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Explanations of the Labor Market Reward

for Bilingualism in Puerto Rico

EXPLANATIONS OF THE LABOR MARKET REWARD FOR BILINGUALISM

IN PUERTO RICO

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ABSTRACT

Previous research has found a correlation between bilingualism and occupational earnings and prestige among French Canadians in Quebec province. Explanations of this relationship are proposed. A similar correlation exists for Spanish mother-tongue English bilinguals in Puerto Rico. Explanations involving the effect of management power on the bilingualism of employees are tested only on the labor force in manufacturing. Much but not all of the relationship between bilingualism and occupation is explained by variables which affect both bilingualism and occupational placement: education, exposure to speakers of English, age, and sex. The paper finds that an hypothesized intrinsic occupational need for bilingualism does not explain the relationship between occupation and bilingualism, nor does the presence of English-speaking mainlanders in management positions in manufacturing affect the bilingualism of the labor force in manufacturing as a whole. There is some slight effect of English language management on white collar workers. Bilinguals in manufacturing, particularly white collar bilinguals, are concentrated in industries which pay more for bilinguals, indicating that a market for bilingualism probably exists.

There has been considerable interest in the sociology of language group relations in American sociology in recent years. (cf. Grimshaw, 1971) This interest is partly due to the occurrence of language problems in the U.S.: an awareness that language shift among immigrants was not as natural and easy a process as it had previously been thought to be, hispano militancy and the drive for bilingual programs in the public schools, the new awareness of Black English and the problems its speakers face, and the realization that, world-wide, language is a very common basis for stratification and political cleavage.

Interest is also based on the insight that language groups can provide valuable information on the dynamics of status groups, of which they are one type. Language groups differ from other status groups, such as racial or ethnic groups, in that it is more readily possible to enter one by learning or leave one by forgetting, the processes of the spread of bilingualism and language shift. To a greater extent than in any other group defined by a socially recognized ascribed marker, membership is a matter of individual decision. It is also a matter of school policy and the structure of the labor market, which create opportunities and incentives that affect individual decisions.

This paper examines one aspect of the dynamics of language groups, the reward for bilinguals in the labor market in Quebec province and Puerto Rico. An attempt is made to sort out the most plausible explanations for the

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existence of a reward for bilingualism in English among Spanish mother-tongue native born Puerto Ricans in 1970 as far as the data permit. English mother-tongue Spanish bilinguals are not discussed because they could not be identified.

The best researched case of labor market influence on bilingualism is Canada. Studies of language group relations in Canada have paid close attention to the labor market. Both the Canadian Royal Commission on Bilingualism and Bi-culturalism in the third volume of its report, The Work World, and Stanley Lieberson, in Language and Ethnic Relations in Canada, examine the pattern of bilingualism over occupations and the earnings advantage of bilinguals. Both studies, based on the 1961 census, show that incentives for French Canadians of French mother-tongue to become bilingual are greater than incentives for English Canadians to become bilingual, and that, in fact, more French Canadians are bilingual than English Canadians. (Canada, 1969: 21,75; Lieberson, 1970: 142, 167-175)

There may well be a market for bilingualism in certain languages in many countries. Bilingualism in English among those of Spanish mother-tongue in 1970 in Puerto Rico has a similar pattern as bilingualism in English among French Canadians in Quebec province in 1961. The correlation between percent bilingual over a 12 category major occupational group classification of occupation and average weekly earnings in 1969 for the native-born Puerto Rican

labor force, i.e., people with Spanish mother-tongue, was .90. See appendix for method of calculating average weekly earnings. The correlation of percent bilingual with NORC prestige ratings, aggregated into the 1970 census' 12 category major occupational group classification of occupations, is .77, and with Duncan SES scores is .90. (cf. Siegel, 1971; Duncan, 1965) Bilinguals are clearly concentrated into the better jobs.

Explanations

There are four particularly plausible and one speculative explanation of why bilingualism appears to be rewarded in the labor market. The first is that it is not really, that both bilingualism and occupational placement are both effects of a common set of factors which affect each of the variables separately. Factors which are obviously related to either the acquisition of bilingualism, such as education and exposure to speakers of English, or occupational placement, such as age and sex, are related to the other dependent variable as well.

The second explanation is that there is an intrinsic relationship between performance in an occupation and bilingualism, that bilinguals do the job better. In a bilingual society an occupation in which communicating is central to accomplishing tasks is likely to be one with a high intrinsic need for bilingualism. Employers may selectively hire, retain, and promote bilinguals to fill

positions where communicating with a linguistically heterog-
eneous set of people is important. It suffices that the
more highly paid, more prestigious occupations have a higher
need for communication to produce the observed correlation
between earnings and prestige and bilingualism.

The third explanation is that a management either
arbitrarily discriminates or for reasons of internal commu-
nication and company cohesiveness selectively hires, re-
tains, and promotes people who speak their language. Such
a process over a period of years would produce a correla-
tion between bilingualism and the pay and prestige of occu-
pations. The effect would naturally vary over sectors of
the economy according to the proportion of the labor force
working for managements of a particular language.

The fourth explanation is that there is an inter-
action between intrinsic occupational need for bilingualism
(explanation #2) and management power (explanation #3).
Certain occupations may be particularly sensitive to man-
agement's tendency to discriminate on the basis of language
or its perceived need for company communication and cohe-
siveness. White collar occupations may be particularly
susceptible to pressure from top management for language
conformity. It is they who must talk with and carry out
the orders of top management.

A fifth explanation consists of speculation. Bi-
lingualism may be an effect of an unmeasured variable which
also affects occupational placement, other than sex, age,
education, or exposure to speakers of English.

The Canadian Studies

A number of the studies of language groups and bilingualism in the Canadian labor force touch on several of the proposed possible explanations of the existence of a reward for bilingualism. Lieberson (1970) has commented on the distribution of bilingualism over occupations among English and French Canadians in the metropolitan Montreal area in 1961. He found that for French Canadians bilingualism increased from the less well paid and less prestigious to the better paid and more prestigious occupational categories. There was hardly any relationship at all between bilingualism and occupation for English Canadians. The correlation between English Canadian and French Canadian bilingualism is -.22. (Lieberson, 1970:141)

Differential social power seems the simplest explanation of this state of affairs. Upward mobility for French Canadians requires linguistic conformity. Higher status English Canadians could largely ignore the French language in 1961. In fact, English Canadians occupied a privileged place in the Montreal labor force in 1961. (Canada, 1969:35-60) Many of the larger business organizations are owned and managed by English Canadians and operate in English. (cf. Lussier, 1967) It appears that the division of labor among language groups in the Montreal metropolitan area is such that it is the French Canadians who must largely make a linguistic accommodation to the English Canadians in return for being hired, retained, and

promoted.

Lieberson (1970:138,139,149-167) also suggests that there may be a need in certain occupations in which clients or customers may have different mother tongues to be bilingual. These occupations tend to be sales workers, government employees who deal with the public, service workers, transport operatives, and particular other occupations such as telephone operator which involve public contact. Presumably, this kind of need for bilingualism would be felt equally by all employees in these occupations, regardless of mother-tongue.

There are a number of Canadian studies which document a management's preference for members of its own language and ethnic group, and if it cannot get that, then for people whose second language is its first. Roy (1935:148) in a study of manufacturing industries in the '30's found that smaller firms tend to be ethnically, and consequently linguistically, homogeneous. The larger English managed firms did discriminate in favor of English Canadians, particularly among white collar workers, and among French Canadians in favor of bilinguals. (Roy, 1935:45,50) Lussier (1967:103,104) found that in 1961 and over a period stretching back 30 years before then that the larger the percentage of English Canadians in white collar jobs in a particular sector of manufacturing in Quebec province, the larger was the percentage of English Canadians in the industry as a whole. He did not examine the matter of bilingualism.

Morrison's (1970:51) study of the language composition, practices, and policies in 44 manufacturing corporations in Eastern Canada found that the language of top management tends to become the operating language of the company.

There is some evidence that the sensitivity of white collar jobs to the language of top management is higher than blue collar jobs and increases at successively higher levels in the organization. This was one of the major findings of the Royal Commission Report.(Canada, 1969: 4) Roy (1935:27,50) found that in some Montreal industries in the 1930's there were relatively few obstacles against monolingual French Canadians being trained and promoted into skilled blue collar jobs by English companies but success in a white collar job in an English company absolutely necessitated a French Canadian's being bilingual. The Royal Commission (Canada, 1969:252-259) found that management leadership and team work situations require a high degree of language proficiency and are difficult to handle in a second language. Both the Commission and Carlisle (1966:137) found that effective managing and career advancement require off-the-job socializing. Sociability requires a greater degree of proficiency than do more formal situations. Morrison (1970:170-172) found that English Canadian executives in English language firms had considerable difficulty in picking up French, even when bilingualism was officially company policy. Carlisle (1966:141,159) also found that Berlitz-type courses in French for English

executives were not paid much attention to. However, when English Canadian executives of electric power companies taken over by the province of Quebec found themselves to be employees of Hydro-Quebec, a very Francophone organization, they displayed a remarkable enthusiasm for French language courses and an aptitude for language learning not previously thought to be characteristic of English Canadian executives. (Canada, 1969:498-500)

The bulk of the literature on language group relations and bilingualism in Canada suggests that social power, particularly the control of business organizations, rather than the intrinsic functional requirements of occupations, explains most of the Canadian pattern of bilingualism.

Puerto Rico and Quebec

Many of the findings about bilingualism in Quebec ought to be applicable to Puerto Rico. There are many similarities. A majority of the people in both places speak a romance language and are Roman Catholics. In both cases there is an English speaking minority who own and manage a disproportionate share of the economy, particularly large firms in manufacturing, and is reputed to be slow in becoming bilingual in the other language. Both are rather autonomous but affiliated with a large, developed, English-speaking country. Puerto Rico is unlike Quebec in that few of the native speakers of English consider themselves to be natives of Puerto Rico. In Puerto Rico they are fairly

transient, many only staying several years. (Hirsbrunner, 1971:26)   In any event, they are a tiny minority. Consequently, Puerto Rico is not a fundamentally bilingual society in the sense that it is not divided into two large mother-tongue groups. Nearly everyone speaks Spanish.

Methods

The 1970 Census of Population in Puerto Rico asked in Spanish the question, "Can this person speak English?", and permitted a yes or no response. A 'yes' response indicated a minimal ability in conversation. The instructions to enumerators state:

> Mark 'yes' for a person who can make himself understood in English conversation. Mark 'no' for a person who can speak only a few words, such as 'hello' and 'goodbye.' (U.S. Bureau of the Census, 1970a:67)

The 1970 census did not ascertain whether the respondent spoke Spanish. The population under study is a subset of the whole civilian population chosen to insure that its mother tongue is Spanish. Spanish mother-tongue is universal among native born Puerto Ricans of native born parents. These people, 90% of the civilian population, are basically the population under study. Only one parent need have been Puerto Rican born to pass the screen. Some additional restrictions are imposed, however, since it is the native-born Puerto Rican Spanish mother-tongue labor force about which explanations for the reward for bilingualism

will be tested. People not in the labor force are excluded as are those 19 or younger and those missing data on education, occupation, or industry. There are 27,188 people in the public use sample being used, the 1:100 municipio sample. (U.S. Bureau of the Census, 1970c)   7,515 people passed all the screens, 32.5% of the total number of people on the municipio sample tape. 'Municipio sample' means that of the three public use samples drawn from the 1970 census of population and housing in Puerto Rico, this particular tape has information about municipios, or county-like administrative entities. The municipio sample tape is an unbiased random sample of all households.

In order to investigate management power in manufacturing more closely, cases which passed the above screens were taken from all three public use sample tapes of the 1970 census. Out of the 81,540 people on the three tapes, 4,783 passed the screens, that is, are native born Puerto Ricans with at least one native born Puerto Rican parent in the labor force, no missing data on occupation or industry, are 20 or older, no missing data on education, are not farmers, farm laborers, or private household workers, and are identifiable as having been employed or last employed in one of the following sectors of manufacturing:

1. lumber and wood products, except furniture

   furniture

   paper and allied products

2. stone, clay, and glass products

3. metal industries

4. machinery, except electrical

   electrical equipment

   professional and photographic equipment, and watches

5. miscellaneous manufacturing industries

6. food and kindred products

   tobacco manufactures

7. textile mill products

   apparel and other fabricated textile products

8. printing

9. chemicals and allied products

   petroleum and coal products

   rubber and miscellaneous coal products

10. leather and leather products.

This group is called the native-born Puerto Rican labor force in manufacturing.

A measure of exposure to speakers of English, EXPO, was created by assigning people who had either been in the armed forces or had been in the continental U.S. for six months or longer in the five years preceding April 1970 in one category and those who had not in a second. Education, defined as the highest grade of enrollment, was recoded into five categories in a way that preserved as much variance as possible. Age was recoded into decades with those 50+ forming the last category. Two sets of marginals are given in Table 1, one set for the whole labor force (N=7, 515) and one set for people in manufacturing (N=4,783).

A technique of multi-variate analysis used in this paper is the log-linear analysis of contingency tables. 0.5 has been added to all cells to remove the problem of zero cells. Lambda coefficients from the log-linear analysis are discussed. These are ANOVA or MCA-type statistics, expressing a category effect as a deviation from a mean of zero. (cf. Goodman, 1972) The maximum likelihood chi-square statistic is used as a measure of the fit of expected values under a particular model to the data. The difference between the chi-square of a model and the chi-square of a model which is identical save for a variable or an inter-action of variables can be used to evaluate the statistical significance and contribution to the fit of the term the models do not have in common. The significance of that term is the difference of the chi-squares of the two models and the degrees of freedom of that chi-square is the differ-ence in the degrees of freedom of the two models. (cf. Good-man, 1972) Further, the adjusted partial r-square statis-tic, $\dfrac{x_0/df_0 - x_1/df_1}{x_0/df_0}$, where

x_0 = chi-square of model without

term to be tested, the "baseline model"

df_0 = degrees of freedom of model

without term to be tested

x_1 = chi-square of model with term

to be tested

df_1 = degrees of freedom of model with

term to be tested,

measures how much the term being tested improves the fit of the model without it. The adjusted partial r-square ranges from a negative number, an indication that adding the extra term worsens the ratio of fit to degrees of freedom used, to 1.0 which indicates that adding the term makes the fit perfect.

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Table 1 about here

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Marginals

People in the labor force have a higher level of ability to speak English than the average. 52.2% of the native born Puerto Rican labor force is able to speak English, whereas only 42.7% of the population as a whole is. Both exposure to speakers of English, EXPO, and education are strongly related to speaking English. The young know somewhat more English than the old. The peak age group are the 30-39 year olds.

Bilingualism in the native born Puerto Rican labor force resembles French Canadian bilingualism strongly. The more prestigious, better paid organizations have higher levels of bilingualism. The primary sector of industrial activity, agriculture, mining, and construction, has a lower level of ability to speak English than manufacturing which in turn is below nearly all the services. Within manufacturing, printing has the highest level of ability to speak English, as might have perhaps been expected given

the language sensitivity of the activity. The two other
highest sectors are machinery and chemicals, high technol-
ogy sectors. The three lowest in ability to speak English
are miscellaneous manufactures, 'food and tobacco,' and
'stone, clay, and glass products,' the latter two being low
technology activities. With the exception of sex, the mar-
ginals on ability to speak English are very similar for
both the total labor force and those in manufacturing.

Explanations

The first explanation of the concentration of bi-
linguals in higher paying occupations is that the pattern
is produced by the inter-correlation of factors which af-
fect both occupational recruitment and bilingualism. The
variables which are controlled for are age, sex, education,
and exposure to speakers of English, EXPO.

Model 1 shows occupation and bilingualism as simul-
taneously dependent on the background variables: age, sex,
education, and exposure to speakers of English.

Model 1 about here

Model 1 fits the data fairly well. The chi-square between
the actual table frequencies and the expected table fre-
quencies is not significant. The Occupation-Bilingualism
interaction term is constrained to be zero in model 1. It
is evident that sex, age, education, and exposure to

speakers of English do explain a lot of the variance in the two dependent variables. A comparison of model 2 with model 1 shows that not all the variance in Occupation and Bilingualism is accounted for by the background variables, however.

Model 2 about here

Model 2, the same as model 1 but for the Occupation-Bilingualism interaction term, has a chi-square of 1510 with 1709 degrees of freedom, or a chi-square 246 smaller than that of model 1 with 11 degrees of freedom. The Occupation-Bilingualism interaction term is significant beyond the highest conventional levels of significance. The adjusted partial r-square of the term is .135, showing that it substantially improves the fit of the model. The explanation of the concentration of bilinguals in the higher paying occupations as simply the result of the operation of the factors of age, sex, education, and exposure to speakers of English, factors which obviously affect both bilingualism and occupation, can be rejected.

The second explanation of the concentration of bilinguals in certain occupations is that there is an intrinsic need in these occupations for communication between different mother-tongue groups. The rule of thumb that comes out of Lieberson's work on occupational bilingualism in Canada is that customers or clients of heterogeneous

mother-tongues can exert pressure, either political or economic, on organizations which serve them to speak to them in their mother-tongue. Thus Lieberson (1970:138-152) sees salespeople in large stores with linguistically diverse customers, policemen, and telephone operators, as well as white collar workers in general as occupations with a high intrinsic need for bilingualism. Cebollero (1945:113-114) foresaw in 1945 that tourist-oriented occupations would require bilinguals.

The Analysis of the needs for English in Puerto Rico suggests the following generalizations:

. . . .

7. A limited number of persons in specialized occupations, such as shop keepers, policemen, taxi drivers, waiters, etc., working in San Juan or in other large towns where they might come into contact with American tourists would gain by acquiring the ability to engage in the simple type of specialized conversation required by their occupations.

There is an expectation then that bilingualism would be high in the major occupational groups of sales workers, transport operatives, and service workers, beyond what would be accounted for by education or previous exposure to speakers of English.

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Table 2 about here

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Table 2 displays the lambdas between Occupation and Bilingualism from model 2, the relationship between the two with the background variables controlled for. The lambdas for sales workers, transport operatives, and service workers are not particularly large. In fact, the lambdas for the controlled relationship between Occupation and Bilingualism are correlated .99 with the percent bilingual by occupation, the uncontrolled relationship, .89 with average weekly earnings in 1969, .79 with the NORC prestige scores, and .89 with the Duncan SES scores, indicating that the controls for sex, age, education, and exposure to speakers of English have not altered the strong relationship between bilingualism and occupational earnings and prestige at all. Sales workers, transport operatives, and service workers are spread out over the middle range of occupational earnings and prestige. Thus it appears that these do not have an especially high concentration of bilinguals. The only argument about an intrinsic relationship between occupation and bilingualism that is defensible in the light of these findings is that there is a factor correlated with prestige which creates an intrinsic need for bilingualism.

The third explanation of a labor market reward for bilingualism is that the top management makes its language the operating language of the firm and either selectively recruits bilinguals or encourages employees to become bilingual. In Puerto Rico since the beginning of Operation Bootstrap after World War II there has been a rapidly

increasing number of manufacturing plants owned and managed
at their top levels by mainland Americans. (cf. Puerto Rico,
1963; Hirsbrunner, 1971) In 1967 non-locally owned manufac-
turing employed 70.4% of the labor force in manufacturing.
(U.S. Bureau of the Census, 1970b) Virtually all the di-
rect investment in Puerto Rico from non-local sources is
from the U.S. mainland. (Hirsbrunner, 1971:39) The charac-
teristic pattern of direct investment is to operate as in a
foreign country, that is, to staff the company with as many
local people as possible but to retain mainland Americans
in a small number of key top jobs. (Hirsbrunner, 1971:30)
There are not many mainlanders, defined as the U.S. born of
U.S. born parents who speak English, in the labor force, at
least proportionately, as Table 3 shows:

Table 3 about here

The per cent of the professional and managerial labor force
who are mainlanders ranges from zero in agriculture and
mining where there are few managers or professionals of any
kind to 8% in entertainment and recreation, which includes
the hotel industry and other tourist oriented services.

There are two sources of information on mainlander
control of sectors of manufacturing, an industry group
which employs 22.4% of the total native born Puerto Rican
labor force. One is the Directory of Manufacturing Estab-
lishments. (Puerto Rico, 1966) It is a census of all

manufacturing plants with 2 or more salaried employees during the week ending October 15, 1966. The Directory publishes the name of the company which owns the plant and the name of the director or manager of the plant. These can be coded as to whether they are Spanish or English language names. Most names were clearly one or the other. Mixed names were coded into a third category. Manufacturing plants were identified according to their principal product by the 2 digit Standard Industrial Code (SIC) which corresponds to the census bureau's 2 digit code for manufacturing industries. A 10% sample of the 2,436 plants with 2 or more employees was taken and the names coded. The results are given in Table 4.

Table 4 about here

The enormous over-representation of American managers is quite evident. Where mainlanders only make up 5.5% of the professional and managerial labor force in manufacturing, they are fully 57% of the plant managers.

The other source of information on mainlander control of sectors of manufacturing is the 1967 Census of Manufactures in Puerto Rico, which like the Directory, is a census of manufacturing plants, not firms. To be counted in the census a manufacturing plant must have 1 salaried employee during census week. Information on the ownership of each plant was obtained. If 51% of the plant was not

owned by residents of Puerto Rico, it was classified as non-locally owned. (U.S. Bureau of the Census, 1970b:120)   The 1967 Census' definitions of sectors of manufacturing are compatible with the codes used in the 1970 census. However, in order to preserve condidentiality in some sectors with few plants, complete statistics are not available. The census data on ownership by sector are given in Table 5 with the deletions noted.

Table 5 about here

The Directory of Manufacturing Establishments is an index to the language group which manages the plants and which owns them; the 1967 Census of Manufacturing is an index to the language group which owns them. Morrison (1970: 51) found in his study of 44 large manufacturing corporations in Eastern Canada that the language of ownership tended usually, but not always, to be the language of top management which was usually the operating language of the company.

> There are some firms in the sample where the language
> of the ownership is English, but the firm has a French-
> language image owing to deliberate policy or historical
> development, such as the purchase of the firm as a go-
> ing concern from French-speaking owners. In a few
> cases the language of the owners is French, but the
> firm operates principally in English at the managerial

level owing again, to deliberate policy or historical development, such as the promotion of English-speaking employees originally selected because they possessed the required skills and educational qualifications.

According to Morrison (1970), English language management is a better index to the likelihood of English being the operating language of the firm than is English language ownership. However, in Puerto Rico the two measures are virtually identical. Per cent of plants directed by a person with an English language name is correlated .978 with non-local ownership. There is ethno-graphic evidence that mainland managements in Puerto Rico operate in English. Hirsbrunner (1971:85) notes that few American executives in Puerto Rico speak Spanish and get along by having bilingual subordinates.

None of the measures of mainlander influence in manufacturing are associated with the per cent of the native born Puerto Rican labor force able to speak English. The per cent of firms with English names is correlated -.137 with per cent able to speak English, and per cent of managers with English names is correlated -.069, per cent of plants non-locally owned is -.114, and per cent of the labor force in non-locally owned plants .011.

These negative results are not altered by attempting to remove the effects of sex, education, and occupation from the distribution of bilingualism over sectors of manufacturing. A comparison of models 3 and 4 shows that there

is a significant relationship between manufacturing sector
and bilingualism. The term Manufacturing Sector-Bilingual-
ism has a chi-square of 35 with 9 degrees of freedom, but
the lambdas between Manufacturing Sector and Bilingualism,
controlling on sex, education, and occupation, are not much
more closely correlated with the measures of mainland influ-
ence than is the uncontrolled relationship, with per cent
bilingual. The lambdas for the Manufacturing Sector-
Bilingualism term are correlated .121 with the per cent of
plants owned by companies with English names, .187 with the
per cent of managers with English names, .123 with the per
cent of plants non-locally owned, and .199 with the per
cent of the labor force employed in non-locally owned
plants. While positive, these correlations are small, in-
dicating that although there may indeed be a management
power effect on the bilingualism of the labor force in man-
ufacturing, that effect is much too small to account for
the relationship between bilingualism and occupation.

Models 3 and 4 about here

Although on the whole the explanation of the rela-
tionship between occupation and bilingualism by a tendency
for companies with English language ownership or management
to recruit bilinguals or encourage bilingualism is not at
all substantiated by the data, there is some evidence that
mainland ownerships or managements are willing to pay more

for bilinguals. A regression of the average weekly earnings
of the native-born Puerto Rican labor force in manufacturing
who were employed in 1969 on occupation, sector of manufac-
turing, education, age, exposure to speakers of English, bi-
lingualism, the interaction between bilingualism and occupa-
tion, and the interaction between bilingualism and sector
of manufacturing was run. See Table 8 in the appendix. The
regression coefficients of weekly earnings on the interac-
tion between bilingualism and sectors of manufacturing indi-
cate the difference in earnings between bilinguals and Span-
ish monolinguals in the various sectors of manufacturing.
These regression coefficients are correlated .192 with per
cent of plants owned by English name companies, .104 with
per cent of plants with directors with English names, .057
with per cent of plants non-locally owned, and .250 with
per cent of the work force in non-locally owned plants.

Apparently mainland firms pay a little more for bi-
linguals on the average but this extra pay does not result
in a concentration of bilinguals in mainland owned or man-
aged firms. There is however a concentration of white col-
lar bilinguals in sectors of manufacturing which pay more
for bilingualism. This fact is evidence that there is a
market for bilingualism and that a supply of bilinguals is
responsive to a higher price. The slopes of the bilingual-
ism-sector of manufacturing interaction terms are corre-
lated .475 with per cent bilingual among white collar work-
ers, .551 with per cent bilingual among professionals and

managers, .374 with per cent bilingual among clericals, but only .234 with per cent bilingual among blue collar workers.

The fourth explanation of the concentration of bilinguals in higher paying occupations is that certain occupations only are sensitive to management's language. The Canadian literature points to the white collar occupations as being sensitive. We have just seen that bilingual white collar workers in manufacturing tend to be concentrated in sectors of manufacturing which pay more for bilingualism, but it has also been shown that the correlation between the presence of mainland ownership or management and the bonus for bilingualism is small. It remains to be seen whether bilingualism in white collar occupations, particularly professionals and managers, is correlated with mainland ownership or management.

The per cent bilingual in the white collar occupations over sectors of manufacturing are slightly correlated with the indices of mainland, English-speaking influence. Per cent bilingual is correlated .176 with the language of the name of the company owning plants, .136 with the language of the name of the managers of plants, .103 with non-local ownership of plants, and .029 with the proportion of the labor force in non-locally owned plants. Per cent bilingual among blue collar workers is correlated -.019, .052, -.007, and .085 with the same variables respectively. It is safe to conclude that bilingualism among blue collar workers is completely unrelated to mainland influence in

the various sectors of manufacturing. For 'white collar oc-
cupations, taken together, there are some very small rela-
tionships.

To explore the possibility of mainland influence on
bilingualism among white collar workers further, white col-
lar occupations were split into two categories: profession-
als and managers, and sales and clerical workers (see Table
6). The per cent bilingual among professionals and mana-
gers is correlated -.205 with the language of firms owning
plants, -.320 with the language of the names of plant man-
agers, -.365 with the per cent of non-locally owned plants
in a sector, and -.384 with the per cent of a sector's work
force employed in non-locally owned plants. These are the
largest correlation coefficients produced yet and they are
completely counter-intuitive. The prediction was that the
higher white collar workers would be more subject to manage-
ment influence than the lower white collar workers, but it
is important to keep in mind that the unit of analysis here
is the manufacturing sector not the firm. It is true that
the smaller companies in each sector are the locally owned
ones and it is possible that a majority of the professionals
and managers are employed in the small, Spanish-language
operations.

Table 6 about here

The relationship between per cent bilingual and

mainland influence for clerical workers is just the oppo-
site of that for professional and managers. Sales workers
are disregarded because they are so few in number. The per
cent bilingual among clerical workers is correlated .259
with the language of names of firms owning plants, .354
with the language of the names of managers of plants in the
sectors, .363 with the per cent of plants non-locally owned,
and .346 with the per cent of a sector's labor force em-
ployed in non-locally owned plants. It seems that it is
the clericals who are most sensitive to mainland influence
in a sector of manufacturing.

There is difficulty of course in attempting to infer
the language policies of individual firms from ecological
data. It is difficult to believe that professionals and
managers within mainland owned and managed firms are less
likely to speak English than professionals and managers in
firms owned and managed by native Puerto Ricans, particu-
larly when there is ethnographic evidence to the contrary.
The most likely explanation is that in sectors of manufac-
turing dominated by mainland companies the Spanish monolin-
gual professionals and managers are concentrated into
smaller Puerto Rican owned firms and use their lower white
collar workers as their linguistic interface with the rest
of the industry. It may be that the Puerto Rican executive
like his mainland counterpart uses his organizational power
to avoid having to use a second language wherever possible.
This latter point, however, is speculation. What has been

shown is that what so much theorizing on the subject has argued is true: white collar occupations are more sensitive to the language of management than blue collar occupations. The effect however is small, and disguises the fact that it is the lower white collar occupations which are most responsive to the domination of a sector of manufacturing by a minority language group.

The fifth explanation of the relationship between occupation and bilingualism not explained by sex, age, education, and exposure to speakers of English is that there is an unmeasured variable which affects both bilingualism and occupational placement. It is now by process of elimination the only viable explanation. The most likely candidate for the crucial unmeasured variable is parents' social class. Epstein (1966:222) observed in a study of school children's attitudes toward learning English that "one need merely speak English fluently to persuade people that he is educated and of more than average means." There are a number of mechanisms by which families of higher social class may transmit both a knowledge of English and an advantaged position in the labor force, which the controls of sex, age, education, and exposure to speakers of English simply do not eliminate. For example, the variable 'education' only measures the highest grade of enrollment not how many years of that education were in private or parochial schools, which do a much more effective job of teaching English than the public schools, or in urban schools, which

do a more effective job of teaching English than do rural schools. (cf. Epstein, 1966:58,63) Similarly, the variable EXPO, exposure to speakers of English, does not control for all experience on the mainland and does not control for the character of that experience. Time spent studying at an American university surely has a greater impact on language skills than time spent in migrant labor camps with fellow Puerto Ricans.

There is, of course, the possible presence of bilingual parents in the homelife of children of higher social class. There has been no control for parental aid in learning a second language. All the explanations of bilingualism tested in this paper are single-generation explanations. In a society such as Puerto Rico bilingualism may be one of the many cumulative advantages of higher social class. Epstein (1966:53) cites a study of achievement test scores in Puerto Rico which shows that father's SES is correlated more closely with English proficiency than with achievement in other subjects. Certainly, the charge that bilingualism in English may be becoming a class barrier has been made. (Epstein, 1966:53)

Conclusions

This paper set out four plausible explanations and one speculative explanation for why bilingualism in societies such as Quebec province or Puerto Rico should be correlated with occupational earnings and prestige. The first

explanation is that the relationship between bilingualism
and occupational earnings and prestige is due to four fac-
tors which obviously affect both variables: sex, age, educa-
tion, and exposure to speakers of English, and with which
both variables have substantial pairwise associations. In
fact, much of the relationship between bilingualism and oc-
cupational earnings is due to the four background variables
because the expected frequencies generated under the log-
linear model which posits no interaction between occupation
and bilingualism (model 1) fit the data fairly well. Never-
theless, there is still a relationship between occupation
and bilingualism which is not explained away by the four
background variables.

Some other explanations are brought forward then.
The second explanation is that some occupations have an in-
trinsic need for bilingualism. Occupations which involve
contact with a linguistically heterogeneous population have
been suggested in the literature as possibly having a high-
er than would otherwise be expected proportion of bilin-
guals because of this possible intrinsic need. It turns
out though that the relationship between occupation and bi-
lingualism, net of the effects of sex, age, education, and
exposure to speakers of English, (expressed as the Occupa-
tion-Bilingualism lambdas of model 2), is as highly corre-
lated with occupational earnings and prestige as per cent
bilingual in an occupation, the uncontrolled relationship.
Since the occupations which have been suggested as being

particularly sensitive to a need for bilingualism are not highly paid or prestigious, the argument that intrinsic occupational need explains some of the relationship between occupation and bilingualism has to be dismissed, unless it is maintained that occupational prestige and intrinsic need for bilingualism are the same dimension.

The third explanation, also based on suggestions from the Canadian literature, suggests that the managements of firms may use their private power to select bilinguals or encourage bilingualism among their employees. No such effect was found in manufacturing in Puerto Rico, one of the industry groups where it would have most likely occurred. A slight tendency for mainland ownerships and managements to pay more for bilinguals was found.

The fourth explanation is a modification of the second and third explanations. The Canadian literature suggests strongly that white collar workers are subject to a need to speak the language of the top executives of their organization. A strong tendency for bilingual white collar workers to be concentrated in sectors which paid more for bilingualism was found. However, only a slight tendency for bilingual white collar workers to be concentrated in mainland owned and managed sectors of manufacturing was found. It is the clericals not the managers and professionals who appear most sensitive to management's language. This finding is so counter-intuitive that it raises questions about attempting to infer the language practices of

firms from aggregated data on sectors of manufacturing. In any event, if the white collar effect on bilingualism is as small in the labor force as a whole as it is in manufacturing, then it could not possibly explain the relationship between bilingualism and occupation.

Finally, with many persuasive theories invalidated, it is suggested that bilingualism may be an advantage of upper class Puerto Rican families or simply correlated with the advantages of upper class Puerto Rican families that are passed on inter-generationally.

Appendix

The question of what the average earnings in an occupational category is is complicated by different amounts of unemployment over occupations. To control for this earnings in 1969 are divided by the number of weeks worked in 1969 to yield average weekly earnings. Earnings are defined as the sum of wages, salary, commissions, bonuses, tips, and profits from business or farm. Unearned income is excluded. Only people who worked in 1969 are included in the regression. There were 6,090 such people, or 81% of the 7,515 people in the native-born Puerto Rican labor force (i.e., born in Puerto Rico with at least one Puerto Rican born parent, in the labor force, no missing data on occupation, industry, or education, and are 20 years or older). Only half the available cases are used in the regression. These are randomly selected.

The question of whether different sectors of manufacturing vary in how much they pay bilinguals in the native-born Puerto Rican labor force can be answered by regressing average weekly earnings in 1969 on a variety of factors apt to affect both earnings and bilingualism and then on the interaction between sector of manufacturing and bilingualism. Earnings are defined as wages, salary, commissions, bonuses, and tips. All other income is excluded. These earnings in 1969 are divided by the number of weeks worked in 1969. Those not working in 1969 are excluded. 3,806 or 79% of the 4,783 people in the native-born Puerto Rican labor force in manufacturing worked in 1969.

The method by which the statistical significance of the interaction between bilingualism and sector of manufacturing on weekly earnings is determined is the F-test for the significance of additional variables. (cf. Kmenta, 1971: 371)

$$\left(\frac{R_Q^2 - R_K^2}{1 - R_Q^2} \right) \left(\frac{n - Q}{Q - K} \right) \sim F_{Q-K, n-Q}$$

where K = the original set of variables

Q = the number of variables after a new set has been added to the original

n = the number of cases.

The interaction of bilingualism and sector of manufacturing is just significant at the .01 level. It has an F of 2.41 with 9 and 3767 degrees of freedom.

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Table 8 about here

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TABLE 1

MARGINALS AND PROPORTION ABLE TO SPEAK ENGLISH
(in percentages)

	Total Labor Force	% Able to Speak English in Total Labor Force	Manu-fac-tur-ing	% Able to Speak English in Manufac-turing
Ability to Speak English				
yes	52.2		52.2	
no	47.8		47.8	
	100.0		100.0	
Sex				
male	65.9	49.2	46.7	56.6
female	34.1	57.9	53.3	48.3
	100.0		100.0	
Exposure to Speakers of English (EXPO)				
yes	27.7	73.6	30.3	73.7
no	72.3	43.9	69.7	42.8
	100.0		100.0	
Education				
never attended through grade 3	17.4	6.8	10.7	11.7
grade 4 through grade 7	22.9	25.7	24.0	27.7
grade 8 through grade 11	21.8	57.2	29.8	56.8
12th grade	22.4	80.3	28.2	73.3
at least some college	15.6	93.5	7.2	91.9
	100.1		99.9	
Age				
20-29	32.3	57.1	41.9	52.6
30-39	24.7	61.8	28.9	55.5
40-49	18.2	53.8	15.9	55.0
50+	24.8	34.9	13.4	40.3
	100.0		100.1	

TABLE 1--Continued

	Total Labor Force	% Able to Speak English in Total Labor Force	Manu-fac-tur-ing	% Able to Speak English in Manufac-turing
Major Occupational Groups				
Professional, technical and kindred	9.6	90.3	2.2	90.6
Managers	5.6	70.9	1.6	84.6
Sales workers	6.4	57.9	1.5	77.0
Clericals	11.1	82.4	5.8	78.9
Craftsmen, fore-men, and kindred	14.8	48.7	14.8	59.6
Operatives	17.5	46.4	62.3	46.7
Transport operatives	4.8	45.5	3.3	45.6
Laborers	7.5	26.8	5.7	42.1
Farmers	1.7	19.7	*	*
Farm laborers	7.5	13.1	*	*
Service workers	11.6	48.3	2.6	44.1
Private household workers	2.0	11.4	*	*
	100.0		99.8	
Major Industrial Groups				
Agriculture	9.8	15.0		
Mining	0.3	33.3		
Construction	11.9	37.8		
Manufacturing	22.4	52.3		
Transportation, com-munications, and other public utilities	8.1	50.7		
Wholesale and re-tail trade	15.5	57.2		
Finance, insurance and real estate	1.9	86.7		
Business and repair services	2.4	64.2		
Personal services	5.7	45.2		
Entertainment and recreation	0.8	61.3		
Professional and related	13.7	71.3		
Public administra-tion	7.5	71.9		
	100.0			

TABLE 1--Continued

	Manufac-turing	% Able to Speak English in Manufac-turing
Sectors of Manufacturing		
Lumber, wood products, and paper	4.7	56.5
Stone, clay, and glass products	3.5	46.4
Metal industries	3.5	60.7
Machinery, equipment, instruments	10.5	67.7
Miscellaneous	3.7	42.1
Food and tobacco	20.0	43.3
Textiles and apparel	37.7	48.8
Printing	2.0	79.4
Chemicals, petroleum, rubber, and coal	7.0	69.1
Leather	7.2	48.4
	99.8	

TABLE 2

THE RELATIONSHIP BETWEEN OCCUPATION AND BILINGUALISM: UNCONTROLLED WITH % ABLE TO SPEAK ENGLISH BY OCCU-PATION, AND CONTROLLING FOR SEX, AGE, EDUCATION, AND EXPOSURE TO SPEAKERS OF ENGLISH, THE LAMBDAS FOR THE OCCUPATION-BILINGUALISM TERM FROM MODEL 2

	Per Cent Able to Speak English	Occupation-Bilingualism Lambdas
Occupation		
Professional, tech-nical and kindred	90.3	0.50
Managers	70.9	0.24
Sales workers	57.9	0.10
Clericals	82.4	0.39
Craftsmen, foremen, and kindred	48.7	0.02
Operatives	46.4	-0.05
Transport operatives	45.5	-0.02
Laborers	26.8	-0.26
Farmers	19.7	-0.24
Farm laborers	13.1	-0.41
Service workers	48.3	0.06
Private household workers	11.4	-0.33

TABLE 3

PER CENT OF PROFESSIONAL AND MANAGERIAL LABOR FORCE WHO ARE
MAINLANDERS (U.S. BORN OF U.S. BORN PARENTS WHO SPEAK
ENGLISH) TOTAL NUMBER OF PROFESSIONALS AND MANAGERS
IN EACH INDUSTRY GROUP IS IN PARENTHESES

Industry

Industry	Per Cent	(Number)
Agriculture	0	(1)
Mining	0	(2)
Construction	4.6	(65)
Manufacturing	5.5	(90)
Transportation, communications, and other public utilities	3.6	(55)
Wholesale and retail trade	0.7	(304)
Finance, insurance and real estate	2.4	(41)
Business and repair services	8.0	(25)
Personal services	9.7	(31)
Entertainment and recreation	8.0	(25)
Professional and related	4.3	(653)
Public administration	2.6	(151)

TABLE 4

PER CENT OF MANUFACTURING ESTABLISHMENTS WITH 2 OR MORE
SALARIED EMPLOYEES IN THE WEEK OF OCTOBER 15, 1966 IN
PUERTO RICO WITH A DIRECTOR WITH AN ENGLISH LANGUAGE
NAME OR OWNED BY A COMPANY WITH AN ENGLISH
LANGUAGE NAME
(Source: Puerto Rico, Department of Labor, 1966)

	Distri-bution of Plants	% of Plants with a Di-rector with an English Language Name	% of Plants Owned by a Company with an English Language Name
Sectors of Manufacturing			
Lumber, wood prod-ucts, and paper	14.0	11.8	32.4
Stone, clay, and glass products	8.6	4.8	28.6
Metal industries	9.9	16.7	58.3
Machinery, equipment, instruments	6.2	53.3	100.0
Miscellaneous	4.5	45.5	100.0
Food and tobacco	21.4	5.8	28.8
Textiles and apparel	19.3	44.7	83.0
Printing	4.9	8.3	16.7
Chemicals, petroleum, rubber, and coal	7.0	35.3	88.2
Leather	4.1	50.0	100.0
	99.9 (243, 10% sample of 2,436 plants listed)		

TABLE 5

PER CENT OF MANUFACTURING ESTABLISHMENTS WITH 1 OR MORE
SALARIED EMPLOYEES IN MARCH 1967 NON-LOCALLY OWNED,
AND PER CENT OF EMPLOYEES IN NON-LOCALLY OWNED
MANUFACTURING ESTABLISHMENTS

(Source: U.S. Bureau of the Census, 1970b: 100,101)

	Distribution of Plants	% of Plants Non-locally Owned	Distribution of Employees	% of Employees in Non-locally Owned Plants
Sectors of Manufacturing				
Lumber, wood products, and paper[1]	10.6	17.9	4.1	40.3
Stone, clay, and glass products	10.6	13.6	5.4	20.9
Metal industries	9.8	21.6	3.8	45.9
Machinery, equipment, and instruments[2]	6.0	67.7	8.5	87.6
Miscellaneous[3]	4.7	59.0	3.0	80.9
Food and tobacco	21.9	19.9	24.5	58.4
Textiles and apparel	21.2	63.1	35.1	83.4
Printing	5.8	18.6	2.2	54.7
Chemicals, petroleum, rubber, and coal[4]	6.1	53.3	4.5	72.1
Leather	3.5	79.5	9.0	87.3
	100.2 (2,226)		100.1 (114,716)	

Note: To protect confidentiality, the census does not disclose figures for sectors of manufacturing with only a few manufacturing establishments. The following sectors are missing data:

[1] Lumber, wood products, and paper is missing data on lumber and wood products other than furniture.

[2] Machinery, equipment, and instruments is missing data on transportation equipment and instruments.

[3] Miscellaneous includes one ordnance plant.

[4] Chemicals, petroleum, rubber, and coal is missing petroleum and coal products.

TABLE 6

PER CENT ABLE TO SPEAK ENGLISH OF VARIOUS OCCUPATIONAL GROUPS BY SECTORS OF MANUFACTURING (TOTAL NUMBER OF PEOPLE IN EACH OCCUPATIONAL GROUPING IS IN PARENTHESES)

Sectors Manufacturing	Per Cent Able to Speak English			
	White Collar Collars	Blue Collar Workers	Professional Managerial Workers	Clerical Workers
Lumber, wood products, and paper	70.8(24)	54.8(199)	71.4(14)	66.7(6)
Stone, clay, and glass products	86.9(23)	40.0(145)	100.0(8)	80.0(15)
Metal industries	87.5(16)	57.9(152)	100.0(7)	75.0(8)
Machinery, equipment, instruments	88.7(71)	64.2(433)	86.9(23)	87.2(39)
Miscellaneous	80.0(15)	38.7(163)	85.7(7)	80.0(5)
Food and tobacco	74.8(155)	37.2(803)	85.1(47)	67.9(78)
Textiles and apparel	78.7(80)	47.4(1725)	84.2(19)	78.2(55)
Printing	88.2(51)	69.6(46)	93.3(15)	93.5(31)
Chemicals, petroleum, rubber, and coal	88.4(86)	62.5(251)	95.0(40)	83.3(30)
Leather	81.3(16)	46.8(329)	75.0(4)	83.3(12)

TABLE 7

REGRESSION COEFFICIENTS FROM A REGRESSION OF WEEKLY EARN-
INGS IN 1969 ON 11 DUMMY VARIABLES REPRESENTING THE 12
CATEGORY MAJOR OCCUPATION GROUPS--TOTAL NATIVE-BORN
PUERTO RICAN LABOR FORCE (COEFFICIENTS ARE EXPRESSED
AS DEVIATIONS FROM OMITTED CATEGORY:
FARM LABORERS)

Major Occupational Groups	Regression Coefficient	Dollar Equiv-alent	F-ratio
Professional, technical, and kindred	.8395	$83.95	148.48
Managers	.8172	$81.72	115.27
Sales workers	.3800	$38.00	24.87
Clericals	.4469	$44.69	44.50
Craftsmen, foremen, and kindred	.3951	$39.51	38.62
Operatives	.2835	$28.35	20.20
Transport operatives	.3591	$35.91	19.16
Laborers	.2714	$27.14	13.87
Farmers	.1150	$11.50	0.86
Farm laborers	0*	0*	
Service workers	.3100	$31.00	21.36
Private household workers	-.0096	$ .96	.01

$$R^2 = .079$$

TABLE 8

REGRESSION COEFFICIENTS OF WEEKLY EARNINGS IN 1969 ON THE
INTERACTION BETWEEN BILINGUALISM AND SECTOR OF
MANUFACTURING--NATIVE BORN PUERTO RICAN LABOR
FORCE IN MANUFACTURING

(Coefficients are expressed as deviations
from omitted category: food and tobacco)

Already in equation: occupation, sector of
manufacturing, education, sex, age, exposure
to speakers of English, bilingualism, and the
interaction between bilingualism and occupations.

Sector of Manufacturing	Regression Coefficient	Dollar Equiv- alent	F-ratio
Lumber, wood products, and paper	-.1683	-$16.83	5.83
Stone, clay, and glass products	-.1020	-$10.20	1.68
Metal industries	.1380	$13.80	2.95
Machinery, equipment, instruments	-.0342	-$ 3.42	0.37
Miscellaneous	.1421	$14.21	2.67
Food and tobacco	0*	0*	
Textiles and tobacco	-.0077	-$ .77	.03
Printing	.1123	$11.23	.80
Chemicals, petroleum, rubber, and coal	.0928	$ 9.28	2.11
Leather	-.0692	-$ 6.92	1.24

MODEL 1

Table 1: Bilingualism by Occupation by Sex by Age by
         Education by Expo (exposure to speakers of English)
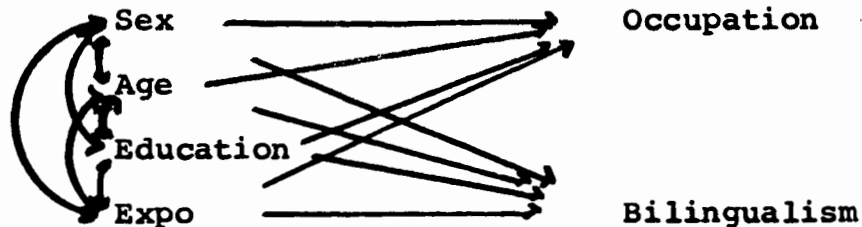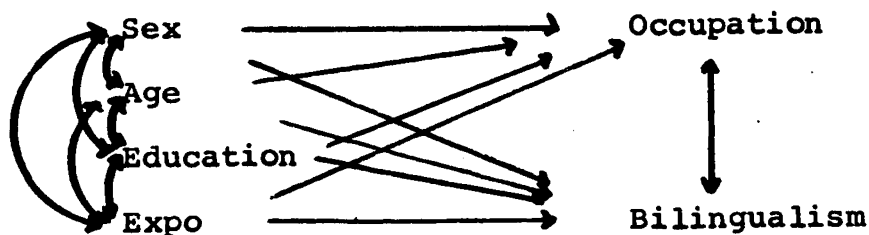Fitted Marginals: Sex-Age-Education-Expo Sex-Occupation
                 Age-Occupation Education-Occupation
                 Expo-Occupation Sex-Bilingualism
                 Age-Bilingualism Education-Bilingualism
                 Expo-Bilingualism
Dependent Variables: Bilingualism, Occupation
Chi-square (likelihood ratio) of the fit: 1756
Degrees of Freedom: 1720

Significance level at which null hypothesis that expected
frequencies under the model and actual frequencies differ
only by chance can be rejected: greater than 0.50 (indicat-
ing that null hypothesis cannot be rejected)

MODEL 2

Table 1: Bilingualism by Occupation by Sex by Age by
Education by Expo (exposure to speakers of English)

Fitted Marginals: Sex-Age-Education-Expo Sex-Occupation

Age-Occupation Education-Occupation

Expo-Occupation Sex-Bilingualism

Age-Bilingualism Education-Bilingualism

Expo-Bilingualism Bilingualism-Occupation

Dependent Variables: Bilingualism, Occupation, Bilingualism-
Occupation

Chi-square (likelihood ratio) of the fit: 1510

Degrees of Freedom: 1709

Significance level at which null hypothesis that expected
frequencies under the model and actual frequencies differ
only by chance can be rejected: greater than 0.50 (indicat-
ing that null hypothesis cannot be rejected)

MODEL 3

Table 2: Bilingualism by Occupation by Sector of Manufactur-
ing by Sex by Education

Fitted Marginals: Sex-Sector of Manufacturing Sex-Occupa-
tion

Sex-Bilingualism Education-Sector of

Manufacturing

Education-Occupation Education-
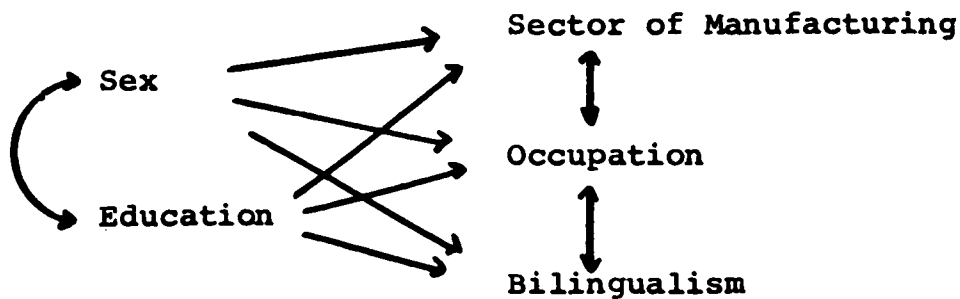
Bilingualism

Sector of Manufacturing-Occupation

Occupation-Bilingualism

Dependent Variables: Bilingualism, Occupation, Sector of

Manufacturing, Occupation-Bilingualism,

Sector of Manufacturing-Occupation

Chi-square (likelihood ratio) of the fit: 1046

Degrees of Freedom: 1602

Significance level at which null hypothesis that expected
frequencies under the model and actual frequencies differ
only by chance can be rejected: greater than 0.50 (indicat-
ing that the null hypothesis cannot be rejected)

MODEL 4

Table 2: Bilingualism by Occupation by Sector of Manufactur-
ing by Sex by Education

Fitted Marginals: Sex-Sector of Manufacturing Sex-Occupa-
tion

Sex-Bilingualism Education-Sector of
Manufacturing

Education-Occupation Education-Bilingual-
ism

Sector of Manufacturing-Occupation
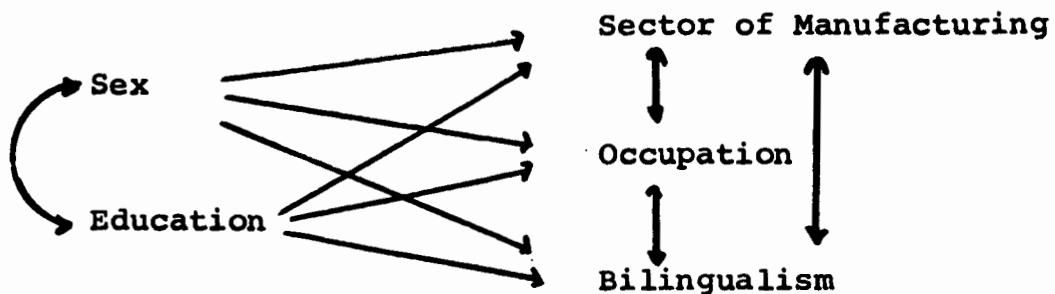
Occupation-Bilingualism

Sector of Manufacturing-Bilingualism

Dependent Variables: Bilingualism, Occupation, Sector of
Manufacturing, Occupation-Bilingualism,
Sector of Manufacturing-Occupation
Sector of Manufacturing-Bilingualism

Chi-square (likelihood ratio) of the fit: 1011

Degrees of Freedom: 1593

Significance level at which null hypothesis that expected
frequencies under the model and actual frequencies differ
only by chance can be rejected: greater than 0.50 (indicat-
ing that the null hypothesis cannot be rejected)