 (-2.31)	-0.271 (-7.3)	-0.337 (-8.47)
TRANSP	-0.272 (-17.41)	-0.247 (-11.31)	-0.318 (-8.26)	-0.343 (-6.98)
OTHER	-0.237 (-16.69)	-0.186 (-8.15)	-0.598 (-18.56)	-0.541 (-11.97)
MARIT	-0.104 (-9.17)	-0.153 (-4.9)	-0.029 (-1.62)	-0.016 (-0.41)
QUEB	0.001 (0.03)	-0.013 (-0.67)	0.037 (1.24)	0.137 (4.81)
PRAIR	-0.039 (-3.05)	0.010 (0.18)	-0.004 (-0.2)	-0.089 (-1.06)
ALTA	0.092 (8.87)	-0.087 (-1.81)	0.024 (1.18)	0.040 (0.47)
BC	0.148 (5.47)	0.156 (2.88)	0.086 (4.79)	0.074 (1.33)
CMA	0.060 (8.36)	0.043 (4.27)	0.061 (4.96)	0.063 (4.12)
Sample	35644	14742	9848	4607
R-Squared	0.1423	0.1384	0.2092	0.2866
Adj. R-Sqr.	0.1417	0.1368	0.2069	0.2822
F-Statistic	211.03	84.41	92.77	65.68
White's Stat	117.98	148.01	524.31	208.14

\* t-Statistics in Brackets

Table III-C  
1986 Regression Results

	Private Sector		Public Sector	
	English	French	English	French
Constant	1.309 (30.65)	0.991 (14.24)	0.980 (11.63)	1.313 (11.23)
EDUC	0.046 (14.87)	0.059 (11.56)	0.057 (9.73)	0.038 (4.96)
EXPER	0.035 (12.98)	0.046 (10.37)	0.034 (6.69)	0.025 (3.44)
EXPSQR	-0.00045 (-13.66)	-0.00056 (-10.37)	-0.00052 (-8.5)	-0.00043 (-4.9)
EDxEXP	-0.00028 (-2.42)	-0.00080 (-4.21)	0.00010 (0.47)	0.00053 (1.79)
BILING	0.010 (0.63)	0.045 (3.61)	0.058 (3.02)	0.061 (3.11)
HIBILING	0.012 (0.24)	0.015 (0.51)	0.196 (2.57)	0.018 (0.54)
NEWIMM	-0.230 (-5.14)	-0.533 (-2.29)	-0.191 (-1.73)	-1.265 (-2.17)
OLDIMM	-0.095 (-3.36)	-0.324 (-4.19)	-0.083 (-1.79)	-0.251 (-1.16)
DIVORC	0.096 (5.36)	0.143 (3.98)	0.181 (5.26)	0.165 (3.56)
MARRY	0.190 (16.91)	0.239 (13.15)	0.245 (9.85)	0.253 (8.22)
SME	-0.042 (-3.06)	-0.025 (-1)	-0.072 (-2.78)	-0.062 (-1.77)
SOCSCI	-0.267 (-6.11)	-0.231 (-3.55)	-0.175 (-5.35)	-0.071 (-2.01)
TEACH	-0.253 (-2.75)	-0.105 (-0.62)	-0.055 (-3.4)	-0.036 (-1.4)
HEALTH	-0.152 (-3.34)	-0.372 (-3.75)	-0.178 (-6.52)	-0.199 (-4.81)
SALES	-0.314 (-24.97)	-0.306 (-14.47)	-0.412 (-3.01)	-0.170 (-2.01)
SERV	-0.438 (-33.6)	-0.375 (-17.47)	-0.119 (-6.93)	-0.171 (-6.75)

Table III-C, ...Continued  
1986 Regression Results

	Private Sector		Public Sector	
	English	French	English	French
FARM	-0.857 (-24.54)	-0.695 (-12.83)	-0.356 (-6.08)	-0.229 (-2.27)
PRIM	-0.079 (-3.2)	0.043 (1.17)	-0.164 (-1.8)	-0.156 (-1.11)
MANUF	-0.237 (-21.71)	-0.218 (-11.72)	-0.229 (-5.48)	-0.212 (-4.05)
CONST	-0.229 (-16.37)	-0.029 (-1.31)	-0.186 (-5.3)	-0.125 (-2.75)
TRANSP	-0.327 (-20.02)	-0.241 (-9.91)	-0.252 (-4.52)	-0.213 (-2.41)
OTHER	-0.305 (-21.06)	-0.217 (-9.27)	-0.282 (-8.14)	-0.204 (-4.67)
MARIT	-0.128 (-10.23)	-0.138 (-3.88)	0.014 (0.71)	-0.118 (-2.53)
QUEB	0.011 (0.5)	-0.002 (-0.08)	-0.099 (-2.68)	-0.012 (-0.38)
PRAIR	-0.082 (-6.41)	-0.169 (-3.14)	0.007 (0.38)	0.015 (0.21)
ALTA	0.058 (5.29)	-0.038 (-0.64)	0.038 (2.06)	-0.096 (-1.34)
BC	0.112 (11.15)	-0.023 (-0.27)	0.039 (2.21)	-0.030 (-0.33)
CMA	0.073 (9.72)	0.054 (4.6)	0.075 (5.71)	0.036 (2.04)
Sample	37623	14771	9859	4476
R-Squared	0.147	0.131	0.2101	0.218
Adj. R-Sqr.	0.1463	0.129	0.2078	0.2131
F-Statistic	231.38	79.37	93.38	44.28
White's Stat	179.46	188.33	532.29	90.73

\* t-Statistics in Brackets

sector during this period. There are no apparent trends in education returns in the public sector.

Chapter 3 forwards the prediction that Francophones will receive higher returns to education than will Anglophones, assuming that language differences are the source of discrimination [Lang (1986)]. This is not observed in 1971, when Anglophone returns are roughly 50 percent higher than Francophone returns. Higher Francophone returns *are* observed in both sectors in 1981, and only in the private sector in 1986. Since the prediction holds in only three of six cases, the regression results fail to consistently support the language theory of discrimination. This issue is raised again in item (c), "Language Skills".

**(b) Experience**

The experience variables are correctly signed in all cases, and all but one is highly significant (public sector Francophones in 1971). The estimated returns to experience are quite stable across time. The returns realized by Anglophones are always in the range of 3.1 to 3.6 percent, while returns realized by Francophones generally fall between three and four percent (with the exception of the 1971 public sector result which is particularly small and insignificant). The only obvious trend in the experience coefficients is the increase in returns that private sector Francophones receive in each successive Census year. There are no clear differences between Anglophones and Francophones across time.

**(c) Language Skills**

The results for the language (bilingualism) variables are relatively complex, but

deserve considerable attention in this study. First, there are a number of interesting results on the BILING variable (speak both official languages, but don't speak the second language at home). Bilingualism appears to pay for Francophones in both sectors and to a lesser extent for Anglophones in the public sector (after 1971), but Anglophones in the private sector are never highly rewarded for their bilingualism. Further, Francophones always realize greater returns to language skills than do Anglophones when compared within sectors. This pattern of rewards for bilingualism among Anglophones in 1971 is also observed by Shapiro and Stelcner (1982). The positive and significant return realized by public sector Anglophones in 1986 is higher than the return found in Roberts (1992), but he does find that bilingualism is better rewarded in the public sector.

It is also observed that the returns to bilingualism increase in the public sector for both language groups. For Anglophones the return is small and insignificant in 1971, but it increases to three percent in 1981 and by 1986 is 5.8 percent. For Francophones the return is roughly four percent in 1971 (significant at the ten percent level), and it increases to 6.1 percent in both 1981 and 1986. Within the private sector there is no trend in bilingualism returns among Anglophones, but there is a distinct decline in returns to bilingualism for Francophones. In particular, private sector Francophones have a highly significant 12.5 percent return on their English skills in 1971, but this falls to 5.1 percent in 1981 and to 4.5 percent in 1986 (all significant at  $\alpha < .005$ ).

The increased returns to bilingualism in the public sector are consistent with the expected supply and demand impacts of French language policies discussed in Chapter 3. The emphasis on bilingualism in federal government recruitment

programs and the increased use of French in Quebec's public institutions suggest that returns to bilingualism would rise over time. Further, the consistently higher returns to bilingualism for Francophones may reflect the Language theory of discrimination prediction of higher returns to education. In particular, the model used in this study includes separate variables for education and bilingualism, implying that the education returns are *net of* returns to language skills. Lang's (1986) prediction of higher returns to education for Francophones relies on the supposition that English is learned in school, but it is actually the language skills which generate the superior returns. In the context of the model used here, the empirical outcomes are consistent with Lang's prediction, though it is impossible to ascertain this because the higher return to bilingualism among Francophones is also consistent with higher demand for English language skills.

Second, the HIBILING variable (bilingual *and* speak the second language at home - also known as "language transfers" [see Beaujot (1980)] - yields equally interesting results. This variable is often not significant (nine of twelve cases), and in some cases does not have the expected positive sign.

The most intriguing result is the negative return on this variable for private sector Anglophones in 1971 and 1981. This result is surprising since it is hypothesized that the HIBILING variable will capture higher proficiency in the second language and will thus be positive. The strong negative result, however, *is* consistent with one of hypotheses entertained in Chapter 3; there are separate job information networks for Francophones and Anglophones and the Francophone network is relatively poorer. Thus, if Anglophones who speak French at home are more likely to be part of the French information network than the English network, then they will be

relatively disadvantaged in comparison with Anglophones who don't speak French at home. By 1986 there is effectively no return on the language transfer variable for private sector Anglophones, possibly suggesting that information networks became less operative over time (this is consistent with the occupational integration noted in section 4.3.3). Also, a negative return on this variable is found for public sector Anglophones in 1981.

The converse of the argument presented above is that Francophone language transfers will have a greater likelihood of being in English information networks, and will consequently realize a benefit over other Francophones. This possibility is unobservable since it predicts a positive sign and is thus consistent with the original hypothesis that language transfers are more proficient in the second language than are other bilinguals (i.e., superior human capital endowment). It is interesting that only one of these coefficients is statistically significant (French public sector, 1971), despite the fact that language transfer Francophones could benefit both from being in the English network *and* from having higher proficiency in English than other Francophone bilinguals.<sup>64</sup>

#### **(d) Other Human Capital Variables**

The quadratic experience term EXPSQR is correctly signed in all cases, and is highly significant in all but one case (French public sector, 1971). The coefficients on this variable are quite stable across time, and are very similar across language groups and sectors in all years. The only exception is some variability in the estimates for

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<sup>64</sup> Five of the six HIBILING variables in Francophone equations are correctly signed (except in the public sector, 1981), but in 1981 and 1986 the associated t-statistics are insignificant ( $t \approx .5$  on all four coefficients).

Francophone public sector workers across time, though after 1971 they are quite comparable to the other three groups.

The interaction of education and experience (EDxEXP) is usually negative and is always significant in the private sector for both language groups. It is never significant for English public sector workers. The interaction effect declines (approaches zero) each Census year for Anglophones in both sectors, and by 1986 it is positive for English public sector workers. The opposite trend is observed for French private sector workers, with the interaction becoming more negative each year, possibly reflecting the relatively rapid increase in educational attainment for this group.

Immigration variables also conform to the prediction that recent immigrants are more disadvantaged than immigrants who have been in Canada for a longer period. Almost 75 percent of these variables are significant at  $\alpha=.05$  or better. The only unusual result on this variable is that in 1981 recent Francophone immigrants do relatively better than more established Francophone immigrants. The reason for this outcome is unclear. It is also interesting that in 1971 the more established immigrants in the public sector actually do relatively better than the Canadian-born and long-term residents (reference group) in both language groups.

Marital status variables conform to expectations: married and widowed workers always receive a wage advantage over divorced and separated workers. All but one of the coefficients is highly significant. The strongest similarities are found within sectors, and the only discernable pattern in these variables is that after 1971 they are consistently better rewarded in the public sector.

#### 4.4.3 Comparisons of Wage Equations: Control Variables

The coefficients on occupation variables indicate that the Managerial/Administration reference group does comparatively better than most other occupations (as indicated by the negative signs on most of the occupational variables). The coefficients on these variables are often highly significant, and there is a clear pattern in the private sector: differentials between the managerial reference category and the non-managerial occupations are almost always smaller for Francophones than for Anglophones. This observation may reflect a number of factors, including: (i) better rewards paid to Francophones in the private sector for their "other" human capital endowments (as defined in 4.1.1), (ii) relatively higher compensating wage demands among Francophones for accepting the merits (or drawbacks) of a particular occupation, (iii) a more compressed wage structure for Francophones, possibly as a result of discrimination against Francophone managers, and (iv) systematic differences in status (and wage) levels within the aggregated Census occupation categories across language groups.

There is no a priori support for the first two explanations of the occupation variable outcomes, and neither seems likely in the present context. In particular, there is no a priori reason to believe that Francophones would receive consistently higher returns than Anglophones on their "other" human capital endowments, or that Francophones consistently demand higher compensating wages than Anglophones.<sup>65</sup>

The third explanation (i.e., lower relative wages for Francophone managers) is

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<sup>65</sup> Consistently higher compensating wage demands among Francophones imply differences in preferences between the two groups, and may also imply lower labour force participation rates among Francophones. It was noted in Chapter 3 that preferences are assumed to be the same across the two groups.

consistent with the observation that private sector Francophones generally earn less than Anglophones and that Francophones are generally under-represented in management and other high-status occupations, potentially because of discrimination. It is also consistent with the observation made by Shapiro and Stelcner (1982) that the earnings advantage for Anglophones over Francophones increases with the level of education. Again, this may be due to wage discrimination that becomes more pervasive in higher income categories such as management. Further, this explanation is consistent with the lower base wage (constant) faced by Francophones which may, in part, be due to lower returns to Francophones managers.<sup>66</sup>

The fourth explanation (i.e., censoring of the Census data) is also plausible, and is consistent with results of previous studies and the lower Francophone base wage (intercept). In particular, it is possible that Francophones are consistently over-represented at the lower end of the management scale, while proportionately more Anglophones are represented in senior management positions. Aggregation in the Census data precludes verification of this possibility, since all managers, regardless of level, are included in the "Managerial and Administration" occupations category. An over-representation of Francophones in middle or lower management levels is predicted by Coleman in his study of French language policies [Coleman (1981), p.482]. Also, as noted, the smaller Francophone intercept terms may reflect lower management wages, which in turn may reflect segregation of Francophones into the

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<sup>66</sup> The lower base wage is consistent with lower managerial wages for Francophones, but it may also reflect lower demand for French language skills, or lower returns to other reference-group characteristics (ie., single, Canadian-born or long-term resident, Ontario resident, rural resident). A more detailed comparison of wages across language groups and occupational categories is needed in order to verify this assertion.

lower-status (and wage) portion of the management hierarchy.<sup>67</sup>

The regional variables indicate that the Ontario reference group does relatively well compared to workers in other regions. There are two minor patterns: (i) Anglophones tend to do best in B.C., other things constant, and (ii) all groups tend to have lower wages in the Maritimes region. It is also observed that in the public sector Francophones always do better than Anglophones in Quebec, relative to Ontario-residing members of their respective language groups. The opposite is true in the private sector, where Anglophones in Quebec always do better than Anglophone in Ontario and Francophones in Ontario always do better than Francophones in Quebec, other things constant.<sup>68</sup>

The urbanization variable (CMA) is always significant and positively signed. A consistent increase in the return on this variable is observed for Anglophones in both sectors and for Francophones in the private sector.

#### 4.4.4. Summary of Wage Equation Results

The estimated wage equations reveal a number of interesting results. First, the equations exhibit systematic differences across time, across sectors and across language groups. The changes across time suggest a degree of dynamism in Canadian wage structures overall. Differences in wage structures across sectors are

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<sup>67</sup> It is worth emphasizing that the lower constant wage is consistent with the third and fourth explanations. Under the third explanation the smaller intercept is due to discrimination, while under the fourth explanation it is due to segregation. There is no way to determine which explanation is more likely, given the structure of the model and limitations of the Census data.

<sup>68</sup> These results are only statistically significant in three of twelve cases: private sector Francophones in 1971, public sector Francophones in 1981 and public sector Anglophones in 1986.

not the focus of this thesis, but other economic studies have attributed them to different levels of unionization [Simpson (1986)], or other constraints on wage determination processes [Shapiro and Stelcner (1989)]. Differences across language groups are particularly interesting, and provide the foundations for the discrimination tests presented in the following chapter.

In addition to overall differences across equations, there are noteworthy patterns in particular variables. Four major points stand out. First, Francophones in the private sector realize higher returns on their education investments *and* job experience for each successive Census year. Conversely, Anglophones in this sector saw their education returns decline so that by 1981 they actually realized smaller education returns than those obtained by Francophones.

Second, Francophones are always better rewarded for bilingualism when compared to Anglophones in the same sector. Further, Anglophones in the private sector are generally not rewarded for bilingualism, and bilingualism returns realized by private sector Francophones decline between 1971 and 1986. In the public sector, returns to bilingualism increased for both language groups, likely because of the increased demand for bilingualism generated by French language policies.

Third, the wage differences between Francophone managers and Francophones in other occupations is smaller than the differences observed for Anglophones. This result may reflect an underpayment of Francophones, compared to their equally-skilled Anglophone counterparts, in high-status jobs, or alternatively, it may reflect censoring of Census data which obscures differences in occupational status across language groups (i.e., Francophones may be over-represented in lower levels of management).

Finally, public sector Francophones always do relatively better than Anglophones in Quebec, but private sector Anglophones always do better than Francophones in Quebec.

The prediction in Chapter 3 that Francophones will be underpaid for their human capital on average (all three theories) is difficult to verify because comparisons of the wage equations show that the pattern of advantages fluctuates across time. Further analysis of this prediction is carried out in the following chapter.

## CHAPTER 5

### Discrimination: Measurement and Testing

The main objective of this thesis is to determine whether wage discrimination contributed to earnings differentials between the English and French in Canada between 1971 and 1986. The theoretical sources and implications of discrimination are discussed in Chapter 3. It is hypothesized in Chapter 3 that *if* wage discrimination existed in 1971, then French language policies would work to reduce discrimination over time. This hypothesis is tested by: (i) determining whether the measure of discrimination is positive in 1971, and (ii) determining whether measured discrimination decreased over time. It is also observed that language policies could promote or enhance "reverse" discrimination (i.e., against Anglophones), if the initial Anglophone earnings advantage is not due to discrimination. In either case, the improved economic circumstances facing Francophones is attributed to increased integration of English and French workers in the workforce predicted in Chapter 3.

The first section of this chapter outlines the mechanics of measuring discrimination. The second section outlines the procedure used to test the statistical significance of the discrimination measures and also explains how the measurement technique is applied to the model used in this thesis. The final section presents and interprets the empirical results.

#### 5.1 Measuring Wage Discrimination

Wage discrimination is measured using the standard wage decomposition technique. This technique has been applied in other studies of wage differentials, including studies of public-private sector wage differentials [for example, see Shapiro

and Stelcner (1989)] and studies of gender-based wage differentials [see, for example, Nadeau, Walsh and Wetton (1991)]. In general, the wage decomposition technique analyzes the difference in the means of the dependent variable across two independently estimated wage equations by separating the difference into two components. The first part is due to different endowments of human capital between the two groups and is called the endowment effect. The second part arises from different rates of return on human capital factors across the two groups, and is called the discrimination effect.

In the present case the dependent variable is the natural log of the hourly wage rate (hereafter "wage rate"), and the wage equations are linear. Under this specification the mean wage rate is related to the mean levels of human capital endowments as follows:

$$\mu_j^y = \beta_j' \mu_j^x \quad (8)$$

for group  $j$  ( $j=E,F$ ). It then follows that

$$\begin{aligned} \mu_E^y - \mu_F^y &= \beta_E' \mu_E^x - \beta_F' \mu_F^x \\ &= \beta_E' \mu_E^x - \beta_F' \mu_F^x + \beta_E' \mu_F^x - \beta_E' \mu_F^x \\ &= \beta_E' (\mu_E^x - \mu_F^x) + \mu_F^{x'} (\beta_E - \beta_F) \\ &= \quad H \quad + \quad D \end{aligned} \quad (9)$$

These two summary terms  $H$  and  $D$  are the Endowment (Human capital) and Discrimination effects respectively.

Economic interpretations can be given to both of these expressions.<sup>69</sup> The endowment effect (H) measures the value of an average Francophone's human capital endowment "deficit" ( $\mu_{-E}^x - \mu_{-F}^x$ ) at the same market returns received by Anglophones ( $\beta_{-E}$ ). It is the increase in the average hourly wage rate which *would* be realized by an averagely-skilled Francophone *if* the individual acquired the same human capital levels possessed by Anglophones.

The discrimination term (D), measures the impact of the different rates of return on human capital received by each group ( $\beta_{-E} - \beta_{-F}$ ), evaluated at the Francophone group's average human capital endowment. It is the increment to the hourly wage rate which *would* be realized by a Francophone with average skills *if* he received the same rates of return as Anglophones on his human capital skills.

The sample analogues to H and D are derived from the separate regression equation estimates as follows:

$$\begin{aligned} \bar{y}_{-E} - \bar{y}_{-F} &= \hat{\beta}_{-E}'(\bar{x}_{-E} - \bar{x}_{-F}) + \bar{x}_{-F}'(\hat{\beta}_{-E} - \hat{\beta}_{-F}) \\ &= \hat{H} + \hat{D} \end{aligned} \quad (10)$$

where

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<sup>69</sup> Anglophones are used as the comparative basis. This conforms with the usual majority/minority definitions applied in wage discrimination studies. Assigning the majority to be the comparative base reflects the likelihood that it faces a more competitive wage determination process than does the minority (i.e., if discrimination exists against the minority).

$$\begin{aligned}
 E[\bar{y}_j] &= \mu_j^y \\
 E[\bar{X}_{-j}] &= \mu_{-j}^x
 \end{aligned}
 \tag{11}$$

for  $j \in \{E, F\}$ , and where  $\bar{y}_j$  is the sample mean of the dependent variable and  $\bar{X}_{-j}$  is a vector of sample means of the explanatory variables.

## 5.2 Testing the Significance of Wage Discrimination

Discrimination and endowment effect estimates have traditionally been treated as deterministic values and hence their statistical significance has not usually been tested.<sup>70</sup> This shortcoming can lead researchers to conclude that discrimination exists whenever positive estimates of  $D$  are obtained, even when  $\hat{D}$  is not significantly different from zero. This study applies two tests on discrimination (and endowment) measures. The first test checks a sufficient condition for the absence of discrimination, which requires the overall regression coefficients to be equal across the English and French equations. A Wald test is used to determine whether differences across the estimated wage equations are statistically significant.<sup>71</sup> This test is asymptotically valid, and should be reliable with the large samples used in this study.

A limitation of the Wald test approach for testing discrimination is that it is

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<sup>70</sup> For example: Carliner (1981) measures the endowment effect in his language group study, and Shapiro and Stelcner (1989) measure the endowment and discrimination effects. Neither study tests the statistical significance of the measures.

<sup>71</sup> The use of a Wald test to determine the equality of coefficients between equations is suggested by Nadeau, Walsh and Wetton (1993). This test is described in Greene (1990), p.223.

not a direct test of the magnitude of the discrimination estimate. It is possible for the Wald test to reject the hypothesis that the coefficients are the same overall, and consequently to determine that discrimination is present, even if the overall impact of discrimination is negligible (i.e.,  $\hat{D} \approx 0$ ). This can occur when the wage processes differ across groups (equations), but the discrimination effect works to the benefit of one group with respect to a certain set of variables, and works to the benefit of the other groups with respect to another set of variables. Thus, discrimination can arise from particular variables in the model, but the contributions of these variables may be offsetting so that there is no significant degree of discrimination overall.

The second test used in this study checks a necessary condition for discrimination by directly testing the statistical significance of the discrimination estimate. The methodology for performing these tests is provided by Nadeau, Walsh and Wetton (1993). This methodology also allows statistical tests to be performed on the contribution of a subset  $\Omega$  of the  $K$  explanatory variables to the aggregate estimates of  $D$  (and  $H$ ). The subset of  $j$  explanatory variables ( $j \leq K$ ), includes the full set of variables as a special case when ( $j=K$ ). Application of this methodology relies on the following definitions:

$$\omega_i = \begin{cases} 1 & \text{if variable } i \text{ is a member of subset } \Omega \\ 0 & \text{if variable } i \text{ is not a member of subset } \Omega \end{cases}$$

and

$$\hat{w}' = [ \bar{x}_{-E} \omega, \bar{x}_{E1} \omega_1, \bar{x}_{E2} \omega_2, \dots, \bar{x}_{EK} \omega_K ] \quad (12)$$

for the Anglophone equations. An analogous vector is constructed for Francophones by replacing all occurrences of  $E$  with  $F$ .

To perform tests with respect to the contribution of variable subset  $\Omega$  to the

overall measure of discrimination, the test statistic is:

$$\hat{\delta}_\alpha = \frac{\hat{D}_\alpha - D_\alpha}{s} \quad (13)$$

where

$$\hat{D}_\alpha = \hat{w}'_{-F} (\hat{\beta}_{-E} - \hat{\beta}_{-F}) \quad (14)$$

and

$$s^2 = \hat{w}'_{-F} (V_{-E} + V_{-F}) \hat{w}_{-F} \quad (15)$$

The terms  $V_j$  ( $j=E,F$ ) are the regression coefficient variance-covariance matrices.<sup>72</sup>

Under the null hypothesis ( $H_0$ : no discrimination) the statistic reduces to

$$\hat{\delta}_\alpha = \frac{\hat{D}_\alpha}{s} \quad (16)$$

which has the following distribution<sup>73</sup>:

$$\hat{\delta}_\alpha \stackrel{a}{\sim} N(0,1) \quad (17)$$

Thus, the null hypothesis is rejected if

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<sup>72</sup> These matrices are adjusted for heteroskedasticity, as described in section 4.2.

<sup>73</sup> This result requires that both equations satisfy the relatively unrestrictive assumptions of the CLRM (Classical Linear Regression Model). The variance of the error term does not need to be equal across the equations.

$$\delta_{\alpha} > Z_{\alpha} \quad (18)$$

where  $\alpha$  is the chosen significance level.<sup>74</sup>

A similar procedure is used to test whether the contribution of the subset of variables to the overall endowment effect is statistically significant. The analogous test statistic is:

$$\hat{\xi}_{\alpha} = \frac{\hat{E}_{\alpha}}{s} \quad (19)$$

where

$$\hat{E}_{\alpha} = \beta' \begin{pmatrix} \hat{w} & - & \hat{w} \\ -E & -E & -F \end{pmatrix} \quad (20)$$

and

$$s^2 = \begin{pmatrix} \hat{w} & - & \hat{w} \\ -E & -E & -F \end{pmatrix}' V \begin{pmatrix} \hat{w} & - & \hat{w} \\ E & -E & -F \end{pmatrix} \quad (21)$$

This statistic has the same distribution and rejection criterion as  $\delta_{\alpha}$  under the null hypothesis of no endowment effect.

### Application of the Nadeau, Walsh & Wetton Methodology

The model used in this thesis consists of four independently estimated equations:

English Private Sector (EP)  
 English Public Sector (EG)  
 French Private Sector (FP)  
 French Public Sector (FG)

which each contain 29 variables (a constant, four education and experience variables, two bilingualism variables, two immigration variables, two marital status variables,

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<sup>74</sup> A two-sided test may be more appropriate in some circumstances, particularly where both positive and negative discrimination may exist.

twelve occupational variables, five regional variables, and an urbanization variable). Trends in discrimination between 1971 and 1986 are assessed using intra-sectoral comparisons across the two language groups. In other words, discrimination between Anglophones and Francophones is measured in the private sector and then in the public sector for each Census year. Tests are performed on the following subsets of variables:

- All Variables
- Education and Experience Variables (EDUC, EXPER, EXPSQR, EDxEXP)
- Language Variables (BILING, HIBILING)
- Immigration Variables (NEWIMM, OLDIMM)
- Marital Status Variables (DIVORC, MARRY)
- Occupational Variables (SME, SOCSCI, TEACH, HEALTH, SALES, SERV, FARM, PRIM, MANUF, CONST, TRANSP, OTHER)
- Location Variables (MARIT, QUEB, PRAIR, ALTA, BC, CMA)
- All Human Capital Variables (Education, Experience, Language, and Marital Status Variables)
- All Control Variables (Occupational and Location Variables)
- Intercept<sup>75</sup>

Grouping the variables into logical subsets allows the general sources of

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<sup>75</sup> The intercept term reflects returns to reference group characteristics (net of education and experience contributions). The contribution of particular characteristics to the discrimination effect cannot be determined, so it is assumed that returns on these factors are equal for Anglophones and Francophones (as per the null hypothesis of no discrimination). Thus, the only source of constant wage (intercept) differentials between Anglophones and Francophones is different returns to English or French language skills respectively (the only qualitative difference between the constants in the Anglophone and Francophone equations is in the mother tongue spoken).

discrimination and endowment effects to be determined without having to assess the impacts of each variable in the model.

### 5.3 Discrimination Test Results

Discrimination test results are presented separately for each sector. Wald tests determine that the public and private sector equations are different, and these differences may be due to a number of factors, including language policies or other constraints on wage determination processes [see Simpson (1986), Shapiro and Stelcner (1989)].<sup>76</sup> As is noted previously, this thesis does not attempt to explain these inter-sectoral differences.

Throughout the following discussion there are two key points to observe. First, the term "wage rate" is used to denote the "natural logarithm of the hourly wage rate" to enhance the readability of the discussion. Second, all of the estimated discrimination and endowment effects presented in Tables IV-A and IV-B are in real terms. This is an artifact of the logarithmic transformation applied to the dependent variable in each equation.<sup>77</sup>

The discussion of discrimination in each sector assesses the overall level of discrimination in each year, as well as the individual factors which contribute to

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<sup>76</sup> These Wald tests are presented in Appendix C.

<sup>77</sup> The difference in the means of the log of the hourly wage rate is unaffected by price level changes, even though the magnitude of the means is affected. In particular, assuming the P is the price level adjustment factor and W is the untransformed hourly wage rate, then:

$$\begin{aligned}\ln(PW_E)-\ln(PW_F)&=\ln(W_E)-\ln(W_F)+\ln(P)-\ln(P) \\ &=\ln(W_E)-\ln(W_F).\end{aligned}$$

discrimination. Particular attention is drawn to trends across time. Also, the role of human capital endowments (the endowment effect) is assessed since this is the converse of discrimination under the measurement techniques described above (i.e., the portion of the overall wage differential not due to discrimination is attributed to endowment differences, and vice versa). The statistical results of the discrimination tests are presented in Tables IV-A on page 102 and IV-B on page 111. A convention adopted in these tables is that sources of Anglophone wage advantage are shaded. This allows readers to orient themselves with the trends and patterns discussed in the text.

### 5.3.1 Discrimination in the Private Sector: 1971-1986

#### Overall Measures of Discrimination

There is a marked downward trend in discrimination in the private sector between 1971 and 1986. In 1971, 60 percent of the French-English wage rate differential is due to discrimination against Francophones. The remaining 40 percent is due to superior Anglophone human capital (and control variable) endowments. Both measures are highly significant ( $\alpha < .005$ ). Although the discrimination effect is large and significant in 1971, by 1981 it is small, insignificant and actually works in favour of Francophones. The endowment effect in this case accounts for *more* than the total difference in average wage rates, while the discrimination effect is negative (reverse discrimination) and consequently counteracts a portion of the overall Anglophone endowment advantage. However, in 1981 only the endowment effect is statistically significant. By 1986 the reverse discrimination against Anglophones disappears, and is replaced by discrimination against Francophones which accounts

for 30 percent of the wage differential. Only the wage rate differential due to the endowment effect (70 percent) is statistically significant (at  $\alpha=.05$ ) in 1986.

In terms of the discrimination and endowment measures (in real terms, as noted above) the discrimination component is 0.091 in 1971, -0.005 in 1981 and 0.014 in 1986, while the endowment measure also declines overall from 0.061 in 1971, to 0.058 in 1981, and to 0.032 by 1986. The consistent decline in the endowment measure suggests that human capital endowments were equalizing across the Francophone and Anglophone language groups in the private sector. Convergence of endowments is noted in section 4.3.

Changes in discrimination across time are particularly interesting since there is a dramatic decline in discrimination between 1971 and 1981 which results in reverse discrimination, but by 1986 discrimination again benefits Anglophones (though neither the 1981 nor 1986 measure is statistically significant). A possible reason for this trend is that French language policies were successful and, hence, caused discrimination to decline to the point where Francophones actually gained from discrimination. The increase in discrimination between 1981 and 1986 may be due, in part, to post-1981 court decisions which repealed certain language policy provisions affecting the private sector (see Appendix B).<sup>78</sup> It is also noteworthy that the downward trend in discrimination is coincident with a narrowing of the gap in average wage rates. The gap observed in 1971 declines by 65 percent between 1971 and 1981, and by 70 percent between 1971 and 1986.

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<sup>78</sup> The relaxation of particular language policies in the public sector may have had indirect impacts on the private sector as well.

**Results of Hypothesis Testing Procedure:  
Private Sector**

	1971		1981		1986	
	Endow.	Discrim.	Endow.	Discrim.	Endow.	Discrim.
<b>All Variables</b>	0.061	0.091	0.058	-0.005	0.032	0.014
t-stat	(5.44)	(7.16)	(4.99)	(-0.39)	(2.07)	(0.80)
% of Diff. in Means	40.13	59.86	109.26	-9.28	70.28	29.69
<b>Constant</b>	-	0.076	-	0.081	-	0.317
t-stat	-	(0.77)	-	(0.87)	-	(3.07)
% of Diff. in Means	-	50.03	-	150.99	-	697.6
<b>All Human Capital</b>	0.085	0.022	0.023	-0.079	0.015	-0.268
t-stat	(9.71)	(0.25)	(3.42)	(-0.92)	(2.04)	(-2.79)
% of Diff. in Means	55.86	14.58	43.17	-147.36	32.31	-588.62
<b>Education &amp; Experience</b>	0.071	0.128	0.037	-0.04	0.026	-0.208
t-stat	(26.93)	(1.43)	(21.50)	(-0.47)	(17.06)	(-2.13)
% of Diff. in Means	46.97	84.59	68.8	-75.57	56.96	-456.68
<b>Language</b>	0.014	-0.092	-0.005	-0.022	-0.005	-0.019
t-stat	(1.71)	(-7.54)	(-0.76)	(-2.29)	(-0.72)	(-1.81)
% of Diff. in Means	9.47	-60.24	-9.35	-41.4	-11.01	-41.77
<b>Immigration</b>	-0.005	0	-0.006	0	-0.003	0.0014
t-stat	(-6.06)	(0.04)	(-9.99)	(0.77)	(-5.95)	(2.70)
% of Diff. in Means	-3	0.02	-10.71	0.73	-5.64	3.12
<b>Marital Status</b>	0.004	-0.015	-0.003	-0.017	-0.004	-0.042
t-stat	(8.67)	(-0.67)	(-11.68)	(-0.92)	(-14.45)	(-2.30)
% of Diff. in Means	2.41	-9.78	-5.55	-31.13	-8.00	-93.29
<b>All Controls</b>	-0.024	-0.008	0.035	-0.007	0.017	-0.036
t-stat	(-2.12)	(-0.21)	(2.60)	(-0.24)	(1.00)	(-1.11)
% of Diff. in Means	-15.72	-4.75	66.09	-12.91	37.97	-79.31
<b>Occupation</b>	0.016	-0.096	0.012	-0.03	0.011	-0.058
t-stat	(13.98)	(-4.01)	(16.73)	(-1.94)	(17.03)	(-3.51)
% of Diff. in Means	10.42	-63.19	22.34	-56.28	23.7	-127.44
<b>Location</b>	-0.04	0.089	0.023	0.023	0.006	0.022
t-stat	(-3.55)	(3.87)	(1.72)	(1.01)	(0.38)	(0.81)
% of Diff. in Means	-26.14	58.44	43.75	43.37	14.27	48.13

Wald Statistics:	583.7	105.3	129.03
English Mean:	1.3426	2.223	2.5137
French Mean:	1.1905	2.1694	2.4682
Difference in Means:	0.152029	0.05352	0.0455

*Shaded: Anglophone Advantage*

### Sources of Discrimination: Private Sector

Constituents of the overall measures of discrimination and endowment effects are analyzed in groups (as defined in section 5.2). There are a number of trends in both the endowment and discrimination contributions of these variable subsets, and there is a remarkably consistent pattern of advantages across the years used in the study.

An interesting trend is the increasing contribution to discrimination from the constant wage (intercept) term.<sup>79</sup> This term reflects the base wage of the reference group, which has the following qualities: monolingual, long-term resident or Canadian-born, single, manager or administrator, Ontario resident, does not live in an Census Metropolitan Area (CMA). Anglophones in this category always realize a wage advantage over Francophones in the private sector. This is not particularly surprising since the French reference group comprises monolingual Francophones who live in Ontario, and thus the differential in constant wages may reflect lower demand for French language skills in an English-dominated economic environment.<sup>80</sup> The surprising result is that the Anglophone wage advantage for this group increased dramatically between 1981 and 1986. Compared to the discrimination measure on this variable in 1971, the 1981 value increases roughly seven percent, but the 1986 value is more than three times as large as the 1981 value. The constant wage is a prominent source of discriminatory Anglophone wage advantage in all three years, but only in

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<sup>79</sup> There is no endowment effect associated with the constant wage because, by definition, the means are equal to 1 in both language groups.

<sup>80</sup> The lower constant wage for Francophones may also be due to lower wages paid to Francophone managers, as discussed in section 4.4.3.

1986 is it statistically significant ( $\alpha < .01$ ). The constant wage advantage is the only major component of pro-Anglophone discrimination which increases over time.

Superior human capital endowments (excluding controls) always provide a wage advantage for Anglophones, though after 1971 the positive contribution from human capital endowments is outweighed by reverse discrimination. The size of the Anglophone benefit from endowment differentials (in real terms) declines considerably between 1971 and 1986; the 1981 advantage is only 27 percent of the 1971 advantage, and the 1986 advantage is only 18 percent of the 1971 advantage. Conversely, the small discrimination factor arising from this subset in 1971 reverses and become quite a strong benefit for Francophones by 1986. The human capital variables endowment effect is always statistically significant, and the discrimination effect becomes significant by 1986.

The overall contributions of human capital variables to the endowment and discrimination effects are comprised of contributions from the more refined subsets of Education and Experience variables, Language variables, Immigration variables, and Marital Status variables. The contributions of these subsets vary over time and are sometimes offsetting, though the pattern of relative advantages is identical between 1981 and 1986.

A strong endowment effect favouring Anglophones always arises from the education and experience subset, and this subset is consistently the largest contributor to Anglophone endowment advantages. The magnitude of the education and experience endowment advantage decreases over time. The education and experience subset is also the largest contributor to pro-Anglophone discrimination in 1971, but by 1981 it becomes a source of reverse discrimination, and by 1986 this subset is the

largest contributor to reverse discrimination.

Language variables provide a consistent source of Francophone advantage, both from the endowment effect and the discrimination effect.<sup>81</sup> However, the relative influence of these variables is quite small after 1971. The discrimination advantage decreases over time, dropping almost 80 percent between 1971 and 1986. The Anglophone endowment advantage in 1971 becomes a minor source of disadvantage by 1981, and remains quite constant between 1981 and 1986. These outcomes are due to the fact that (i) Francophones are always much more bilingual than Anglophones, and (ii) the Francophone returns to bilingualism generally exceed the returns realized by Anglophones.

Immigration variables contribute very little to the discrimination and endowment effects. The same can be said for the endowment effect arising from the marital status variables. The Francophone discrimination advantage from marital status variables in 1971 actually increases in impact during each successive year of the study, though the relative impact of these variables continues to be small in 1986.

Overall, the contribution of control variables to discrimination effects is usually small relative to the impacts of the human capital variables, although the Francophone discrimination advantage from these variables increases each year. The endowment effect from control variables exceeds the human capital endowment effects in both 1981 and 1986, though there is no clear trend in the overall contribution of control variables.

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<sup>81</sup> This statement is true in five of six cases. The exception is the 1971 endowment effect which actually works in favour of Anglophones. This result is unexpected and is attributed to the negative signs on BILING and HIBILING in the Anglophone equation.

The pattern of contributions to endowment and discrimination effects from the occupational variables is identical for each year. Anglophones always receive an endowment benefit from occupational variables, but this is always outweighed by a disadvantage from the discrimination effect. The endowment advantage consistently declines between 1971 and 1986, and there is no distinct trend in the discrimination effect (smallest Francophone advantage in 1981). Both effects are almost always significant at the five percent level or better, the only exception being the discrimination effect in 1981 ( $\alpha \approx .05$ ). The endowment effect arises from the lower proportions of Anglophones in occupations with the greatest wage disadvantages.

The contribution of occupational variables to reverse discrimination indicates that Francophone wage disadvantages across occupations (compared to managerial jobs) are less pronounced than Anglophone disadvantages. It is noted in section 4.4.3 that this outcome may be caused by compression of the wage structure for Francophones, or by over-representation of Francophones in lower levels of the management hierarchy.

Generally, for the location variables both effects work in favour of Anglophones, though in 1971 the endowment effect benefits Francophones. In 1981 and 1986, however, neither effect is statistically significant. In each year, the largest source of the discrimination effect from location variables is the higher returns to living in Quebec for Anglophones than for Francophones. This result reflects the fact that monolingual English workers realize higher returns from living in Quebec than in Ontario (reference region), while French monolinguals realize higher returns in Ontario than in Quebec. The corollary of this observation is that monolingual Francophones appear to be *highly* disadvantaged in Quebec's private sector,

potentially as a result of wage discrimination. A more detailed study of discrimination in Quebec needs to be done to verify this observation.

The Francophone endowment advantage from location variables in 1971 is attributed to the lower proportion of Francophones in the two most disadvantaged areas of the county: the maritimes and the prairies. In 1981 and 1986, the Anglophone advantage comes from the greater proportion of Anglophones living in British Columbia.

### **Conclusions: Discrimination in the Private Sector**

The trend towards lower levels of discrimination against Francophones in the private sector is noted above. This general result is consistent with the predictions made in Chapter 3; given that discrimination existed in 1971, French language policies are expected to promote reduced discrimination over time.

The pattern of changes within the variable subsets is equally interesting. Between 1971 and 1986, almost every change in the most influential sets of variables works to the advantage of Francophones by either reducing Anglophone endowment advantages or increasing/creating Francophone discrimination advantages. The Anglophone endowment advantages declines in the following subsets of variables: education and experience, language skills, marital status and occupations. Further, changes in discrimination measures which work to the benefit of Francophones are observed in the following subsets of variables: education and experience, marital status, and location. In a broader view, changes in the human capital variable subset served to benefit Francophones through greatly reduced endowment differences, and a very sizable amount of reverse discrimination. Reverse discrimination from control

variables also increased, giving Francophones further advantage. The most notable results which work against Francophones in the private sector are the increasing constant wage difference and an endowment advantage in control variables for Anglophones.

### 5.3.2 Discrimination in the Public Sector: 1971-1986

#### Overall Measures of Discrimination

The most surprising result in this study is that Francophones in the public sector benefit from reverse discrimination in all three Census years, and equally surprising is the fact that this advantage becomes *extremely* large by 1986. These results warrant considerable attention.

In 1971 Anglophones have an overall wage advantage, but this advantage is smaller than it should be in the absence of reverse discrimination. The superior human capital endowments possessed by Anglophones justify a wage advantage almost 80 percent larger than the observed advantage. Reverse discrimination offsets this potential advantage. By 1981 Francophones possess the wage advantage, but 96 percent of this advantage is attributed to reverse discrimination. Conversely, the small and insignificant endowment effect in 1981 suggests that human capital endowments are quite similar between Anglophones and Francophones by this time, and that the wage differential should be almost eliminated. It is also interesting that the 1981 endowment effect works in favour of Francophones, implying that they actually surpass Anglophone human capital endowment levels on average.

Given the slight endowment advantage for Francophones in 1981, it is quite unexpected that a large endowment advantage for Anglophones exists in 1986. Further, the real value of this advantage is more than double the 1971 value. Despite this large Anglophone endowment advantage in 1986, Francophones benefit from reverse discrimination which is **nine times** as large as the Francophone wage advantage and which consequently negates the entire Anglophone endowment advantage. Neither the endowment nor the discrimination effect is statistically

significant in 1971, but both effects are significant in 1986. In 1981, only the discrimination effect is significant.

Although these results come as somewhat of a surprise, they are consistent with the expected impacts of French language policies discussed in Chapter 3. In this case, however, it appears that language policies did not serve to remove discrimination against Francophones, but to reinforce discrimination against Anglophones. Analysis of this outcome is complicated by the instability of results, in terms of both the overall discrimination and endowment measures and in terms of the contributions of variable subsets to discrimination and endowment measures.

#### **Sources of Discrimination: Public Sector**

The pattern of advantage in the constant wage is unstable. In 1971 Francophones benefit from very substantial reverse discrimination attributed to this variable (18 times the total wage differential!). By 1981 the advantage shifts so that Anglophones benefit from constant wage discrimination, which is only about one quarter of the 1971 Francophone advantage in real terms. In 1986, the advantage again shifts so that Francophones benefit from discrimination and, interestingly, the real Francophone advantage in 1971 is almost identical to the 1986 value. The instability of this pattern is difficult to explain, but it is observed that the constant wage is the principle source of reverse discrimination in 1971 and 1986.

Although the constant wage advantage shifts in an odd pattern between 1971 and 1986, there *is* an interesting pattern in the relationship between the human capital variables' contribution to discrimination and the contribution of the base wage. In particular, whichever group is advantaged by a higher base wage in a given year is

**Results of Hypothesis Testing Procedure:  
Public Sector**

	1971		1981		1986	
	Endow.	Discrim.	Endow.	Discrim.	Endow.	Discrim.
<b>All Variables</b>	0.034	-0.015	-0.003	-0.064	0.081	-0.091
t-stat	(0.80)	(-0.32)	(-0.12)	(-2.71)	(2.90)	(-3.04)
% of Diff. in Means	177.81	-76.79	3.98	96.02	-806.31	906.13
<b>Constant</b>	-	-0.35	-	0.08	-	-0.333
t-stat	-	(-1.63)	-	(0.50)	-	(-1.86)
% of Diff. in Means	-	-1809.22	-	-120.81	-	3319.34
<b>All Human Capital</b>	0.024	0.437	0.02	-0.072	-0.014	0.292
t-stat	(1.04)	(2.12)	(2.02)	(-0.47)	(-1.36)	(1.71)
% of Diff. in Means	123.69	2287.97	-29.45	108.08	139.72	-2907.36
<b>Education &amp; Experience</b>	0.052	0.382	0.029	-0.04	0.025	0.286
t-stat	(16.10)	(1.91)	(17.91)	(-0.26)	(15.97)	(1.68)
% of Diff. in Means	273.38	2002.71	-43.28	59.86	-246.84	-2849.96
<b>Language</b>	-0.029	-0.011	-0.013	-0.02	-0.041	0.009
t-stat	(-1.35)	(-0.35)	(-1.37)	(-1.31)	(-4.05)	(0.52)
% of Diff. in Means	-155.32	-62.35	19.5	30.26	406.61	-90.94
<b>Immigration</b>	-0.002	0	-0.004	-0.001	-0.0013	0.0014
t-stat	(-2.76)	(-0.23)	(-4.52)	(-1.24)	(-2.48)	(1.94)
% of Diff. in Means	-12.72	-1.12	6.03	1.2	13.03	-13.47
<b>Marital Status</b>	0.004	0.067	0.008	-0.011	0.003	-0.005
t-stat	(3.34)	(1.34)	(7.94)	(-0.34)	(9.37)	(-0.14)
% of Diff. in Means	18.35	348.73	-11.69	16.76	-33.09	47.01
<b>All Controls</b>	0.01	-0.1	-0.022	-0.072	0.095	-0.05
t-stat	(0.24)	(-1.42)	(-0.93)	(-1.74)	(3.16)	(-1.04)
% of Diff. in Means	54.12	-555.55	33.43	108.76	-946.03	494.16
<b>Occupation</b>	0.01	-0.049	0.002	0.013	-0.001	0.0001
t-stat	(6.12)	(-1.30)	(1.84)	(0.73)	(-1.34)	(0.01)
% of Diff. in Means	50.21	-256.09	-2.64	-19.95	14.84	-1.39
<b>Location</b>	0.001	-0.057	-0.024	-0.085	0.096	-0.05
t-stat	(0.02)	(-0.90)	(-1.01)	(-2.26)	(3.21)	(-1.13)
% of Diff. in Means	3.9	-299.46	36.07	128.71	-960.86	495.55

Wald Statistic:	58.09	54.63	58.52
English Mean:	1.4259	2.3213	2.6860
French Mean:	1.4068	2.3876	2.6961
Difference in Means:	0.019092	-0.06631	-0.0100

*Shaded: Anglophone Advantage*

also disadvantaged with respect to human capital contributions to discrimination. The offsetting forces are of similar magnitude within each year, working to cancel each other out to a significant extent.

The most consistent pattern in the public sector results is the important Anglophone endowment advantage arising from the education and experience subset of variables. This endowment advantage is the largest source of the overall Anglophone endowment benefit in 1971, and in 1971 and 1981 it is sufficiently large to generate overall human capital endowment benefits for Anglophones. As is observed in the private sector, the Anglophone education and experience endowment advantage declines (by 50 percent) between 1971 and 1986. The education and experience subset also generates considerable discrimination in 1971 and 1986. In both years these variables provide the vast majority of the overall human capital discrimination advantage for Anglophones. In 1981 education and experience variables provide the strongest contribution to reverse discrimination

Language variables are always a source of endowment advantage for Francophones, and in 1971 and 1981 they also contribute to reverse discrimination. The endowment contribution of language variables is largest in 1986, and in all years it is the largest source of Francophone human capital advantage. Only in 1986 is it of sufficient magnitude to offset the Anglophone human capital advantages arising from other sources. These variables also generate reverse discrimination in 1971 and 1981, but the impacts are neither large nor statistically significant. It is interesting that in 1986 Anglophones benefit from discrimination due to language variables, though this effect is relatively small and not significant.

The immigration and marital status variables generally have little impact on

discrimination and endowment measures, though in 1971 the marital status subset contributes extensively to pro-Anglophone discrimination.

Occupational variables only impact the 1971 results. The Anglophone occupational advantage in 1971 is due largely to the lower proportion of Anglophones in construction and "other" occupations. The 1971 Francophone occupational discrimination advantage is due almost entirely to more favourable returns in the service occupations.

Location variables have considerable impacts in all years, but the pattern of these impacts varies. There is always a reverse discrimination impact, and this is dominantly due to higher returns received by public sector Francophones for residing in Quebec. The discrimination effect is only statistically significant in 1981. Further, the endowment effect favours Anglophones in 1971, and is small and insignificant, but it works in favour of Francophones in 1981 because the returns to living in Quebec are higher than returns to living in Ontario. In 1986 the relative rates of return are reversed and, consequently, the endowment effect works against Francophones in this year. Overall, the location variables' contribution to the endowment effect is unstable across the three Census years and is only significant in 1986.

### **Conclusions: Discrimination in the Public Sector**

Discrimination against Francophones in the public sector is not a problem in any of the Census years used in this study. In fact, the most pressing problem appears to be reverse discrimination which is large in all years, and is very large in 1981 and 1986. In 1971 and 1986 the most prominent source of reverse discrimination is the large constant wage advantage over Anglophones. In all years the higher

Francophone returns to language skills and to Quebec residency also contributed heavily to the overall discrimination effect.

As is found in the private sector results, Anglophones continued to hold an education and experience advantage in all years, though the advantage declines considerably over time. It is notable that the discrimination effect from these variables persists in 1986, even though they are a source of reverse discrimination in the private sector in both 1981 and 1986.

In general, the Anglophone advantages from the discrimination and endowment effects are partly or entirely eroded between 1971 and 1986, particularly in the most influential subset of variables: education and experience. Other trends do not appear to exist, since the importance of factors shifts in an unstable fashion, generating considerable influence in one year but not in others.

## CHAPTER 6

### Conclusions

The economic position of the Francophone minority in Canada improved substantially between 1971 and 1986, compared to the Anglophone majority. The Anglophone advantage in annual earnings and hourly wages declined considerably in both the private and public sectors. This trend is partially attributable to the convergence of human capital endowments between the two language groups. Convergence of human capital endowments is statistically confirmed by the declining human capital endowment effect (in real, absolute terms) in both sectors across time, as shown in Chapter 5, and by the descriptive statistics in section 3.3 which indicate convergence in education and experience levels between Anglophones and Francophones across time.

Although changes in relative earnings between 1971 and 1986 indicate improved economic circumstances for Francophones, wage differentials continued to exist between English and French workers in all three Census years. The main objective of this paper is to determine whether, and to what extent, these differentials can be attributed to wage discrimination. The results of Chapter 5 clearly show that discrimination contributes to wage differentials. It is also clear that the sources and levels of discrimination between 1971 and 1986 change across time and differ between the public and private sectors.

Discrimination generally works in favour of Anglophones in the private sector, though the magnitude declines considerably between 1971 and 1986. The Anglophone discrimination advantage decreases from 60 percent of the wage

differential in 1971 to 30 percent in 1986. Only the positive discrimination in 1971 is statistically significant.

In the public sector discrimination always works to the advantage of the French minority. The overall Francophone discrimination advantage increases dramatically overall: the 1981 estimate of reverse discrimination is four times as large as the 1971 estimate, and the 1986 estimate is six times as large as the 1971 estimate. The 1981 and 1986 measures of reverse discrimination are statistically significant. It is also noteworthy that the 1986 measure of reverse discrimination in the public sector is 6.5 times as large (in absolute value) as the Anglophone discrimination advantage in the private sector for 1986. This represents a reversal of the 1971 situation in which the Anglophone discrimination advantage in the private sector is over six times as large as the reverse discrimination measure in the public sector.

Despite the apparently substantial wage discrimination advantage for Francophones in the public sector in 1986, it is important to note these individuals comprise only 23 percent of Francophones in the 1986 sample. Thus, discrimination reduces the wages of more than three quarters of the Francophone workers included in this study in 1986 (again, the measure of discrimination in the private sector is not significantly different from zero).

An oddity of the discrimination trends is that in 1981 discrimination favours Francophones in both sectors. In the public sector this advantage is consistent with the increasing trend of reverse discrimination, but the reason for reverse discrimination in the private sector in 1981 is unclear, particularly since discrimination in this sector works in favour of Anglophones in both 1971 and 1986. Although the incidence of reverse discrimination in the private sector in 1981 is somewhat

surprising, it should be noted the measure of discrimination is very close to zero and is statistically insignificant. Thus, the trend in this sector may be better described as a change from a large Anglophone discrimination advantage in 1971 to a trivial discrimination effect in both 1981 and 1986.

Specific sources of discrimination vary considerably across sectors, though there are certain consistencies. For example, Francophones almost always benefit from discrimination due to language skills (higher returns). Over time this advantage declines in the private sector, and in 1986 in the public sector this advantage actually reverses to favour Anglophones.

In the private sector the pattern of discrimination advantages is identical in 1981 and 1986 (though the magnitudes of these effects vary between the two Census years). The primary source of pro-Anglophone discrimination in all years is the higher constant wage received by Anglophones, which likely reflects greater demand for English language skills in the English-dominated North American economy. The real measure of this source of discrimination actually increases in each successive Census year. After 1971, Francophones benefit from reverse discrimination due to higher returns on education and experience endowments, and the reverse discrimination impact of these variables increases over time. Francophone occupation returns advantages appear to result from wage discrimination against Francophone managers, or from over-representation of Francophones in lower managerial ranks. The real value of this measure also declines somewhat between 1971 and 1986, suggesting that discrimination against Francophone managers or intra-occupational segregation may be decreasing over time. Anglophones in the private sector consistently realize higher returns to living in Quebec than do Francophones, but this

advantage also declines over time. As a general observation almost all of the changes in discrimination within the private sector across time worked to the advantage of Francophones.

In the public sector the only consistent discrimination advantage for Francophones comes from their higher returns to living in Quebec. Again, the trends across time show that Francophones in the public sector became less disadvantaged in the most influential source of pro-Anglophone discrimination: education and experience. Further, the major sources of reverse discrimination in 1971 remain relatively constant to 1986. The public sector discrimination results should be interpreted with a degree of caution since they exhibit considerable instability across the Census years.

Chapter 3 outlines three theories which provide potential explanations for the sources of discrimination. The predicted outcomes from these theories are observed in some cases, but the overall explanatory value is questionable, particularly since Francophones in the public sector are never discriminated against in the years included in this study. There are four principle results relating to discrimination theories.

First, before the introduction of French language policies in the mid-1970's, Francophones receive lower returns than Anglophones on their human capital endowments in both sectors. This is indicated by the positive discrimination estimates on the "human capital" subset of variables. All three theories of discrimination predict this outcome. It should be noted however that this "human capital" subset is not significant in the private sector in 1971. The pattern in

subsequent years is less clear, since Francophones receive higher human capital returns on average than Anglophones after 1981 (except in the public sector in 1986).

Second, the higher returns to education predicted under the Language theory of discrimination are not observed in any consistent fashion, though consistently higher returns to bilingualism for Francophones are observed in both sectors. It is noted in 4.4.4 that higher returns to education will likely not be exhibited because of the separation of education and language skills in the model used in this study, but the higher returns to bilingualism cannot be taken as a confirmation of Lang's (1986) hypothesis because they are also consistent with the higher demand for English skills hypothesis [ie Carliner (1981)].

Third, the occupational segregation predicted by the Information Networks and Language theories of discrimination is observed in both sectors, but is most obvious in the private sector. In particular, Francophones are underrepresented in managerial jobs (and other higher-status occupations) and overrepresented in the lowest status jobs (ie. construction). Fourth, the large negative coefficient on the language transfer variable (HIBILING) for private sector Anglophones in 1971 suggests that Information Networks may be operative. In this case, the Anglophone language transfer group may be integrated into the relatively disadvantaged French information network. The language transfer return for private sector Anglophones is also negative in 1981, but is considerably lower than the 1971 estimate, suggesting that information networks may have become less influential over time.

In sum, all three theories appear to be supported in 1971, and the Language and Information Networks theories appear to be most reasonable. After 1971, however, the theories are not well supported by the empirical results, particularly in

the public sector.

The results of this study are consistent with the predictions in Chapter 3 regarding the impacts of language policies. First, it is predicted that discrimination would decline, or that reverse discrimination would increase, over time. This prediction holds in both the public and private sectors, at least in terms of the percentages of wage differentials due to discrimination. In the private sector the Anglophone discrimination advantage declines considerably between 1971 and 1986. In the public sector the real value of reverse discrimination increases, and becomes increasingly important in terms of the observed wage differential.

The prediction of decreasing discrimination against Francophones (or increasing reverse discrimination) is made under the assumption that French language laws would promote integration of the French and English language groups in the workplace. It is unclear, however, whether this is the cause of change. In particular, it is observed that the level of bilingualism and the proportion of Anglophones in Quebec declined between 1971 and 1986. This raises the question of whether integration or segregation of Anglophone and Francophone workers motivated the trends in discrimination.

Second, it is predicted that changes in discrimination would differ between sectors. This also appears to hold, since the pattern of discrimination sources is more unstable in the public sector. It is difficult to determine in which sector these policies are more effective because the sources of discrimination are different in each.

This study indicates that discrimination played a substantial role in wage differences between the English and French in Canada between 1971 and 1986. Discrimination worked in favour of Francophones in the public sector and against Francophones in the private sector overall. Comparisons across the three Census years show that trends in discrimination worked increasingly in favour of Francophones. These changes are likely attributable to French language policies which were initiated in the 1970's, since they provided economic incentives to increase the number of Francophones in the workplace. Also, these policies led to large outmigrations of Anglophones from Quebec and, consequently, opened additional jobs to Quebec's Francophone majority.

Although the trends in discrimination are consistent with the predictions of discrimination theories, given the existence of French language policies, it remains to be determined whether these trends are attributable to increased integration of Canada's dominant language communities, or whether they are attributable to increased segregation in which Quebec became more "French". A more detailed study of discrimination in Quebec could provide further insight into this question.

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## APPENDIX A

Mathematical Results: Language  
Theory of Discrimination

This appendix provides the mathematical basis for Lang's results (Lang, 1986).

Attention is focused on Lang's third and fourth cases, since they are more realistic and yield richer results than the other cases presented in his paper. For the reader's benefit, the simplifying assumptions listed in the text (3.1.3.) are repeated here:

1. There are two groups {E=English and F=French} which are unable to communicate unless at least one person (an interpreter) learns to speak both languages;
2. The two groups must communicate in order to conduct trade;
3. All individuals are equally able to learn the second language, and may do so at a constant positive cost ( $\lambda$ ). The second language is strictly productive and does not generate utility independent of its impact on earnings;
4. Both groups have identical tastes and production sets (i.e., equal productive capacity);
5. Exchange between the two groups occurs because group E has relatively more capital than group F.<sup>82</sup> This implies that group E will be net hirers of F workers. For the purposes of exposition all hirers are assumed to come from group E;
6. Since group E are hirers, they will be indifferent between two bundles of workers if and only if the marginal costs are equal across the bundles.

**Case 3: Fixed Ratio of Supervisors to Labourers**

Employers require two grades of workers, supervisors (S) and labourers (L), which are used in a fixed proportion of  $L/S=n$ . Transaction costs cannot be minimized if the employer hires a mixed labour force (i.e., L is not comprised of both E and F labourers) since this requires more than one individual to learn a second

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<sup>82</sup> This is the Heckscher-Ohlin theorem, as noted in Chapter 3.

language, assuming that all workers must communicate to engage in efficient productive activity. Hence, the employer faces four options:

- a. Hire an E supervisor (ES) and E labourers (EL)
- b. Hire an F supervisor (FS) and F labourers (FS)
- c. Hire an E supervisor (ES) and F labourers (EL)
- d. Hire an F supervisor (FS) and E labourers (FS)

Option (a) is the comparative base since no transaction costs are incurred. Total labour costs with an (ES,EL) labour force are:

$$C_a = w_{ES} + n w_{EL} \quad (\text{A-1})$$

where

$$w_{ES} = w_{EL} + \mu . \quad (\text{A-2})$$

The term  $\mu$  is the cost of additional education required to become a supervisor.

Hence, the total cost of option (a) can be restated as:

$$C_a = (n+1) w_{EL} + \mu . \quad (\text{A-3})$$

Option (b) is similar except that French supervisors must incur the cost of learning English (to communicate with owners) as well as the cost of acquiring supervisory training. It is assumed that French supervisors have a base wage equal to the wage of a French labourer. Thus, for F supervisors to be enticed into the labour market they must earn:

$$w_{FS} = w_{FL} + \mu + \lambda . \quad (\text{A-4})$$

The total cost of the all-Francophone (FS,FL) labour force is:

$$\begin{aligned} C_b &= w_{FS} + n w_{FL} \\ &= (n+1) w_{FL} + \mu + \lambda . \end{aligned} \quad (\text{A-5})$$

Employers are indifferent between the two types of labour forces (all-Anglophone or

all-Francophone) only if the costs of options (a) and (b) are equal. Thus, the equilibrium relative wage rates are determined by equating the two cost functions (eqns. A-3 and A-5) and solving for  $w_{FL}$  and  $w_{FS}$  (relative to  $w_{EL}$  and  $w_{ES}$ ). First, the equilibrium wage rate for French labourers is derived as:

$$\begin{aligned} C_a &= C_b \\ (n+1)w_{EL} + \mu &= (n+1)w_{FL} + \mu + \lambda \\ w_{FL} &= w_{EL} - \frac{\lambda}{(n+1)} \end{aligned} \quad (\text{A-6})$$

and based on equation (A-4) the corresponding wage for supervisors is:

$$\begin{aligned} w_{FS} &= w_{FL} + \mu + \lambda \\ &= \left( w_{EL} - \frac{\lambda}{(n+1)} \right) + \mu + \lambda \\ &= (w_{EL} + \mu) + \lambda - \frac{\lambda}{(n+1)} \\ &= w_{ES} + \frac{n\lambda}{(n+1)} \end{aligned} \quad (\text{A-7})$$

The first obvious conclusion from these results is that Francophone labourers are paid less than their Anglophone counterparts (eqn. A-6). This occurs despite the fact that both groups have the same human capital endowments, except for language skills, even though neither group has to learn a second language. The second conclusion is that Francophone supervisors actually earn more than Anglophone supervisors (eqn. A-7). This result is tempered by the observation that they are still paid less than similarly skilled Anglophones (i.e., bilingual Anglophones). In particular, a bilingual Anglophone supervisor would receive

$$w_{BS} = w_{EL} + \mu + \lambda \quad (\text{A-8})$$

which is more than the bilingual Francophone supervisor earns. In both cases, then,

Francophones are underpaid compared to equally-skilled Anglophones. Furthermore, these are equilibrium wages, so the observed discrimination will persist. The implications of these results on human capital returns are discussed in the text (3.1.3.).

It can also be shown that options (c) and (d) will not be chosen by cost minimizers. Option (c) combines an Anglophone supervisor with Francophone labourers (ES, FL), yielding a total cost of:

$$\begin{aligned} C_b &= w_{ES} + n w_{FL} \\ &= w_{EL} + n w_{FL} + \lambda + \mu . \end{aligned} \quad (\text{A-9})$$

Solving for the Francophone equilibrium wage rate by equating the cost functions of options (a) and (c) (eqns. A-3 and A-9), we find:

$$w_{FL} = w_{EL} - \frac{\lambda}{n} \quad (\text{A-10})$$

and hence, Francophone labourers are paid even less under this option than under option (b). This solution is ruled out by the fact that Francophone labourers would maximize their incomes by working only with Francophone supervisors.

Similarly, option (d) combines a Francophone supervisor with Anglophone labourers (FS,EL) to yield a total cost of:

$$\begin{aligned} C_d &= w_{FS} + n w_{EL} \\ &= w_{FL} + n w_{EL} + \lambda + \mu . \end{aligned} \quad (\text{A-11})$$

Again, by equating equations A-3 and A-11, the equilibrium wage rates can be derived:

As for option (c), there is no incentive for the worker (in this case a Francophone supervisor) to accept the lower wage rate under option (d) since a higher wage is available if he works with Francophone labourers (eqn. A-7).

$$\begin{aligned}
 w_{FL} &= w_{EL} - \lambda, & \text{and} \\
 w_{FS} &= w_{FL} + \lambda + \mu \\
 &= w_{EL} + \mu \\
 &= w_{ES}.
 \end{aligned}
 \tag{A-12}$$

In summary, then, minimization of transaction costs under a fixed supervisor-labourer ratio leads to the equilibrium wage rates in equations A-6 and A-7, and also guarantees that supervisors and labourers will be matched by speech community (i.e., French supervisors work only with French labourers).

#### **Case 4: Variable Ratio of Supervisors to Labourers**

In this case employers still require two grades of workers, supervisors (S) and labourers (L), but they are used in varying ratios across industries. As in the previous case, transaction costs cannot be minimized if the employer hires a mixed labour force (ie. L cannot be comprised of both E and F labourers). Further, based on the results of Case 3, each supervisor-labourer unit will consist of either Francophones or Anglophones, but not a combination of both.

The objective is to determine the supervisor-labourer ratio at which an industry (or firm within an industry) is indifferent between hiring all-Anglophone or all-Francophone workforces. Let:

z be the supervisor-labourer ratio in the industry of interest;

and,

k be the supervisor-labourer ratio at which the industry is indifferent between hiring Francophones or Anglophones.

Hence, in this particular industry the total costs of the respective workforces are:

The relative costs of these options depend on the relative wages paid to E and F,

$$\begin{aligned} C_E &= W_{ES} + Z W_{EL} \\ C_F &= W_{FS} + Z W_{FL} \end{aligned} \quad (\text{A-13})$$

where  $w_{EL}$  provides the comparison basis. It is assumed that wage rates are determined exogenously to the industry (i.e., set by the labour market), so that each industry is a price taker for labour services. Using equations A-6 and A-7, the equilibrium relative wages paid to Francophones, and replacing  $n$  with  $k$  (the indifference point), the total cost of an F workforce  $C_F$  is:

$$\begin{aligned} C_F &= W_{FS} + Z W_{FL} \\ &= \left( W_{ES} + \frac{k\lambda}{(k+1)} \right) + Z \left( W_{EL} - \frac{\lambda}{(k+1)} \right) \\ &= W_{ES} + Z W_{EL} - \frac{(Z-k)\lambda}{(k+1)} \end{aligned} \quad (\text{A-14})$$

Equating  $C_E$  and  $C_F$  (from eqn.A-14), the indifference point can be found:

$$\begin{aligned} C_E &= C_F \\ W_{ES} + Z W_{EL} &= W_{ES} + Z W_{EL} - \frac{(Z-k)\lambda}{(k+1)} \\ 0 &= - \frac{(Z-k)\lambda}{(k+1)} \end{aligned} \quad (\text{A-15})$$

Hence, a particular industry is indifferent between hiring Anglophones and Francophones only when  $k=z$ . Further, the industry will hire Anglophones ( $C_E < C_F$ ) when ( $k < z$ ), and Francophones ( $C_E > C_F$ ) when ( $k > z$ ). The interpretation of this result, in terse terms, is that an industry hires a Francophone workforce when its supervisor-labourer ratio is relatively high, and hires Anglophones when its S/L ratio is relatively low. Francophones, then, will be segregated into labour-intensive industries while Anglophones are segregated into capital-intensive industries. The economic intuition behind this result is that supervisors are relatively more expensive

than labourers in Francophone workforces (ie.  $(w_{FS}-w_{FL}) > (w_{ES}-w_{EL})$ ), and hence employers tend to substitute away from the relatively expensive factor by ensuring high S/L ratios.

## APPENDIX B

A Chronology of Canadian Language Policies<sup>83</sup>

<b>Bill 60 (1964) - Quebec</b>	
<b>Policy Area:</b>  Education	<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>• to modernize the Quebec economy</li> </ul> <p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>• state takes control of education: begins standardization of curriculum and centralization of control</li> </ul> <p><b>Outcomes:</b></p> <ul style="list-style-type: none"> <li>• increased enrolment in English schools</li> </ul>
<b>Official Languages Act (1968) - Canada</b>	
<b>Policy Area:</b>  Language Use in the Public Sector	<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>• to allow Francophones to access federal services in French</li> <li>• to increase French representation in the federal public service, and in policy formation</li> </ul> <p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>• the federal public service is declared officially bilingual</li> <li>• French training programs initiated for federal employees</li> <li>• bilingualism emphasized in recruitment of federal employees</li> </ul>
<b>Bill 63 (1969) - Quebec</b>	
<b>Policy Area:</b>  Education	<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>• to formalize language of education rights</li> </ul> <p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>• parents receive unrestricted rights to have their children educated in either English or French</li> </ul> <p><b>Outcomes:</b></p> <ul style="list-style-type: none"> <li>• enrolment increased in English schools (in 1973 12.4% of students in English schools were Francophones)<sup>84</sup></li> </ul>

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<sup>83</sup> The details of French language policies are drawn from the following sources:

Coleman (1981), Commissioner of Official Languages (1992), Dyck (1986), VanLoon and Whittington (1987), and Whitaker (1984).

<sup>84</sup> Coleman (1981), p.467.

<b>Bill 22 (1974) - Quebec Official Language Act</b>	
<b>Policy Area:</b>	<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>• to promote the French language</li> <li>• to increase participation of Francophones in the Quebec economy</li> </ul>
Language Use in Provincial Government	<p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>• provincial public sector becomes unilingual French for internal communications and communications with "moral persons" (ie., Church officials)</li> <li>• services provided in both English and French</li> <li>• official documents or texts must be in French</li> </ul> <p><b>Exemptions:</b></p> <ul style="list-style-type: none"> <li>• English translations of official documents and texts are allowed</li> </ul>
Language Use in Local Governments	<p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>• municipalities and school boards publish all official documents and texts in French</li> <li>• internal communication and communication with "moral persons" is to be in French</li> <li>• health and social services were to communicate with the provincial government in French</li> </ul> <p><b>Exemptions:</b> (municipalities &amp; school boards)</p> <ul style="list-style-type: none"> <li>• English documents and texts are allowed if at least 10% of the clientele is Anglophone</li> <li>• communications may be in English if at least half of the clientele is English</li> </ul>

<p>Language of Instruction</p>	<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>• to halt the increasing enrolment in English schools caused by Bill 60 (1964) and Bill 63 (1969)</li> </ul> <p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>• children could attend English schools if they possessed a "sufficient knowledge" of English</li> <li>• an upper limit on the total enrolment in English schools was imposed</li> <li>• graduation from secondary school was contingent on knowledge of French</li> </ul> <p><b>Outcomes:</b></p> <ul style="list-style-type: none"> <li>• many non-Canadian immigrants and Francophones retained the right to attend English schools. Enrolments in English schools continued to rise (measured in percentage terms). (Coleman, p.467)</li> </ul>
<p>Language Use in the Private Sector</p>	<p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>• to enhance the visibility of French in the market place</li> <li>• to promote increased use of French in the workplace</li> </ul> <p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>• French is to receive priority over English for company names, product labels, and advertising notices or signs</li> <li>• all notices, directives, etc., from employers to employees must be written in French, with optional English translation</li> <li>• effort is made to instill French as the language of labour relations</li> <li>• firms are encouraged to contact the Regie de la langue francaise to get provisional francization certificates. Permanent certificates could be issued upon further assessment of the organization. Otherwise, firms must initiate an internal francization program. Certificates are optional so that firms can assess whether the benefits outweighed the costs, but are required for a firm to be eligible for government premiums, subsidies, purchase contracts, service contracts, or public works contracts. The firms's management is responsible for overseeing the francization program</li> <li>• professionals must be proficient in French in order to practice</li> </ul> <p><b>Exemptions:</b></p> <ul style="list-style-type: none"> <li>• professionals exempt if the individual does not come into contact with the general public, or works for a single employer</li> <li>• francization certificates are optional</li> <li>• labour relations directives are non-binding</li> </ul>

<b>Bill 101 (1977) - Quebec Charter of the French Language</b>	
<p><b>Policy Area:</b></p> <p>Language Use in Provincial Government</p>	<p><b>Objective:</b></p> <ul style="list-style-type: none"> <li>• to revise Bill 22 (1974)</li> </ul> <p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>* retains the policies in Bill 22 (1974), plus:               <ul style="list-style-type: none"> <li>• communications with outside governments can be in any language</li> <li>• English translations of official documents and texts are no longer allowed</li> </ul> </li> </ul>
<p>Language Use in Local Governments</p>	<p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>• municipalities, school boards, health, and social services must publish all official documents and texts in French</li> <li>• external communications with provincial government, other governments, or "moral persons" must be in French</li> <li>• internal communication is to be in French</li> <li>• employee hiring, promoting, and transfers is contingent on the individual's ability to speak the "appropriate" level of French (defined in a later regulation)</li> </ul> <p><b>Exemptions:</b></p> <ul style="list-style-type: none"> <li>• internal communication in school boards, social services and health institutions can be in other languages if the majority of the clientele is not Francophone</li> </ul>
<p>Language of Instruction</p>	<p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>* graduation requirement remains</li> <li>• access to English schools was restricted to children who had:               <ul style="list-style-type: none"> <li>- one or both parents who received primary education in English in Quebec</li> <li>- one or both parents who received primary education in English outside of Quebec, but who lived in Quebec before the law was passed</li> <li>- legally received English education before the law was passed</li> <li>- older siblings who had received English education before the law was passed</li> </ul> </li> <li>• all private schools receiving provincial subsidies were subject to the law</li> </ul> <p><b>Exemptions:</b></p> <ul style="list-style-type: none"> <li>• temporary residents of Quebec can apply for three-year permits which allow their children to attend an English school. A second period of three years can be applied for</li> </ul>

<p>Language Policy in the Private Sector</p>	<p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>* the priority of French over English remains for firms' names and product labels</li> <li>• advertising notices and signs are to be strictly in French.</li> <li>• all workplace communications to employees must be in French, including collective agreements and arbitrated grievance settlements</li> <li>• workers' associations must communicate to workers in French, unless the individual initiated communication in another language</li> <li>• employers cannot fire, lay off, or displace a worker because he/she speaks only French, <u>unless</u> the employer can prove that knowledge of another language is required</li> <li>• firms must contact the Office de la langue française for a provisional francization certificate. Further assessment of the organization dictates whether a permanent certificate is issued or the firm has to initiate an internal francization program. Certificates are compulsory for firms employing more than 50, and are required for: <ul style="list-style-type: none"> <li>- immunity from charges for failure to comply with the law</li> <li>- access to government premiums and subsidies</li> <li>- access to government purchase, service, or public works contracts.</li> </ul> </li> </ul> <p>The firms's management is responsible for overseeing the francization program. Appeals are accepted from firms who believe they were unfairly charged. Head offices can enter special agreements with the Office de la langue française</p> <ul style="list-style-type: none"> <li>* restrictions on professionals remain</li> </ul> <p><b>Exclusions:</b></p> <ul style="list-style-type: none"> <li>• firms with 4 or less employees</li> <li>• certain ethnic group cultural activities</li> <li>* a regulation (1979) extends the exclusion to <u>all</u> cultural and educational products, thus allowing labelling, etc., to be in any language</li> </ul>
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<b>Charter of Rights of Freedoms (1982) - Canada</b>	
<p><b>Policy Area:</b> Official Languages of the Federal and New Brunswick Governments</p>	<p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>• English and French are the official languages of Canada and of New Brunswick. Each language has equal status and legal rights in their use in federal and New Brunswick governments</li> <li>• individuals can use English or French in debates and other proceedings of Parliament and the New Brunswick legislature</li> <li>• all statutes, records and journals of the federal and New Brunswick governments must be printed and published in English and French. Both language versions are equally authoritative</li> <li>• individuals are guaranteed the right to use English or French in any dealings with federal or New Brunswick courts</li> <li>• individuals can receive services from the federal and New Brunswick governments in either official language where: <ul style="list-style-type: none"> <li>- demand for services in both languages is "significant";</li> <li>- the nature of the office requires that services be available in both languages</li> </ul> </li> </ul>
<p>Language Education Rights</p>	<p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>• Canadians with French or English mother tongue can have their children educated in either official language</li> <li>• Canadians who received primary school education in Canada in English or French can have their children educated in either official language</li> <li>• Canadians who have one child with primary or secondary school education in English or French in Canada can have all their children educated in the same language</li> </ul> <p><b>Exemptions:</b></p> <ul style="list-style-type: none"> <li>• provision of the services outlined above requires that the number of children in the minority is sufficient to warrant the provision of minority language instruction out of public funds. Where sufficient numbers exist, the right to separate minority language education facilities is guaranteed</li> </ul>

<b>Review of Bill 101 (1983 &amp; Court Decisions) - Quebec</b>	
<p><b>Policy Area:</b></p> <p>Language Use in Quebec Governments</p> <p>Language of Education</p> <p>Language Use in Private Sector</p>	<p><b>Policy Details:</b></p> <ul style="list-style-type: none"> <li>• eased some of the regulations in the area of institutional bilingualism for English-language hospitals and social service agencies</li> <li>• allowed a five-year temporary permit for immigrants from other provinces to attend English-language schools</li> <li>• courts struck down restrictions against Canadian citizens attending English-language schools in Quebec</li> <li>• courts struck down the provision for French-only signs</li> <li>• courts struck down compulsory French-language proficiency tests for professionals</li> </ul>

## APPENDIX C

**Statistical Tests of Differences**  
**Between Equations**

<b>First Comparison Group (Language Group/Sector)</b>	<b>Second Comparison Group (Language Group/Sector)</b>	<b>Wald Statistic (Critical Value, <math>\alpha=.05</math>: 42.56)</b>
<b>Comparisons Within Language Groups and Sectors, Across Time</b>		
English/Private (1971)	English/Private(1981)	408.95
English/Private (1981)	English/Private(1986)	117.73
French/Private (1971)	French/Private (1981)	473.58
French/Private (1981)	French/Private (1986)	58.09
English/Public (1971)	English/Public (1981)	198.09
English/Public (1981)	English/Public (1986)	132.71
French/Public (1971)	French/Public (1981)	71.69
French/Public (1981)	French/Public (1986)	122.58
<b>Comparisons Within Language Groups and Across Sectors (same year)</b>		
English/Private (1971)	English/Public (1971)	463.93
French/Private (1971)	French/Public (1971)	247.38
English/Private (1981)	English/Public (1981)	475.12
French/Private (1981)	French/Public (1981)	363.52
English/Private (1986)	English/Public (1986)	500.66
French/Private (1986)	French/Public (1986)	196.96

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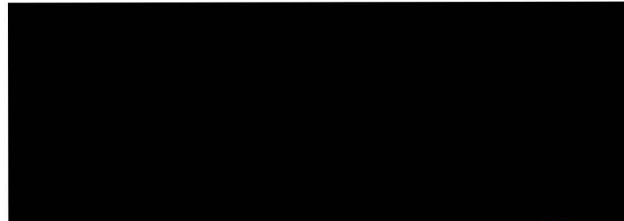
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