Probability of Staying in Canada

by

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Abstract: Canada's contemporary brain drain debate has largely concentrated on estimating the net number of highly skilled Canadian émigrés to the United States. This paper reverses the logic and asks under what conditions would highly educated Canadians stay in Canada given the substantial returns to movement to the United States?[1] To answer this question we first estimate the private and social returns from acquiring subsidized post-secondary education in Canada under the conditions of staying or migrating to the United States. Given the large rates of return derived from the joint investment of education and migration to the United States, we next outline the changing United States immigration laws circa 1990-2000 which uniquely lowered the Canadian movement costs to the United States. Then we estimate with two cross sections of data (1996 and 1990) – a logistic cumulative distributive function – to predict the probability that a highly educated Canadian will remain in Canada. We find that the probability of staying in Canada is convex in age, and depends on marital status, previous mobility history and the expected income gain from moving. Finally, there exists evidence that the staying function has shifted between 1990 and 1996 further suggesting that United States immigration policy and relative economic conditions between the two countries affect the risk of movement for the highly skilled from Canada to the United States.

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Keywords: International Migration, Human Capital and Brain Drain

[1] Paul Miller provided me with this insight and I thank him.

I. Introduction

The debate over the size and even the existence of the 'brain drain' or human capital transfer from Canada to the United States has dominated immigration policy research in Canada in the late 1990s. Central to the inherent ambiguity in the debate is a lack of firm data on the number of both permanent and temporary highly skilled Canadian movers to the United States. DeVoretz and Laryea (1998) and Iqbal (1999) both argue that the numbers of highly skilled permanent Canadian movers to the United States circa 1989-1996 are substantial in some fields (medicine) and growing in other occupations. In addition, they document that the number of post NAFTA (1994) temporary Canadian movers to the United States is large. In sum, they argue that the combined size of the permanent and temporary movement of highly skilled Canadians relative to their graduation rate confirms that a brain drain exists. Helliwell (1999) and others argue the contrary. They note that the number of permanent Canadian movers is a modest fraction of the stock of skilled Canadians and that skilled temporary movement of skilled Canadians to the United States is transient.

DeVoretz and Laryea extend the debate beyond simple numbers by providing an economic dimension when they estimate the replacement cost for this Canadian outflow to the U.S. as $ 6.0 billion (Cdn) circa 1989-96. Moreover, they estimate the 'churning costs' resulting from replacing Canadian émigrés with less productive rest-of-the-world immigrants as $12.6 (1996 Cdn). Wagner (2000) addresses a second economic issue by assessing the role that Canadian taxes play in pushing the highly skilled to the United States. Wagner concludes that a higher Canadian tax burden provides an added, albeit small, incentive for Canadian human capital to move to the United States.[2] In fact, Canadian-United States tax differences according to Wagner accounted "for at least 6 percent of Canada's migrants to the U. S." (Wagner 2000:22).

[2] Wagner estimates the tax exposure of Canadians living in Canada and the United States. He then reverses their location placing Canadians in the United States back into Canada and vice-versa. This allows him to calculate which group has the largest tax savings and finds that those Canadians with the greatest tax savings actually choose to live in the United States. Statistics Canada corroborates this finding by noting in a separate study the rise in the number of high-income Canadian tax filers living in the United States.

This literature to date, however, leaves one begged question: Given the new ease of movement and high returns, why do so few highly trained Canadians leave for the United States? In other words, what are the forces that determine the probability of staying or condition the risk of moving? Canada's Prime Minister, Jean Chrétien, offered one potential answer to this question by citing the fact that Canada is ranked number one on the Human Development Index (HDI). This index presumably reflects the quality of life in Canada owing in part to the provision of tax-financed public goods (health, education, etc.) which in turn act as magnets to some potential leavers.[3] We can not address the influence of the HDI directly on Canadian highly skilled emigration. But we develop and estimate a life-cycle model for staying, which incorporates demographic controls to predict the risk of moving for a Canadian household.[4] We note that isolating the significant demographic conditioners (age, marital status, gender, etc.) at various stages in the life cycle may ultimately provide direction for policy interventions to reduce the risk of movement.

The paper is organized as follows. First, we describe the post-1990 changes in United States immigration legislation, which have uniquely reduced the transaction costs of Canadians moving to the United States. Next, we calculate the joint returns to highly skilled Canadians who acquire Canadian education and subsequently move to the United States. Then, we sketch a life-cycle model of immigration, discuss the available data and estimate a logistic cumulative distributive function to estimate the impact of the factors, which condition the risk of highly skilled Canadians moving to the United States. After a discussion of the results we conclude with a limited set of policy recommendations.

II. Incentives to leave Canada for the United States

Several conditioners affect the supply and demand of highly trained Canadian émigrés to the United States. First, the transaction costs of movement to the United States and secondly the

[3] The Human Development Index ranks a country from a weighted index of per capita income, health and education indices relative to the highest in each category in the world. Presumably Canada's ability to provide public health and education at crucial time in the family's life reduces the risk of moving for the higher income gain in the United States.

[4] Wagner's results (2000, pp.20-21) suggest that demographic variables (age, education, and marital status) condition emigration.

individual's cost of acquiring education in Canada both affect the cost of any move and hence the supply of potential Canadian émigrés. The United States immigration policy, with its hemispheric quotas between 1965-1990, reduced the ability of highly skilled Canadians to enter the United States as permanent immigrants.[5] After 1990, the United States increased the admission quotas under both its permanent and primary temporary skilled visa entry categories. This marginally increased the likelihood of a successful Canadian skilled immigrant application but did little to reduce the transaction costs of a move.[6] More importantly for Canadians, the TN-1 temporary visa was introduced under the NAFTA provisions.[7] This visa is uniquely available to only skilled Canadians, and while yearly in duration may be renewed indefinitely. The TN-1 is simple to obtain and thus substantially lowers the transaction costs for highly skilled Canadians to enter the United States (Grasmick 1991).

The low private direct costs for acquiring Canadian post-secondary education coupled with the new ease of entry to the United States has provided Canadian students with a new strategic plan.[8] Central to this view is the theoretical argument of Stark, Helmenstien, Praskawetz, (1997, 1998) that the 'brain drain,' with its attendant rise in the rate of return of education in the destination country, influences home country decisions about acquiring education.[9] In short, the prospect of emigration to the United States encourages post-secondary students in Canada to first acquire subsidized education, even given limited Canadian labour market conditions. Then, given the relative labour market conditions for them in the two countries, they decide to emigrate or not.

We capture the rationale of this strategic behaviour in the Canadian context by first calculating circa 1995/96 the individual's lifetime earning prospects in Canada and the

[5] This of course is why Helliwell (2000), Wagner (2000) and others find the stock of Canadians and pre–1991 Canadian emigration flows to the United States so small relative to the 1950s when there were no hemispheric quotas that kept Canadians out.

[6] Grasmick, J.G. (1995) estimates that prior to the TN-1 visa the legal costs for an HB-1 visa could be as high as $35,000 in legal fees to provide the necessary documentation.

[7] Under the Free Trade Agreement or FTA (1989-1993) which preceded NAFTA, a similar visa was available.

[8] Specifically, private costs only include costs borne by the student (tuition, fees, books, foregone earnings, etc.) while the social costs include all private costs plus taxpayer subsidy (DeVoretz and Laryea,1998).

[9] Stark (1999) theoretically argues that a 'brain drain' has spillover affects in the sending countries. Successful emigration with its attendant high rewards will induce more human capital acquisition in the sending country as potential émigrés acquire greater human capital than they originally attended to acquire.

United States and then computing their internal rates of return to education under various cost and mobility conditions.

For stayers, or individuals who remain in Canada to work after acquiring a post-secondary degree, the internal rate of return from higher education (R) can be computed as follows:

$$C = \sum_{t=0}^{T} (Y_{B.A.} - Y_{H.S.})/(1+R)^t$$

where:

C = the private (or social) cost of acquiring a bachelor's degree in Canada
$Y_{B.A}$ = expected income earned by a baccalaureate degree holder over T working years in Canada
$Y_{H.S.}$ = expected income earned by a high school graduate over T working years in Canada
R = the calculated internal rate of return

On the other hand, the internal rate of return earned by a highly educated Canadian who moves to the United States is given by:

$$C = \sum_{t=0}^{T} (Y_{US} - Y_{CAN})/(1+R)^t$$

where:

C = the cost of acquiring a bachelor's degree in Canada and moving to the United States to work
Y_{us} = the expected income earned by a bachelor degree holder over his/her T working years in the United States
Y_{can} = the expected income earned by a high school graduate over his/her T working years in Canada
R = the calculated internal rate of return

In order to reflect the inherent strategic behaviour engaged in by Canadian émigrés to the United States, we calculate the internal rates of return to higher education acquired in Canada for Canadian stayers or movers under two cost concepts. These two cost concepts – the private and social costs of education – capture respectively the individual's cost of education net of the Canadian taxpayers' subsidy while the social cost concept includes any

taxpayer subsidy, plus the private costs (DeVoretz and Laryea 1998).[10] Both the private and social internal rates of return were calculated under several assumptions controlling for both gender, pre-tax and post-tax conditions in the assumed country of residence.

Table 1: Rates of Return for Educated Canadian Stayers and Movers: 1996-96

	Social	**Private**	**Social**	**Private**
Pre-tax	Female	Female	Male	Male
H.S. Grads (Can)-B.A. Degree (Can)	3.63%	12.59%	4.21%	11.29%
H.S. Grads (Can)-B.A. Degree (USA)	7.67%	34.72%	10.30%	42.46%
Post-tax	Female	Female	Male	Male
H.S. Grads (Can)-B.A. Degree (Can)	2.10%	10.07%	2.09%	8.30%
H.S. Grads (Can)-B.A. Degree (USA)	8.31%	36.74%	11.06%	34.99%

*Non-permanent residents are excluded for the sample of N= 28,141.
Sources: *1996 Canadian Census, Public Use Microdata Individual File* and *Statistics Canada Education Indicators in Canada.*
** N = 12,318
Source of data is the 1995 Current Population Survey, Person Data Files, US Census Bureau

The alternative rates of return reported in Table 1 allow us to investigate several economic phenomena surrounding the decision to stay in Canada or move to the United States for the highly skilled Canadians. Comparing column (1) to (2) or (3) to (4) reveals the effect of the taxpayers' subsidies on the rate of return to potential movers. Further, if we compare row (1) to (2) under the private cost concept (cols. 3 or 4) the rewards from employing a strategy of first acquiring a Canadian education and then immigrating to the United States is revealed. Next, calculating the rates of return under a pre- and post-tax position (panels a and b) addresses two further incentive issues; the role of differential tax rates and the comparative size of the US and Canadian taxpayer subsidies. Finally, the table allows us to analyze the returns from moving or staying by gender, which will potentially reveal the often-noted gender bias in migration.

[10] The direct private and social cost data is taken directly from DeVoretz and Laryea (1998) with the exception of the foregone income component, which was estimated with 1996 earnings data in Canada.

Table 1, row 1 – columns 2 and 4, report the modest educational returns for higher education for both Canadian female and male stayers. The private return earned by Canadian males in Canada before Canadian federal taxes is (11.29%), which is approximately equal to the female pre-tax return (12.6%) if they stay in Canada. The social rates of return earned by Canadian males and females falls dramatically to 4.2 percent and 3. 6 percent respectively when taxpayer subsidies are incorporated in the costs and these highly educated Canadians continue to remain in Canada.

The available literature supports the Canadian findings for the pre-tax private rates of return reported in Table 1. The private rates of return reported for the United States range between 12 to 15 percent (Ashenfelter and Kreuger 1994).[11] For the United Kingdom contemporary estimates for the private rates of return to education are slightly higher at 16 percent (Harmon and Walker 1995). These reported rate-of-return values are above but clearly within the range of the 11.3 and 12.6 male and female private rates of return reported in Table 1 for Canada. Thus, there exists evidence that the rates of return for these developed countries are similar.[12] With respect to the prospect of staying in Canada, the pre-tax returns to acquiring a Canadian post-secondary education for either males or females is substantial to the individual (12%) and represent a distinct incentive to stay in Canada.

What of the Wagner argument that differences in Canadian-US income taxes add, albeit a small, incentive to move? This finding is confirmed in Table 1 when we compare panel A to panel B. The private rates of returns for males and females are only reduced by 3 and 2 percent respectively after the returns are netted for Canadian income taxes. Again, we conclude that the post-tax returns from remaining in Canada for highly educated males (8.3%) and females (10%) still represent a significant force to remain in Canada, which is consistent with Wagner's findings (2000).

However, without the taxpayer educational subsidy, the educational return to a Canadian staying in Canada would be minimal. Under the social cost concept, the returns to males and females are reduced to one-third of their private levels before netting for Canadian

[11] Belzil and Hansen, 1999 report a more modest rate for U.S. white males of 6 percent.

taxes. The post-tax social returns for stayers, who theoretically must bear the full cost of their education, is 2 percent. This represents a minimal incentive to stay in Canada and portrays the situation if students bore the full cost of their education or if taxpayers moved to contingent financing.[13]

Central to this rate of return analysis is the question: What is the return to Canadians who employ a strategic behaviour of acquiring education in Canada and moving to the U.S.? Table 1 indicates that the return from this joint education/migration decision is substantial. Highly educated Canadian males who move to the United States have a four-fold increase in their rates of return (43%) versus staying in Canada (11.3%). Female Canadians approximately triple their rates of return (34.7%) when moving to the United States versus staying (12.5 %) in Canada. In sum, the incentive to jointly acquire a subsidized Canadian education and move to the United States versus staying is clearly established.

Two points emerge from Table 1. For the individual highly trained Canadian, there exists a significant incentive to remain in Canada before or after netting for taxes based on the rate of return from his/her education. However, the rewards from moving to the United States with this subsidized Canadian education are very much larger.

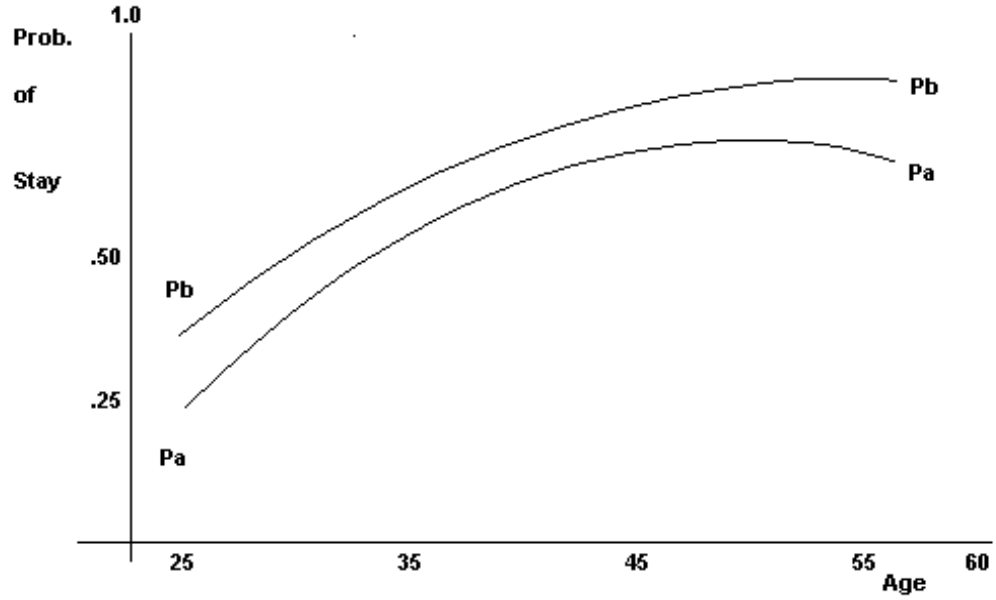
We have now set the pre-conditions for highly skilled Canadians to move; namely ease of entry and substantial rewards. However, in light of these incentives to move, how do we explain the more generally observed phenomenon of staying in Canada? We turn to a life-cycle model to condition household movement on both economic and demographic features to explain the staying phenomenon.

III. A Life-cycle Model of Staying

A life-cycle model, which incorporates changing demographic features of the household over the life cycle (age of head of household, family size, marital status, etc.), provides further non-economic explanations for staying in Canada given the documented large economic incentive to move. We outline such a stylized model below.

[12] It is obvious that the rates of returns can be identical between two countries with vastly different earnings streams if private costs differ. In the Canadian context, private costs and earnings functions are both lower than in the United States. This leads to near equal returns for highly educated stayers in both countries.

Figure 1: Life-cycle Model of Probability of Staying



In Figure 1 we argue that the probability of staying in Canada for a highly skilled headed household is convex in age. As other events occur over the household's lifetime – marriage, divorce, previous internal migration, children – we further argue that the function for staying is simply a monotonic transformation of the original convex in age formulation (P_a-P_a to P_b –P_b).

An inspection of Figure 1 can rationalize these assertions. We assume that at age 25 the highly skilled Canadian enters the Canadian labour market unmarried. At this point there exist few demographic constraints to restrict movement, and the lifetime rewards from movement to the U.S. are high, acting as an incentive to move (see Table 1), and the probability of staying in Canada is less than 50 percent.[14] As the head of household ages, the rate of return from emigrating declines, given that a shorter earning period remains. Thus, the probability of staying increases at a decreasing rate in age. Next, a peak interval is reached (age 45-55) when the staying probability is invariant to age. Finally, changes in household status – marriage, presence of children, previous movement, divorce – are lifetime events

[13] A contingent loan scheme based upon earnings is in place in Australia, and if applied to Canada would lead to these low returns as the social and private returns would be equalized to the social rate.
[14] Note that the returns in Table 1 were calculated from age 27 to 65.

which alter the probability of staying in Canada for two reasons. First, these changes raise (or lower) the cost of movement and thus deter (encourage) movement. Second, access to publicly financed goods can increase as these household status changes occur (children, divorce) which in turn increases the probability of staying. These events are captured by a shift (Pa-Pb) to (Pb-Pb).

When a variety of household status changes occurs simultaneously, the change in the direction of the intercept (raise or lower) is now unknown. An example should clarify this argument. A household whose head has previously moved but subsequently has children will experience two countervailing forces to shift the convex staying function in an unknown direction. First, a previous move will reduce the transactions cost of a further move to the United States while having children raises the accessibility of public goods and increases the household's probability of staying in Canada. The question of which effect is larger must be determined empirically before the shift in the staying function can be determined.

Our sole economic argument that conditions movement is unambiguous in sign and reflects the income gain or opportunity cost for either a mover or a stayer. For stayers, the income gain is defined by Gs where:

$$Gs = Y^{actual}_{CDN} - Y^{expected}_{USA}$$

The rationale to include Gs is that staying in Canada is conditioned on the opportunity cost of staying in Canada or the difference in the earned Canadian income vis-à-vis the expected income to be earned in the USA. Clearly, Gs can be positive or negative in sign and depends on the absolute size of the expected income in the USA ($Y^{expected}_{USA}$)

If Gs is negative, the stayer should move unless she/he values Canadian amenities. The reservation income gain in this case would be the size of the negative value of Gs before movement is induced.

Gm defines the incentive on the margin for the household that moved to the USA and this gain is:

$$Gm = Y^{actual}_{USA} - Y^{expected}_{CDN}$$

Again, for any individual household, Gm can be positive or negative. Theoretically, Gm must at least exceed the cost of movement to make the move economically rational and hence a reservation gain exists for all households before the move.

In sum, most of the main economic and demographic arguments can be unambiguously signed. A growth in income opportunities from moving will lower the probability of staying as will the previous act of movement. An increase in household size (children) will lead to an ambiguous result since this increases mobility costs while increasing the access to public goods. The probability of staying is convex in age since at first the discounted income rewards owing to a move are reduced in time while the accessibility to public goods gradually rises over time. In a discrimination-free world the gender effect should be insignificant. Marital status – single, divorced or married – is argued to be negative, positive and negative respectively as these various states alter the costs of movement and either increase the probability of staying (positive) or leaving (negative).

IV. Logit Estimating Model

Following Hunt (2000), the predicted probability that highly skilled individuals in the labour force remain in Canada is modeled as a logistic cumulative distributive function.[15] A logit analysis is chosen since the disposition to stay in Canada is a binary-dependent variable.[16] In particular, a highly skilled individual either stays in Canada (Y=1) or moves to the United States (Y=0). The logistic distribution is given by:

Eq. 1. $\text{Prob}\,(Y=1) = (e^{Y}) / (1+e^{Y})$

where Y is a linear function of socio-demographic and economic factors such as age, age squared, family size and three dummy variables for gender, marital status and previous

[15] Hunt (2000) in the German setting offers us this modeling direction when attempting to explain the risk of movement for the most highly educated youth in eastern Germany to western Germany after 1989.

[16] Given data limitations and the focus of our analysis on bilateral Canadian-US immigration flows, the choice variable is either to stay in Canada or leave for the US. There exists a relevant third state, namely movement to the rest of the world. If data were available on Canadian highly skilled émigrés to the rest of the world, then we would have posited a degenerative logit model to capture the relevant two-stage process of staying or leaving and then choosing between US or the rest of the world.

mobility. One economic variable, income gain, is used as an additional argument. This variable was defined as either Gm or Gs (above) and represents the presumed income gain from moving (Gm) or the opportunity cost (gain) of staying (Gs).

All the variables that appear above were drawn from our stylized life-cycle model and the expected signs on the variables were rationalized above. These signed variables were as follows:

1. Age > 0
2. $Age^2 < 0$
3. Income gain < 0
4. Family size > 0
5. Previous Movement < 0
6. Marital Status: relative to single > 0
7. Male $= 0$

III. Data Sources:

Data for the logit function were initially drawn from the 1995 Canadian Census and the 1995 Current Population Survey, which yielded a cross-sectional total sample of 1417 highly skilled individuals in both labour forces, of which 78 were Canadian born living in the United States and 1339 were living in Canada. The number of movers in this sample – 78 – represents approximately the portion (5%) of recent highly skilled graduates that moved to the United States (DeVoretz and Laryea 1998).[17] The rate-of-return values reported in Table 1 were derived from Canadian and United States data. Specifically, we used the 1996 Canadian Census, Public Use Microdata Individual File and the 1995 Current Population Survey, Person and Family Data Files, US Census Bureau to estimate the required age earnings profiles in the two countries. A total sample of 40,459 labour force members, of which 69.5 percent are high school graduates and Bachelor's degree holders in Canada and 30.5% are Bachelor's degree holders in the United States, was used to generate age-earnings profiles for the calculations of $Y_{B.A}$ and $Y_{H.S.}$. Information on private and social educational costs was obtained from Education Indicators in Canada, Statistics Canada.

[17] Highly skilled individuals are defined as those holding post baccalaureate degree.

IV. Estimation Results:

The analysis of the results of a multinomial logit model can be reported in at least two forms. First, the estimated coefficients (which measure the size of the impact on the log-odds) will be discussed, next, a series of simulations are produced.

Table 2 reports the estimated coefficients from the multinomial logit model or Eq. 1 with cross-sectional data circa 1995/96. This is the base case. The dependent variable is assigned the value of one if the individual resides in Canada and the reference category (residing in the US) is assigned the value of zero. The interpretation of the MNL coefficients is now well known. That is, an addition of one unit in an explanatory variable reduces (if a negative coefficient) or increases (if a positive coefficient) the propensity to stay in Canada. At this stage, the discussion reports only the sign and the statistical significance of the estimated coefficients. Later, the marginal effects and the predicted probabilities over a lifetime are analyzed for various categories (males, females, married, etc.) of stayers.

Table 2: Estimated Coefficients for the Logit Stayer Model 1995-96*

VARIABLE NAME	ESTIMATED COEFFICIENT	ASYMPTOTIC T-RATIO
Constant	-5. 5355	-2.4
Gender (Male = 1; Otherwise = 0)	0.60767	2.4
Marital Status (Married =1; Otherwise = 0)	1.5458	2.0
Mobility (NonMover = 1; Otherwise = 0)	0.94933	3.4
Age	0.23189	2.2
Age^2	-2.39E-03	-2.0
Family Size	1.7609	3.2
(Marital Status)(Family Size)	-1.6585	-2.9
Change in Total Income**	-1.02E-05	-2.9

*Non-permanent residents are excluded from the sample of N_1 = 1339 stayers in Canada.
Canadian born living in the United States sample size is N_2 = 78.
** This is calculated as follows:
Stayer: Change in Total Income = Total Income $_{Can}$ - Predicted Total Income $_{US}$
Mover: Change in Total Income = Total Income $_{US}$ - Predicted Total Income $_{Can}$
Sources: 1996 Canadian Census, Public Use Microdata Individual File and 1995 Current Population Survey, Person and Family Data Files, US Census Bureau.

The results in Table 2, the base case, generally conform to our life-cycle model's predictions. Also, all of the arguments in the model are significant. As the head of household ages, the probability of staying in Canada increases but is convex in shape since the effect of

age squared is negative. An increase in family size increases the probability of staying in Canada as does being male. If a person has not recently (last 5 years) moved between provinces or if he/she is married then the probability of staying in Canada also increased. An increase in household size increases the log odds of staying in Canada. However, when we interact marital status with family size, this combined state reduces the probability of staying in Canada circa 1995/96.

The income variable, which is defined as the gain in total income resulting from either moving or staying (when appropriate), reduces the probability of staying in Canada. Thus, as the income gain from moving to the US increases relative to predicted income in Canada for a stayer this reduces the probability of the stayer staying in Canada. On the other hand, the greater is the income gain for a mover, the lower the probability of staying in Canada.

Table 3: Estimated Coefficients for the Logit Stayer Model 1990 and 1995-96*

VARIABLE NAME	ESTIMATED COEFFICIENT	ASYMPTOTIC T-RATIO
Constant	4.24	5.9
Gender (Male = 1; Otherwise = 0)	.32	4.0
Marital Status (Married =1; Otherwise = 0)	-2.01	-11.2
Time (1996=1; 1991=0)	-4.99	-2.2
Mobility (NonMover = 1; Otherwise = 0)	2.16	26.2
Age	-0.12	-3.5
Age*Time	0.22	2.0
Age^2	8.80E-04	2.4
Age^2*Time	-2.00E-03	2.2
Family Size	0.34	4.4
Family Size*Time	-0.23	-2.0
Marital Status*Family Size	0.29	3.5
Change in Total Income**	-2.60E-06	-2.2
Change in Total Income*Time	-6.20E-06	-1.6

*Non-permanent residents are excluded from the samples of N_{91} = 1339 and N_{96}=12109 stayers in Canada. Canadian born living in the United States sample sizes are N_{91} = 78 and N_{96}=898.

** This is calculated as follows:

Stayer: Change in Total Income = Total Income $_{Can}$ - Predicted Total Income $_{US}$

Mover: Change in Total Income = Total Income $_{US}$ - Predicted Total Income $_{Can}$

Sources: 1991 and 1996 Canadian Census, Public Use Microdata Individual File and 1995 Current Population 1990 Decennial Census Public Use Persons and Household Microdata and 1995 Current Population Survey, Person and Family Data Files, US Census Bureau.

Table 3 reports the results when we pool the pre- and post-NAFTA data sets to detect any structural break between the two periods 1990 and 1995-96. The intent here is to test for any period break by pooling the data (1990 and 1995/96) by including a dummy variable to detect a period effect. Note, caution must be taken in comparing the pooled model in Table 3 to the 1995/96 results in table 2 since the models are not strictly comparable.

The time variable (1996=1) is significantly negative (-4.49) confirming the hypothesis that the staying probability drops between 1990 and 1996. In addition, the effect of age on the probability of staying in Canada now becomes much more complex when we pool the period and interact age with time. In 1990 (time=0) the combined effect of age and age interacted on time is negative (-.12).[18] For 1996, the sign on age switches to the expected positive when we combine the age effect (-0.12) and age and time (.22) which yields a net positive value of (.10). In other words, aging in 1996 (as opposed to 1990) increases the probability of staying in Canada in the pooled results.

The negative impact on staying derived form the potential income gain when interacted with time illustrates the growing impact of this economic variable over the 1990s. For the pooled data set (1990 and 1995/96) the income effect is negative (-2.60E-06) and significant but when interacted with time triples in magnitude (-6.20E-06) for 1996. This latter coefficient reflects the extra negative impact of pre-tax income gains on staying in Canada in 1995/96 over the income effect for the entire period. Thus, in 1995/96 the combined effect of the interaction of time and income and the simple effect derived from the income gain is a cumulative (-8.80 E-06).[19]

Three key demographic variables – marital status, family size and marital status – when interacted with family size remain significant in the pooled regressions. However, the associated coefficients to these variables are either greatly diminished in magnitude or change sign. For example, in 1995/96 the family size coefficient was (1.7) while in the pooled period the family size coefficient had declined in size to .34. In addition, in the pooled model the interacted time on family size is (-.23). Thus, in the pooled model you can deduce

[18] Note that the interaction effect disappears in 1990 since t=0 in 1990 and the cross product equals zero.
[19] Since time equals zero in 1990 and one in 1995-96 this interpretation follows.

the net 1995/96 marital effect by netting the simple effect (.34) for the interacted effect (-.23) and the odds of staying effect from a family size change is now a minimal (-.11).

Moreover, two demographic variables, marital status and marital status interacted with family size switch signs in the pooled results relative to the base case. The state of marriage in the pooled period yields a negative sign (-2.01) for the log odds of staying over the entire period. The interaction term which captures the effect of being married with children switches sign from negative in 1995/96 to a theoretically more plausible positive (.29) over the whole period.

Simulations: 1995-96

Figure 2: "Effects of Gender, Marital Status and Mobility on Predicted Probabilities of Staying. . . by Age Category" (see page 25) portrays the age profile generated by our estimated logit results (1995/96) for staying in Canada when the probability of staying in Canada is a function of the sample means for total income and family size. In addition, we present alternative fitted functions based upon various household states; married, mobility history, etc.

The hypothesized convexity in age for the staying function is clearly portrayed in Figure 2 in 1996. For married males, the probability of staying rises from the .65 to .80 between the ages of 22 to 30. The staying probability peaks at .88 during the age interval of 42 to 53. In addition, the affect of the change in marital status and mobility experience is portrayed in Figure 2. First, previous mobility experience for married males and females reduces the probability of staying in Canada by 10 to 20 percent.[20] For example, married males aged 35 who have previously moved have a probability of staying in Canada of .85 while those aged 35 with no previous movement in Canada have a staying probability of approximately .92.

Most dramatically, the state of being non-married limits your risk of leaving throughout your life cycle. It should be noted that the non-married include separated, divorced with children as well as never married.

[20] Mobility is defined as an inter provincial movement in the past 5 years.

Gender did not obtain the hypothesized non-zero effect on the probability of staying in Canada. Married females with post-secondary degrees who had moved in the last five years had the lowest probability of staying in Canada.

The literature has strongly argued that the probability of staying in Canada is sensitive to the level of income given your age. Figure 3: "Effects of Gender, Marital Status and Mobility on Predicted Probabilities of Staying. . .in Total Income Category: 1995-1996" (see page 26) depicts the affect of income gain as defined by Gm (or Gs) on the probability of staying in Canada by gender, marital status and previous mobility experience in 1996.

Figure 3 clearly depicts two important phenomena. First, the probability of staying is insensitive to income gains over a wide range. However, when a critical income gain occurs, the turning point effect is substantial and the probability of staying in Canada collapses. Moreover, the probability of staying in Canada is invariant to income gain regardless of household status (married, male or female, mobile) until again a substantial gain ($46,000) in income arises from the prospect of moving to the United States. After that point however, the probability of staying in Canada diminishes rapidly for all household groups regardless of household status. In other words, the critical gain point, which leads to this collapse in staying, is invariant to household status.

Simulations: 1991-95/96

See Figure 4: "Effects of Mobility on Predicted Probabilities of Staying. . . by Change in Total Income Category: 1991 and 1996" (see page 27).

The pooled logit results allow simulations, which depict the structural break owing to the period effect of conditions in 1991 (pre-NAFTA) or post-NAFTA (1995/96). The probability of staying over the relevant income gain range is depicted in Figure 4, now under two status changes – previous mobility and year of movement. As in Figure 3, the probability of staying in Canada is invariant over a large income gain range (until $55,702 or more). However, the probability of staying for any potential income gain is 20 percent lower in 1996. For example, at $55,702 income gain the probability of staying in 1991 is .95 while in 1996 it is dropped to .62. In addition, previous interprovincial mobility in 1996 (but not in 1991) reduces the probability of staying now at a much lower income gain ($13,148).

Figure 5: "Effects of Mobility on Predicted Probabilities. . .by age Category" (see page 28) illustrates the differential impact of mobility status over the pre- and post-NAFTA periods on the probability of remaining in Canada. For households which have not previously moved in Canada there is little difference between the time periods in the probability of staying in Canada. In short, non-mobile Canadians have a near certainty of staying in Canada (.94 – .96) over their entire lifetime. However, households, which have moved internally, have a dramatically different experience. First, the 1991 results indicate a substantially higher probability of staying in Canada up to age 40. Next, the 1996 results for households with previous mobility conforms to our theory with a convex function in age for the probability of staying which is absent in 1991.

See Figure 6: "Family Size on Probability of Staying for Pooled Results" (page 29). Unlike the differential effect of age and income on the probability of staying in Canada between the two periods (1991 and 1996), little significant differences appear in the results when controlled for period or the household's previous mobility history. In either period the only discernable effect from family size occurs for a previously mobile household whose family size grows from 1 to 3. Under these conditions the presumed presence of a spouse and a child or at least a household size of three, increases the probability of staying in Canada from approximately one-half (for a one-person household) to 75 percent for a three-person household.

In sum, comparing our base case of 1996 to 1991 indicates a substantial diminution in the log odds of staying in Canada. In fact, the combined effects of previous mobility and living in the post NAFTA period reduces the log odds of staying in Canada from near certainty in 1991 to less than 60 percent in 1996.

V. Summary and Policy Conclusions:

This paper attempted to answer the question of under what conditions would highly educated Canadians remain in Canada given the large rewards and ease of movement to the United States. The calculated private rates of return from acquiring a subsidized Canadian post-secondary education were moderate (11-12%) and well within the range reported for other countries (U.S. and U.K.). In this sense the private return to a Canadian post-secondary

education appears to be in equilibrium for stayers. However, a strategy of acquiring a Canadian education and then moving to the United States yielded a return to previous Canadian leavers resident in the United States of 36 to 44 percent. Thus, a clear incentive exists to follow an opportunistic strategy of acquiring a heavily subsidized Canadian post-secondary education partially based upon the option value of migrating to the United States. For example, this strategic behaviour rationalizes the continued acquisition of nursing training by students in Canada in the 1990s as nursing vacancies disappeared but the Canadian nursing graduation rate remained high. This ultimately resulted in a substantial outflow of recent nursing graduates of greater than 40 percent (DeVoretz and Laryea 1998).

However, unlike nurses, most highly trained Canadians remained in Canada in the 1990s. This paper outlined a life-cycle model, which predicted staying patterns that are consistent with the thesis that changes in the life events in a household condition the movement for highly trained Canadians to the United States. The fact that the probability of staying is convex in age yields a concept of peak holding power. For example, for a male headed household aged 38 to 54 the probability of staying in Canada exceeded 90 percent for the highly trained. Thus, either the cost of moving increases with age or the benefits of staying in Canada rise or both. Since our simulated probability of staying over a lifetime was produced with income held constant (at the average), any additional pecuniary benefits that held Canadians in Canada had to accrue to the household in the form of public goods. However, given that our age interval for staying peaked when few monetized public benefits are actually accessed (38-54) precludes the Chrétien argument. In fact, DeVoretz and Ozsomer (1999) report that the use of publicly monetized goods is convex in age and reach a minimum during this interval.[21] Thus, costs of movement must rise in age to produce the staying power observed.

Two explicit costs were controlled for in our simulations to detect the size of these effects. First, the presence of extra household members and then the effect derived from a previous mobility experience within Canada were measured through a simulation analysis. While a previous mobility history does reduces the staying probability in Canada, the

[21] DeVoretz and Ozsomer (1999) document that publicly financed goods are consumed by the household as convex in age.

probability remains concave in age peaking at a lower interval over the same age distribution. This would suggest that some portion of fixed costs of movement (psychic) have been reduced for the household. In a similar manner, a change in marital status. i.e. married, reduces the cost of leaving in a uniform manner and suggests scale economies to movement.

The second major source of increased mobility cost (and possible mechanism for enjoying increased social benefits) is larger family size. The effect of this variable on the probability of staying is strictly increasing. Hence, moving from a household with two members to four raises the probability of staying by 20 percent from .67 to .87 for the represented household. Larger families raise the probability of staying to near certainty. In short, both the cost of movement and the access to one primary public good (schooling) increases in household size and accounts for this substantial impact on increasing the probability of staying owing to increased family size.

Finally, the opportunity cost of staying in Canada in the form of the foregone gain in income from moving to the United States has a very powerful if much delayed effect on the probability of staying in Canada. Most Canadian households with highly trained heads do not reduce their probability of staying in Canada until the pre-tax income gain (in Canadian dollars) becomes very large ($135,000). However, when this gain equals this critical value, the probability of staying in Canada collapses. This critical gain measure in turn provides us with an approximation of the reservation price for staying in Canada. In short, highly skilled Canadians do pay a substantial opportunity cost to enjoy Canadian amenities.

This is a substantial finding of a large critical reservation income gain before moving which suggests that several conditions must be in place to induce a move for a highly trained Canadian to recoup this gain. The potential mover first must be young, have a low discount rate, and expect an immediate and rapid gain in earnings. This, in fact, is the profile of knowledge workers who receive payments in the form of stock options, physicians entering their specialties and star academics. Hence, the model appears to be consistent with the stylized facts.

The policy implications for reducing the probability of a move are in two general directions. First, any income tax rebate to curtail leaving must be strategic in nature to be effective. It would have to apply to young, low-income earners who are about to enter the

high-income phase. This suggests a less steep and delayed (higher income) marginal tax rate policy for professionals. Also, income in kind (stock options) which have a potential large gain in value in the future should be taxed less heavily or at least until the gains are realized via disposition of the assets.

Moreover, an age-specific policy strategy to retain the skilled in Canada which focuses on the young (up to age 40) is crucial since once the highly skilled stay to age 40 they continue to remain in Canada. Thus, internships and more aggressive wage bidding at the entry level (age 25-38) may hold the highly skilled until the aging process raises the probability of staying. However, the results in this paper further indicate the futility of most income-based policy measures to stem the outflow once a critical income gain is reached.

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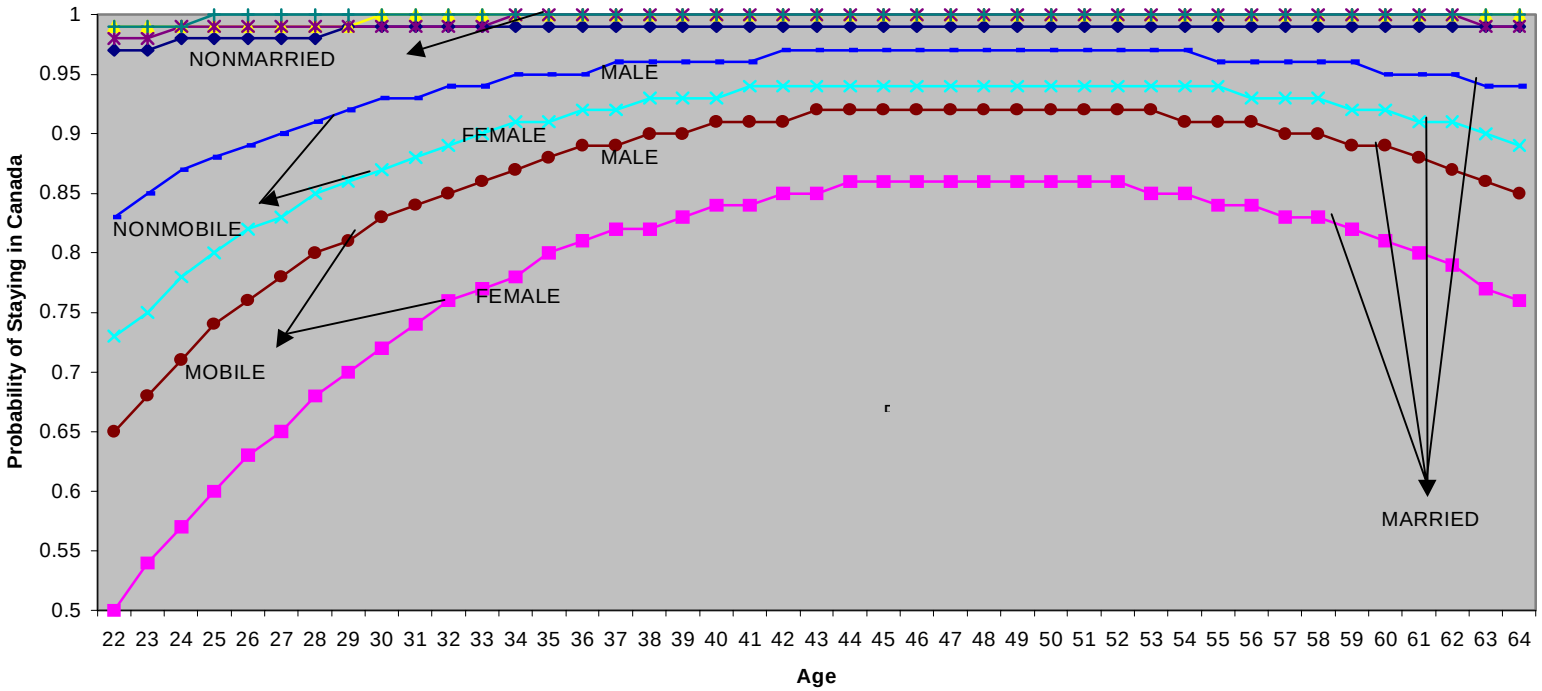
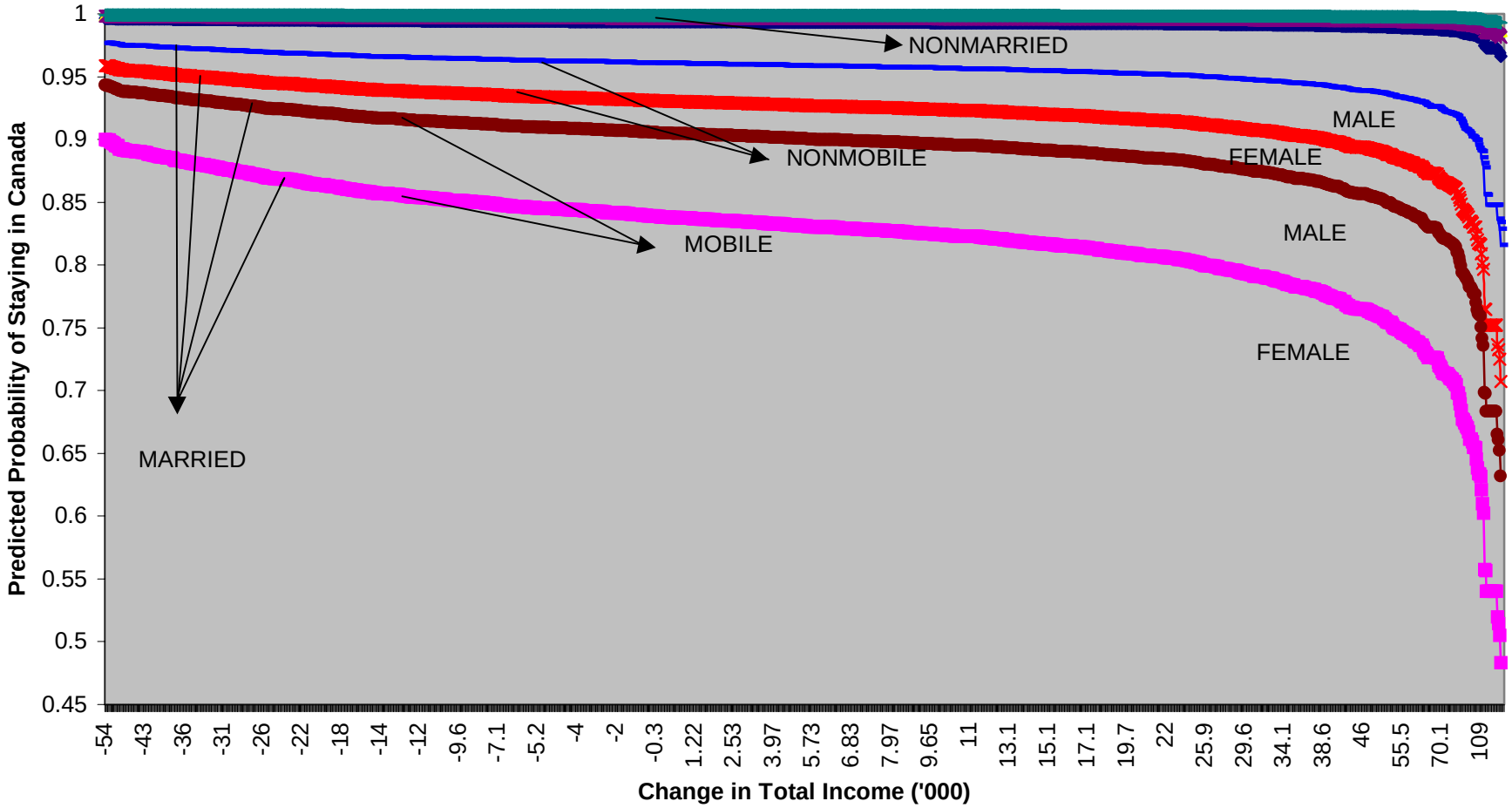
FIGURE 2: Effects of Gender, Marital Status and Mobility on Predicted Probabilities of Staying in Canada of Labour Force Members by Age Category: 1995-1996*



* These are the probabilities as a function of age at the sample means of total income and family.

SOURCES: 1996 Canadian Census , Public Use Microdata Individual Files and 1995 Current Population Survey, Person and Family Data Files, US Census Bureau.

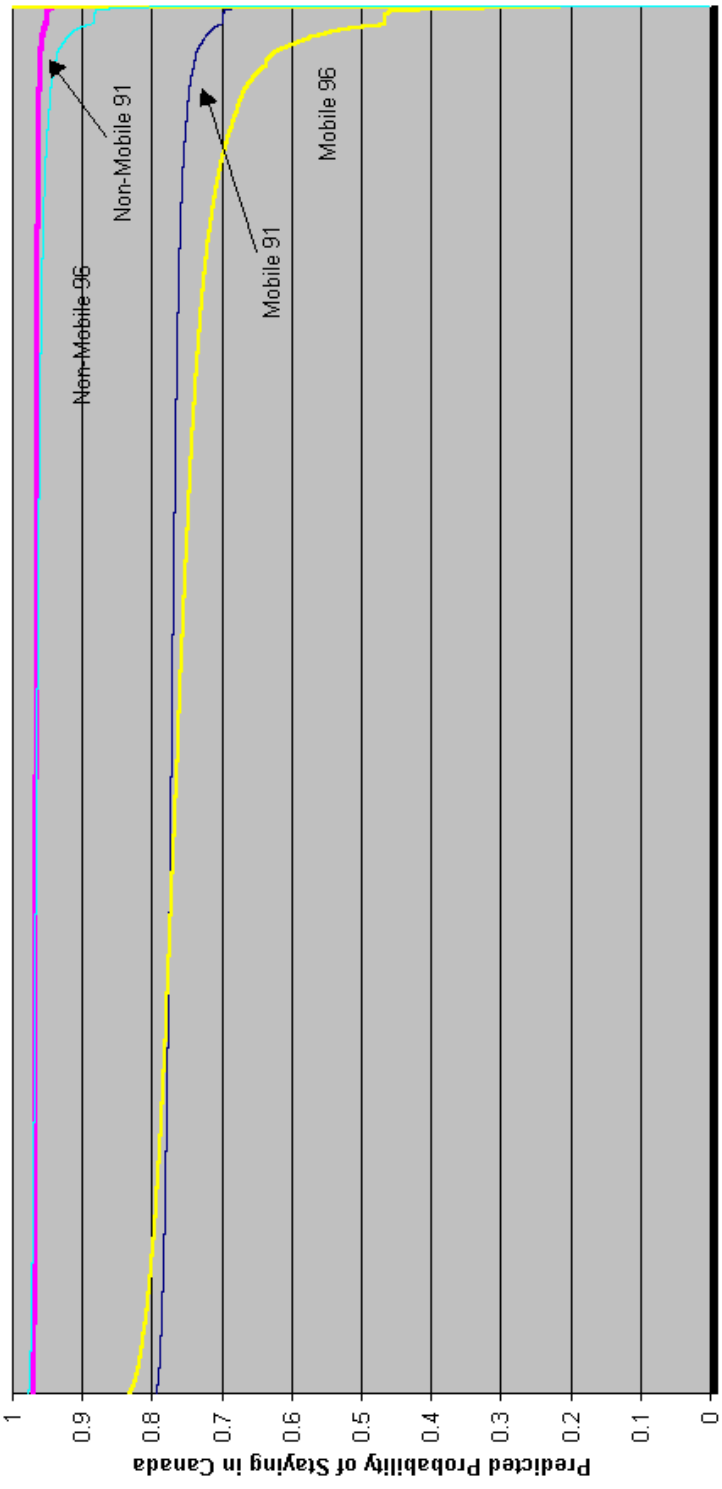
FIGURE 3: Effects of Gender, Marital Status and Mobility on Predicted Probabilities of Staying in Canada of Labour Force Members by Change in Total Income Category: 1995-1996*



*These are probabilities as a function of change in total income at the sample means of age and family size.

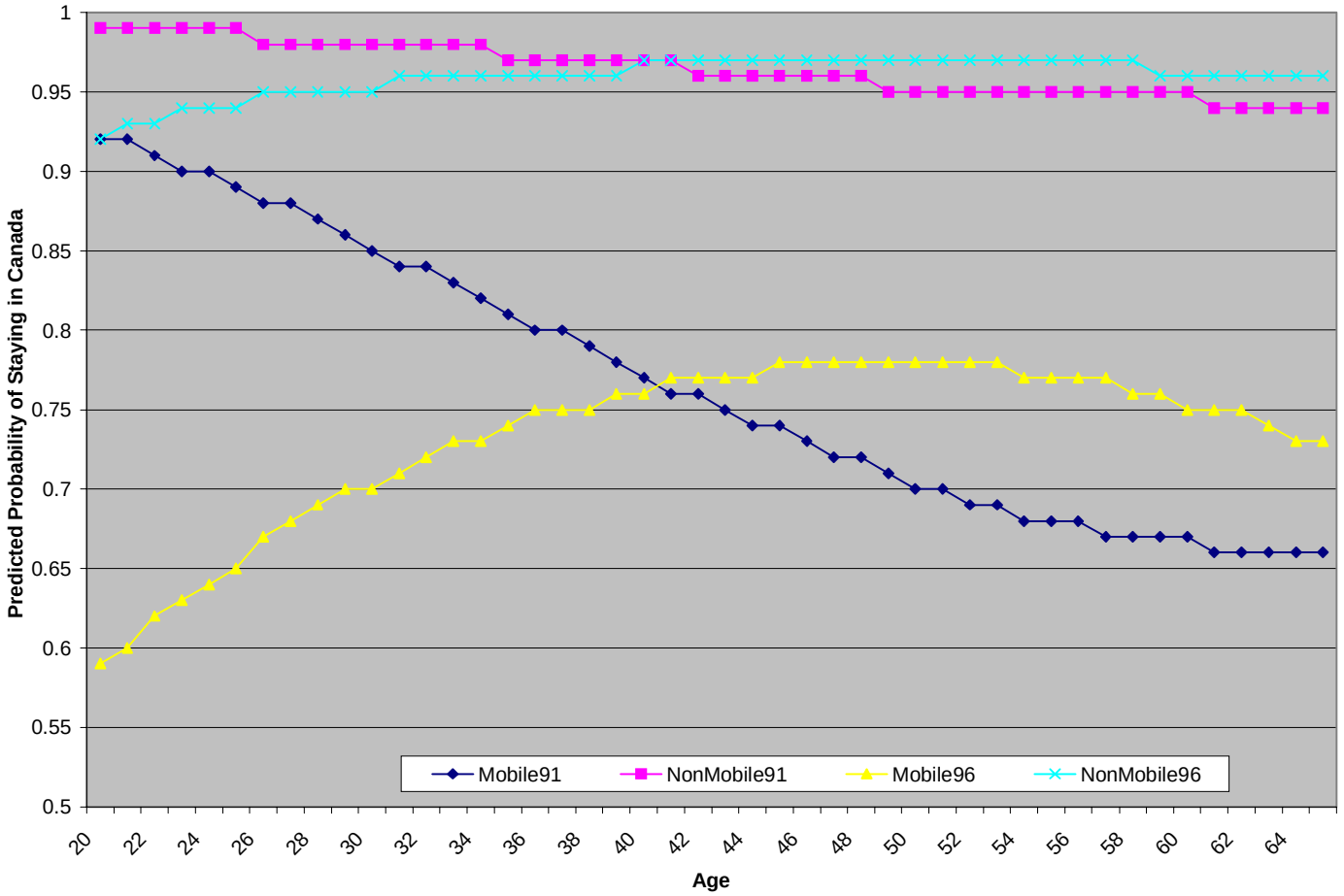
SOURCES: 1996 Canadian Census, Public Use Microdata Individual File and 1995 Current Population Survey, Person and Family Data Files, US Census Bureau.

FIGURE 4: EFFECTS OF MOBILITY ON PREDICTED PROBABILITIES OF STAYING IN CANADA OF MARRIED MALE LABOUR FORCE MEMBERS BY CHANGE IN TOTAL INCOME CATEGORY: 1991 AND 1996*



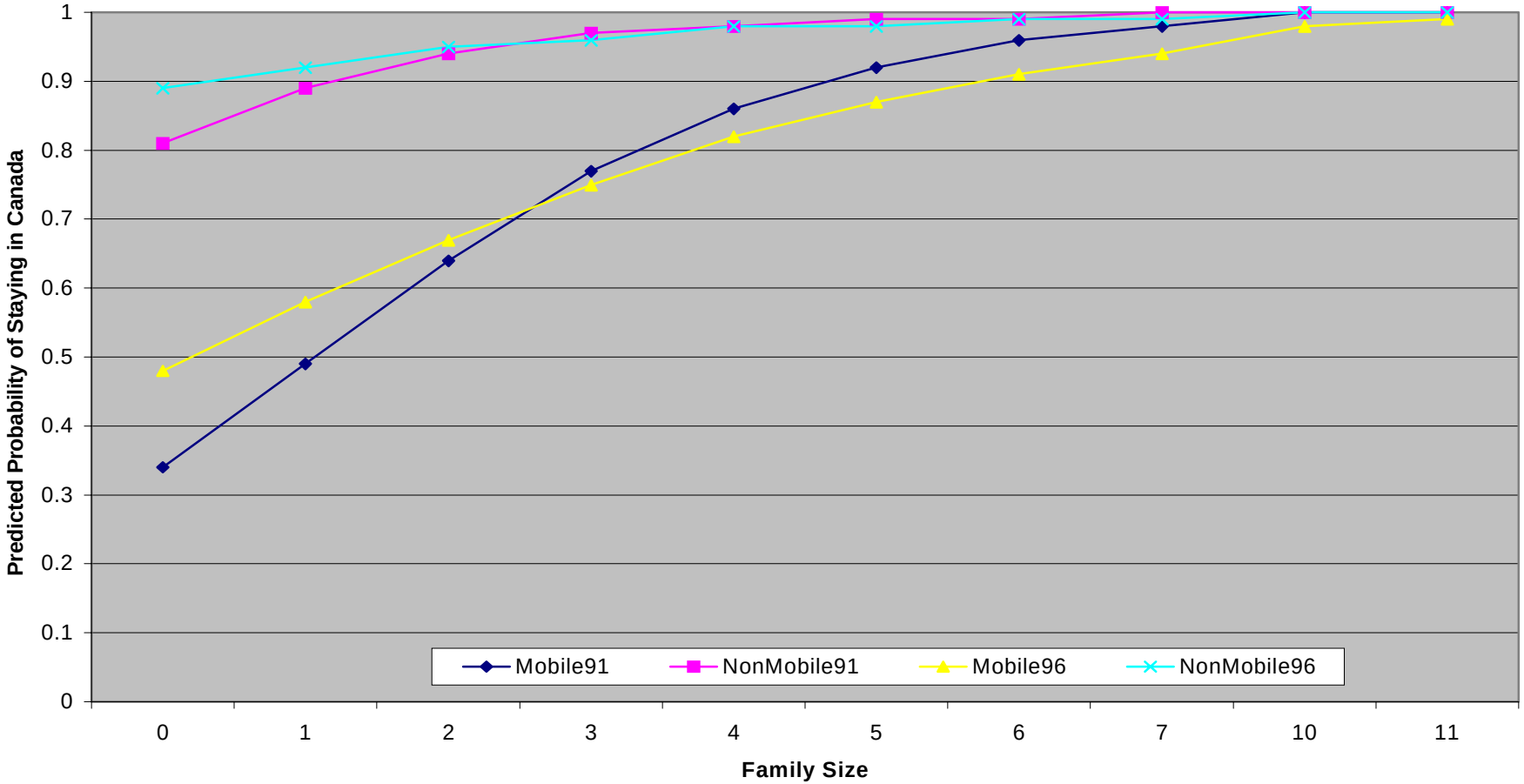
* These are the probabilities as a function of change in total income at the sample means of family size and age.
Sources: 1991 and 1996 Canadian Census, Public Use Microdata Individual File , 1990 Decennial Public Use Persons and Household and 1995 Current Population Survey, Person and Family Data Files, US Census Bureau.

Figure 5: EFFECTS OF MOBILITY ON PREDICTED PROBABILITIES OF STAYING IN CANADA OF MARRIED MALE LABOUR FORCE MEMBERS BY AGE CATEGORY: 1991 and 1996*



* These are the probabilities as a function of age at the sample means of family size and change in total income.
Sources: 1991 and 1996 Canadian Census, Public Use Microdata Individual File , 1990 Decennial Public Use Persons and Household and 1995 Current Population Survey, Person and Family Data Files, US Census Bureau.

Fig. 6 Family Size on Probability of Staying for Pooled Results



* These are the probabilities as a function of family size at the sample means of change in total income and age.

Sources: 1991 and 1996 Canadian Census, Public Use Microdata Individual File , 1990 Decennial Public Use Persons and Household and 1995 Current Population Survey, Person and Family Data Files, US Census Bureau.