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Analysis of the Performance of Immigrant Wages Using Panel Data

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1. Introduction

The economic integration of immigrants–that is, the economic performance of the foreign born relative to the native born–has been studied widely. Most studies have used either one or a series of cross sections, principally census microdata. While such studies are useful, they suffer from important biases arising from data limitations and from unobserved influences on economic performance. In this paper we use a recently released panel data set of Canadian households, the Survey of Labour and Income Dynamics, to investigate biases resulting from conventional estimates on cross-sectional data and those resulting from limitations in the measurement of work experience. We assess the credibility of estimates of immigrant economic integration from panel data using random-effect, fixed-effect and instrumental variable estimates.

Section 2 outlines the basic model of immigrant integration and reviews past contributions for a variety of countries, which principally used one or a series of cross-sectional data sets. We emphasize the idea that immigration represents an interruption to labour market activity and earning capacity, and develop the implications of this concept for econometric analysis of immigrant integration, particularly the bias that may arise from commonly used measures of work experience. Section 3 outlines our econometric approach to the estimation of immigrant integration, a fixed effect, using panel data. Section 4 describes the Survey of Labour and Income Dynamics and its particular value for evaluating immigrant economic performance. Section 5 presents our main empirical results for a variety of common estimators, and assesses the adequacy of these estimators for pooled and separate samples of immigrants and the native born. Section 6 uses available information on parental background to estimate immigrant integration beyond the first generation. Section 7 presents some conclusions.

2. The Basic Problem

The central issue concerning the economic integration of immigrants is the question: What is the mean difference in the performance of otherwise identical individuals who differ only in terms of their immigrant status? Immigrant status refers to whether or not an individual is an immigrant and, for immigrants, how long that individual has lived in the host country. Borjas' (1994, 1671) authoritative review of the research on immigrant integration sets out the basic model for cross-sectional data in the following form:

$$y_i = X_i b + g(h_i) I_i + e_i \qquad [1]$$

where y_i is a measure of economic performance, typically earnings; $\gamma(h_i)$ is a typically nonlinear (quadratic) immigrant status function representing the profile of integration with years since migration h_i; I_i is a dummy indicator whether individual i is an immigrant (I_i=1) or native born(I_i=0); $X_i\beta$ is a linear-in-parameters function representing the expected earnings of native born worker i with human capital and other observable characteristics X_i; and ϵ_i captures unobservable factors. Thus, $\gamma(0)$ is the difference in the performance of immigrants relative to the native born (e.g. a market wage differential) upon arrival in the host country, usually referred to as the "entry effect." Similarly, $\partial\gamma/\partial h_i$ is the rate at which immigrant performance improves relative to the native born. Early results by Chiswick (1978) and Carliner (1980) report the following: (i) $\gamma(0)<0$, implying that immigrants have an initial disadvantage upon arrival (a negative entry effect) and (ii) $\partial\gamma/\partial h_i>0$, implying that immigrants overcome this disadvantage with time in the host country (a positive, and possibly nonlinear, assimilation effect if $\partial^2\gamma/\partial^2 h_i<0$). Chiswick's (1978) initial estimate of the entry effect for men in the U.S. was 16.4% with an assimilation effect initially of 1.5%, implying that immigrants catch up to their native counterparts after 13 years. As Appendix 1 indicates, subsequent studies have confirmed these basic results for the United States, Canada, Australia, Israel and the United Kingdom, using primarily census microdata. Actual estimates of the entry and assimilation effects have varied quite widely, however.

2.1 Immigration and Interruption of Work

A useful way to view equation (1) is in terms of the "interrupted work career." Mincer and Ofek (1982) use this concept to analyze the labour market recovery of married women whose work career is interrupted, and to measure the rate at which previously acquired human capital is restored or repaired upon return to employment. They note (p.18), however, that the model can apply to other work interruptions, including international migration whereby human capital is incompletely transferred across borders, or depreciates in market value as a result of relocation. If so, immigrants will experience a significant work interruption involving substantial labour market inactivity as they resettle in a new country and locate suitable employment. Immigrants may require retraining, or may need to wait for recognition of their credentials by the host country. They may also require time to develop an understanding of labour market processes in their new environment in order to restore lost market value.

Using the notation of equation [1], native born workers (I=0) have earnings given by

$$y_i^0 = X_i b + e_i \qquad [1a]$$

while foreign born workers (I=1) have earnings given by

$$y_i^1 = y_i^0 + g\,(h_i) \qquad [1b]$$

and γ(·) is the immigrant status function defined above, which captures the extent of depreciation of human capital due to migration–the entry effect γ(0)<0–and the subsequent rate of restoration with time h in the host country. Mincer and Ofek argue that the rate of depreciation and the speed of restoration will depend upon the "distance" of immigrants' origin from the host country; in the case of the U.S., immigrants from other English-speaking countries and developed countries would experience a smaller entry effect and/or a more rapid assimilation effect than immigrants from less developed countries, as is commonly found (Beggs and Chapman, 1988; Duleep and Regets, 1992; Kossoudji, 1988; McManus, Gould and Welch, 1983).

Most studies of immigrant integration have relied upon a measure of potential experience (age minus schooling minus 5 years) to explain labour market performance. It is widely acknowledged that this measure presents problems when work careers are interrupted, as is commonly the case for married women. The impact on the comparison of immigrant and native born earnings, even in those studies restricted to men, has been neither recognized nor appreciated, however. Since our data source, the Survey of Labour and Income Dynamics (SLID), measures actual accumulated work experience in full-time equivalent years, we are able to assess the effect of using potential experience rather than actual experience. To motivate our discussion, we note here that the simple correlation between actual experience and potential experience is weaker for immigrant men than for native born men, just as the correlation is much weaker for women than for men. In the two combined panels of SLID, the correlation for immigrant men is 82.2% compared to 90.1% for native born men because of the interruption of the work career arising from immigration.[1]

Suppose that earnings depend only on work experience, *x*, and that potential experience, *p*, differs from actual experience by the amount of labour market inactivity, *n*, so that we can write native born and immigrant earnings as

[1] The correlation between potential and actual experience is 89.4% for all men in SLID compared to 49.7% for all women. For women, there is also a weaker correlation between actual and potential experience for immigrants (39.0%) than those native born (50.7%), indicating an interruption of work history for foreign-born women as well.

$$y_i^0 = p_i b + [e_i - n_i b] \qquad [1a']$$
$$y_i^1 = p_i b + g(h_i) + [e_i - n_i b] \qquad [1b']$$
$$p_i = x_i + n_i$$

The measurement error arising from the use of *p* rather than *x* produces an estimate of the return to experience, β, which will be biased in equations [1a’] and [1b’] if *p* is correlated with *n*.[2] In equation [1b’], which is of particular interest, there may also be a correlation between immigrant status, γ*(h)*, and *n* to bias estimates of the effect of immigrant status on earnings as well.[3]

2.2 Other Sources of Bias

Chiswick’s estimates of the entry and assimilation effects for immigrants was challenged by Borjas (1985), who argued that changes in the productivity of migrant cohorts over time may account for the observed patterns by which immigrants eventually overtake the native born in terms of earnings. Since cohort of arrival is perfectly correlated with years in the host country for any cross-section, declining productivity of successive cohorts of migrants would bias upward estimates of the assimilation effect. Using a series of cross-sections, Borjas and others report a cohort effect that declines over time for the U.S. and which substantially attenuates the assimilation effect. Borjas admits that these estimates remain controversial (Borjas, 1994, 1675). For example, Borjas’ results for recent immigrant cohorts to the U.S. and Canada suggest very slow, if not negligible, assimilation. He finds an overall entry effect of 23% for the 1975-80 cohort for the U.S. with an assimilation rate of 0.5%, and an entry effect of 18% for Canada with no significant evidence of assimilation (Borjas, 1993b). For the 1985-89 U.S. cohort, Borjas (1996) estimates a comparable entry effect of 19% but no assimilation effect. Other studies, however, quite often conclude that immigrants assimilate within 20 years for the U.S. (Butcher, 1994; Duleep and Regets, 1997a and 1997b; Field, Hendrey and Balkan, 1991; Funkhauser and

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[2] The extent and direction of any bias is not immediately clear since, unlike the usual attenuation bias from errors in variables, the errors are uniformly positive, i.e. $n_i \geq 0$ for all *i*.

[3] Additional bias may arise because we do not observe the division between foreign experience and experience in the host country, and foreign experience may be less valuable in the host country. Given the unpredictable interruption caused by immigration, it would appear futile to attempt to impute this breakdown from knowledge of total experience and potential experience (i.e. age and schooling).

Trejo, 1995; Kalmijn, 1996; Kossoudji, 1988; LaLonde and Topel, 1991 and 1992; Long, 1980; Yuengert, 1994) and for Canada (Abbott and Beach, 1993; Baker and Benjamin, 1997; Grant, 1999; Hum and Simpson, 1999; Meng, 1987). Thus, no clear consensus has emerged.

Insofar as cohort effects represent a combination of shifts in the national origin and selection criteria for migrants, some of the differences may be captured by observable characteristics of immigrants, which act as control variables in equations like [1]. Since these differences among successive cohorts can be controlled, however, they cannot account for the remaining cohort differences found by Borjas and others. The obvious explanation (other than discrimination) is that the inclusion of cohort effects partially captures otherwise unobserved differences among immigrants that bias the estimates of assimilation effects. Since the literature is dominated by variants of equation [1]–typically etimated using one or a series of cross-sections of data–we need to assess whether this bias is important and develop consistent estimates of the entry and assimilation effects. To do this, we turn to panel data. In addition, we compare the results obtained when using potential rather than actual work experience to estimate immigrant integration in our panel.

3. The Econometric Model and Approach

Let *y* be a measure of economic performance for foreign-and native-born individuals, typically the wage rate which captures the market price of labour. Using conventional notation, distinguish between the determinants of *y* on the bases of observability and variability over time. Let X be the set of observables which potentially vary through time, such human capital, labour market attachment, family status, residential location, and health. Let Z be the set of fixed person-specific observables, including in particular the immigration status function $\gamma(h_i)I_i$ for individual *i*. Also included among the observed elements of Z' are foreign human capital and linguistic background acquired prior to arrival. Let α be a set of person-specific unobservables, such as motivation and ability, which are presumed to be fixed in the short run, and let η be random error. We can rewrite [1] in the standard formulation of an econometric model for panel data of the form:

$$\begin{aligned} y_{it} &= X_{it}\beta + [\gamma(h_i)I_i + Z_i'\gamma'] + \xi_{it}, \\ &= X_{it}\beta + Z_i\gamma + \alpha_i + \eta_{it}, \quad i = 1,\dots,N; t = 1,\dots,T \quad [2] \end{aligned}$$

for N agents over T panels where problems arise if $E[\alpha_i \mid X_{it}, Z_i] \neq 0$; i.e., where fixed unobservable factors are correlated with observable regressors. This would appear extremely likely *a priori* for the variety of reasons provided in the literature, as discussed briefly in section 2.

Given cross-sectional data (t=1), researchers can estimate the gap between foreign-born and native-born earnings or wages but will be unable to test the hypothesis that $E[\alpha_i \mid X_{it}, Z_i]=0$. This corresponds to the between groups estimator b_B of OLS estimates on

$$\overline{y_i} = \overline{X_i}\mathbf{b} + Z_i g + \mathbf{a}_i + \overline{\mathbf{h}_i}, \quad where\ \overline{y_i} = \sum_{t=1}^{T} \frac{y_{it}}{T}, etc., \ or$$

$$P_V y_{it} = P_V X_{it}\mathbf{b} + P_V Z_i g + P_V \mathbf{a}_i + P_V \mathbf{h}_{it}, \quad where\ P_V = I_N \otimes \frac{\mathbf{i}_T \mathbf{i}_T'}{T} \quad [3]$$

(Hausman and Taylor, 1981). With panel data, however, we can estimate the within groups or fixed effects estimator b_W by running OLS on

$$y^*_{it} = X^*_{it}\mathbf{b} + \mathbf{h}^*_{it}, \quad where\ y^*_{it} = y_{it} - \overline{y_i}, \ or$$

$$Q_V y_{it} = Q_V X_{it}\mathbf{b} + Q_V \mathbf{h}_{it}, \quad where\ Q_V = I_{NT} - P_V \quad [4]$$

and the random effects estimator b_R by running GLS on equation [1]. The random effects estimator will be efficient only if $E[\alpha_i \mid X_{it}, Z_i]=0$, which can now be tested using the estimated coefficients and variance-covariance matrices from the random effects and within regressions (Hausman and Taylor, 1981, 1382).

If the random effects estimator is rejected, then only the fixed effects estimator is consistent. But the within estimator will not yield estimates of immigrant integration because immigration status is a fixed effect; i.e., $Q_V Z_i = Z_i^* = 0$ in equation [4]. In order to obtain estimates of both β and γ in equation [1], we would need to use instrumental variables estimation. Suppose, therefore, that $X=[X_1 \ \ X_2]$ and $Z=[Z_1 \ \ Z_2]$, where $E[\alpha | X_2, Z_2] \neq 0$ but $E[\alpha | X_1, Z_1]=0$. Hausman and Taylor (1981; hereafter HT) recommend using two-stage least squares estimates in which the instruments are derived from first stage regressions of the form $X_2 = W\pi_1 + v_1$ and $Z_2 = W\pi_2 + v_2$ where $W=[Q_V X_1 \ \ Q_V X_2 \ \ P_V X_1 \ \ Z_1]$; i.e., using the within regressors for X and the between regressor for X_1 and Z_1 as instruments. Amemiya and MaCurdy (1986; hereafter AM) and Breusch, Mizon and Schmidt (1987; hereafter BMS) extend this instrument list. Specifically, Amemiya and MaCurdy suggest $W=[Q_V X_1 \ \ Q_V X_2 \ \ X_1^* \ \ Z_1]$, which replaces $P_V X_1$ with all panel observations X_1^* for X_1, and Breusch, Mizon and Schmidt suggest $W=[Q_V X_1 \ \ Q_V X_2 \ \ X_1^* \ \ Q_V X_2^*$

$Z_1]$, which adds all mean differences $Q_V X_2^*$ for X_2. The legitimacy of the instrumental variable set can be tested by comparing the IV estimates and the fixed effects estimates using Hausman's (1978) test. Cornwell and Rupert (1988) find substantial efficiency gains when using the extended instrument lists proposed by AM and BMS. Baltagi and Khanti-Akom (1990), however, question these efficiency gains and argue that some of the instruments proposed by BMS may be inappropriate.

Our approach, then, is to begin with a series of basic regressions to explore the immigrant status funcion $\gamma(h_i)I_i$. We then examine the impact of observable control variables which are fixed in time (Z_i) and which vary through time (X_{it}), and we assess the bias associated with unobservable fixed effects on our estimates. We conclude with instrumental variable estimates of the effect of immigrants on labour market performance of the sort proposed by HT, AM and BMS and evaluate these estimates.

4. Data

The Survey of Labour and Income Dynamics (SLID) is a continuing panel survey of Canadian households begun in 1993. It combines the former Labour Force Activity Survey, an intermittent series of panel surveys conducted during the 1980s, with the Survey of Consumer Finance, a regular cross-sectional survey conducted annually. The SLID design is a series of overlapping 6-year panels, with a new panel enrolled every three years. Statistics Canada has released a file containing the initial six-year panel of annual interviews for the period 1993-1998 and the first three years of the second panel of interviews for 1996-98.[4] This internal SLID file provides a rich set of detailed demographic and labour market activity information and, in particular, details on immigrant arrival not available on earlier public data releases. This information is clearly crucial to our study.

The SLID consists of twice-yearly interviews, one conducted in January to collect the labour force activity data and the other conducted in May to collect the consumer finance data. The labour force activity data is particularly rich, including detailed information on wages and salaries, hours of work and pay structures to allow determination of composite hourly wage rates, which is our preferred measure of labour market performance. SLID also contains retrospective

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[4] Access to the internal file is provided only at specified Statistics Canada sites and analysis is limited to procedures which ensure the confidentiality of individual respondents according to criteria established by Statistics Canada.

information on past accumulated work experience which is not available in other Canadian data sources, such as the Census. Consequently, SLID allows us to assess the effect of using potential work experience (age minus time spent in school) as a proxy for actual work experience, a common practice in studies of immigrant assimilation.

In this study we restrict our analysis to native-born and foreign-born men, in part because many other studies only report results for men. The first "one and one-half" panels of SLID provide a data set of 42,684 men, including 3,889 immigrants, divided between Panel 1 (1993-98) and Panel 2 (1996-98) as shown in Figure 1. A large panel is necessarily an important starting point for a study of this nature because of the relatively small proportion of immigrants,[5] and the unavoidable loss of numerous sample points due primarily to labour market inactivity during the period of the panel. Since our preliminary results suggest that combining the panels would be inappropriate, however, we conduct separate analyses of the two panels. We retain the second, shorter panel because it contains information on immigrant background, particularly information on the immigrant status of the father and mother. In section 6 we use this new information to distinguish second generation Canadians and to evaluate assimilation patterns between first generation and second generations Canadians with respect to other Canadians who are native born.

5. Results

Table 1 provides basic random effects estimates of immigrant integration using the two panels separately and pooled. The estimates of the entry and assimilation effects for immigrants are significant individually and as a group with p-values below 0.005. The results for the first, longer panel imply that immigrants receive a wage that is 40% lower upon entry,[6] but this disadvantage is eliminated within 14 years. This is illustrated in Figure 2, which plots the dependent variable, the logarithm of the wage rate, against years since migration (ysm). The concave pattern of assimilation, implying that the rate of recovery declines with years in the host

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[5] The SLID tends to undersample from the larger population centres at both the municipal and regional level, leading to an undersampling of immigrants who tend to be overrepresented in the larger cities (e.g. Toronto and Vancouver) and larger provinces (Ontario and B.C.).

[6] In a semilogarithmic regression of the form $ln\ y = \beta x + \epsilon$, where x is a dummy variable, the effect of x on y is approximated by $e^{\beta} - 1$ (Halvorsen and Palmqvist, 1980).

country, is supported by the significance of the quadratic term for ysm and the insignificance of the cubic and higher order terms in these and subsequent regressions. Note, however, that the results imply that immigrant wages overtake native born wages and continue to grow, albeit slowly, relative to the native born, conferring a wage advantage beyond 14 years in the host country. These results are consistent with much of the literature discussed above. The results for the second panel are similar. Although the results imply a smaller entry effect and slower assimilation, parity with native born wages is again achieved within about 14 years, as shown in Figure 2. When the two panels are pooled, however, the dummy variable for the first panel is significant and a test for equality of the coefficients in the two regressions is rejected ($\chi^2[4]=50.09$; $p=0.00$). This is not surprising, since the first panel spans an additional earlier period (1993-95).[7] We therefore report separate results for each panel in the remainder of this section.

These simple comparisons of wages ignore other important factors, particularly variables such as years of schooling, work experience, and weeks worked. These components of the human capital model are used in most studies of wages and earnings. Another important consideration is ability to speak one of Canada's official languages (English or French), since language is an important factor in the assimilation experience of immigrants.[8] Since these characteristics are likely to be correlated with immigrant status–immigrants have more schooling, more experience (both actual and potential), and are less likely to list English or French as their mother tongue in the SLID panels–we present random effects and fixed effects estimates of immigrant integration which include these control variables in Table 2a for the first panel and Table 2b for the second panel. We discuss the random effects estimates first and then compare them to the fixed effects estimates.

The effect of including these control variables is to reduce the random effects estimates of the entry and assimilation effects compared with Table 1. For the first panel in Table 2a, the entry

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[7] One way to combine the panels would be to include dummy variables to represent time-specific effects. However, this would potentially confound the effect of years since migration, a time-specific variable for immigrants, which is an important component of the immigrant integration effect under study.

[8] We also include control variables for residence in Canada's regions and community size, but we do not report these results. Standard patterns of generally declining wages from East to West across Canada and lower wages for those living in smaller communities are observed throughout our analysis. These results are available from the authors upon request.

effect is 22% when actual experience is used and 28% when actual experience is replaced by potential experience. The estimated assimilation effects are also smaller than reported in Table 1, but they still imply that immigrants will achieve wage parity within 18-20 years. For the second panel in Table 2b, the entry effects are once again smaller, particularly when actual experience is used. The estimated entry effect is only 8% using actual experience compared to 20% using potential experience. Wage parity is estimated to occur within 14-16 years in each case, although the estimates of the assimilation effect are only marginally significant at the 5% level when actual experience is used.

The results for the control variables correspond to the literature. In particular, the implied return to one year of schooling is 4-6% and statistically significant, as has been found in other recent studies using panel data for the U.S. (Altonji and Dunn, 1996; Eckstein and Wolpin, 1995; Keane and Wolpin, 1997; Light and McGarry, 1998)) and the U.K. (Blundell, Dearden and Reed, 2000). We specify the second-order polynomial form for work experience commonly employed in the literature, and our estimates of initial returns to experience of 4-5% are also consistent with recent U.S. results from the National Longitudinal Survey of Youth (Light, 2001; Light and McGarry, 1998) and the Panel Study of Income Dynamics (O'Neill and Polachek, 1993). The results also suggest visible minority workers earn 6-14% less; the result is smallest and least significant ($p=0.07$) for the first panel with actual experience. In earlier results using the first (1993) cross-section of SLID, we found that the interaction between visible minority status and immigration was significant for men (Hum and Simpson, 1999), but this result receives very limited support in the panel data. At the 5% level of significance, the term is only significant for the first panel using potential experience. The language variables are insignificant, which may not be surprising since they capture only mother tongue and not some more appropriate measure of language proficiency. All regressions reported in this paper are statistically significant at $p<0.005$.

Although these random effects estimates correspond with general patterns reported in the literature, there are problems. The random effects model resoundingly rejects the hypothesis that there is no unobserved variation across respondents. The estimated variance of the unobserved person-specific effect σ_α^2 is in the range of 0.33-0.35 for the two panels and statistically significant. Applying the Hausman test of the random effects estimates against the fixed-effects estimates, we find that they are significantly different. Under the hypothesis that the fixed-effects estimator controls for unobserved person-specific influences and is consistent, this test rejects the random effects estimates for each panel for both actual and potential experience.

Once the random effects estimates are rejected, we can only obtain estimates of immigrant integration by using instrumental variables estimates of the sort recommended by HT, AM and BMS. We specify the human capital variables–schooling, experience, language, and weeks worked–to be potentially endogenous in our model and the remaining variables–immigrant status, years since migration, visible minority status, region of residence and community size–to be exogenous. Table 3a presents instrumental variable estimates for the first panel for both actual and potential experience; Table 3b presents the same estimates for the second panel. We first discuss how we assess the IV estimators before turning to the actual estimates.

Bound, Jaeger and Baker (1998) show that the potential bias of IV estimates is related to the degree of partial correlation of the instrumented variables with the identifying instruments (i.e., the correlation of schooling, experience, weeks worked and language with the HT, AM and BMS sets of instrumental variables). In the second last row of Tables 3a and 3b we report mean R^2 values for the identifying instruments in the first-stage estimation. The potential superiority of the AM and BMS IV estimators is indicated by the higher degree of correlation of the instruments with the instrumented variables. The AM estimator provides only a modest improvement over the HT estimator in this respect, but the BMS estimator dramatically improves the mean R^2 for the identifying instruments, primarily through the improved prediction of experience. This suggests a substantial reduction in bias from the use of the BMS estimator, provided that the additional instruments are uncorrelated with the person-specific error α_i in equation [2] . Looking at the bottom row of Table 3a, however, we see that the Hausman test accepts the HT estimates for actual experience but rejects the AM and BMS estimates. In Table 3b, on the other hand, the Hausman test accepts the legitimacy of the HT and AM estimators but again rejects the BMS estimator. This suggests that the additional instruments used by the BMS IV estimator are not legitimate for this problem. We therefore focus on the HT estimator for the first panel and the AM estimator for the second panel in our discussion of the results.

The HT estimates for the first panel imply large entry effects–65% using actual experience and 73% using potential experience–and no assimilation effect. The coefficient estimates for γ_1 and γ_2 are the wrong sign and statistically insignificant ($p>0.4$). Most other coefficient estimates conform to expectations with the exception of the large negative estimates for language. In contrast, the AM and BMS estimates, which fail the Hausman test, indicate more plausible entry effects, somewhat smaller than the random effects estimates in Table 2a and statistically insignificant. The assimilation effects continue to be insignificant and of the wrong sign, while the estimated effects of language are smaller and generally insignificant. In short, the HT estimates pass the Hausman test of legitimacy but seem implausible, while the AM and BMS estimates fail the Hausman test but are intuitively more plausible.

The results for the second panel are more consistent across estimators. For the AM estimator, which passes the Hausman test, the estimated entry effect using actual experience is small, 4.3%, and statistically insignificant. The estimated assimilation effect has the correct sign, but is statistically insignificant. Using potential experience, the estimated entry effect is larger, 33%, as it has been for each estimator in comparison with estimates using actual experience. The assimilation effect is significant but implies very slow assimilation–immigrants remain 15% below the native born after 20 years in Canada.

Table 4 presents additional random effects, fixed effects and IV estimates of the log wage equations for the immigrant and native born samples separately, using actual experience along with the same control variables as in Tables 2 and 3. That is, we relax the constraint of common effects for immigrants and the native born for each control variable as have a number of earlier studies (Beggs and Chapman, 1988; Borjas, 1985; Chiswick, 1978; Hum and Simpson, 1999, 2000; LaLonde and Topel, 1991, 1992; Miller, 1992). Table 4a presents the results for the first panel. Using the Hausman test to compare the the random-effect and IV estimates with those from the fixed-effect estimator leads us to reject the random-effect estimates quite convincingly as before. For the IV estimates we prefer the BMS to the AM to the HT estimates, but only if they are not statistically significantly different from the fixed-effects estimates. This leads us to choose the AM estimator for the immigrant sample and the HT estimator for the native born sample in Table 4a. The results for the immigrant sample imply no assimilation; the effect of years since migration and its square are very small in magnitude, of the wrong sign, and statistically insignificant. Moreover, at the means for the native born sample and years since migration set to zero to estimate the entry effect, the log wages of immigrants and the native born are equal (2.78). We would note also that, whereas the fixed effects estimates indicate larger returns to schooling for immigrants than for the native born as we reported earlier (Hum and Simpson, 2000), the IV estimates reverse this conclusion. The IV estimate implies a return to schooling for native born men of 8.5%, which is statistically significant, compared to a statistically insignificant return of only 2.4% for immigrant men. One concern with the IV estimates for the native born is the implausibly large effects of language.

The Hausman test results for the second panel in Table 4b also clearly reject the random effects estimates and accept the HT estimates for immigrants and the AM estimates for the native born. The estimated assimilation effect remains small in magnitude and statistically insignificant, but of the correct sign. At the sample means for the native born, there is again no estimated entry effect.[9] The estimated effect of schooling is twice as large for immigrants (24.6%), albeit insignificant, than for the native born (11.6%), a result consistent with the fixed effects estimates found here and in our earlier paper (Hum and Simpson, 2000). The effects of language are now plausible. The estimated effects of experience are the most consistent across all our results and always statistically significant. We have no explanation for the differences in the patterns of the estimates for the two panels, particularly for schooling and language, but the results appear to support our decision not to pool the panels. We now turn to preliminary estimates of the generational effects of immigrant assimilation using the second panel.

6. Extensions - Generational Integration

Economists have devoted relatively little effort to the study of assimilation beyond immigrants themselves, particularly the assimilation of immigrant children or second generation Canadians. One reason is lack of data; questions on parental birthplace are not asked on the Canadian Census and have not been asked on the U.S. Census since 1970. Thus, the questions on parental birthplace on the second panel of SLID offer an opportunity to examine generational integration with a rich, longitudinal data set.

Most studies by economists focus on the relative earnings of first, second and third or later generations, using dummy variables to identify generations. No concensus has emerged. Some studies find that assimilation ends with the first generation. Borjas (1993a) looks for the parents of 1970's second generation in the 1940 and 1950 U.S. Censuses. He finds that the ratio of first to third generation wages in 1940 is marginally higher than the ratio of second to third generation wages in 1970 which implies that upward assimilation ends after the first generation. Borjas (1994) confirms this result using the 1910 and 1940 Censuses and extends the analysis to the third generation using the 1980 Census. He finds similar results across all ethnic groups, implying that that the earnings disadvantages of immigrants are carried into future generations, and that the

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[9] The choice of the means for the native born sample is arbitrary. A better evaluation point might be the mean characteristics for immigrants who have just arrived in Canada, but this sample is very small in a longitudinal survey like SLID.

ethnic composition of immigration has long-lasting labour market effects. Using the 1981 Australian Census of Population and Housing, Chiswick and Miller (1985) also find no signficant difference in personal income for working men in the second and later generations. Other studies, however, suggest that the second generation outperforms succeeding generations. Using the 1970 U.S. Census, Chiswick (1977) estimates that second generation white men earn 4-8% more than their third (or later) generation counterparts, a result that is supported by Carliner (1980) but only for non-whites. Carliner argues that immigrants may have superior motivation but inferior human capital. With successive generations, the motivational advantage of immigrant families dissipates while the human capital disadvantage declines. When the human capital disadvantage disappears quickly, as it does for the descendents of white immigrants, wages decline monotonically by generation.

We incorporate a dummy variable to identify second generation Canadians in our regression estimates in Table 5 for the pooled sample of immigrants and native born, corresponding to Table 3b, and for the native born sample only, corresponding to Table 4b, using actual experience. The random effects estimates imply modest and statistically significant wage advantages of 3-4% for the second generation compared to other native born men, but these estimates are rejected by the Hausman test. The AM IV estimates, on the other hand, are accepted by the Hausman test and imply a negative, but statistically insignificant, second generation effect. Insofar as the random effects estimates are biased by the presence of person-specific fixed effects related to motivation, our results are consistent with those of Chiswick and Carliner. Once the fixed motivational effects are removed by a legitimate IV estimator, second generation effects disappear.

7. Conclusion

We use recently released Survey of Labour and Income Dynamics panel data to investigate the wage performance of male immigrants to Canada relative to native born men. The SLID offers a rich two-panel data set on labour market activity which permits us to assess existing, primarily cross-sectional, estimates of immigrant integration into the Canadian labour market. We interpret immigration as a interruption to labour market activity and show that the correlation between potential experience, which is commonly used in cross-sectional studies, and actual experience, which is captured in SLID, is weaker for immigrants than non-immigrants. We find that the effect of using potential experience is to exaggerate the disruption and recovery caused by immigration;

the estimated entry effects are larger and the assimilation effects are typically larger as well.

The disruption and recovery to individual work activity caused by immigration also appears to be exaggerated by cross-sectional estimates. Conventional tests reject the random effects estimates of immigrant integration in favour of instrumental variable estimates for which the entry effects for immigrants are imprecisely measured and the assimilation effects are never statistically significant. Among those IV estimates found to be admissible, for both pooled and separate samples of immigrants and native born men, we cannot rule out the possibility that the disruption to wages is negligible for immigrants who work compared to the native born who work. For the second panel, in which information on parental birthplace is available, we find evidence that unobservable differences (motivation?) between the immediate descendents of immigrants and other native born Canadians yields a modest wage advantage of 3-4% to this second generation.

References

Abbott, M. and C. Beach (1993) "Immigrant earnings differentials and birth-year effects for men in Canada: post-war—1972." *Canadian Journal of Economics* 26(3): 505-524.

Allensworth, E. (1997) "Earnings Mobility of First and '1.5' Generation Mexican-Origin Women and Men: A Comparison with U.S.-Born Mexican Americans and Non-Hispanic Whites." *International Migration Review* 31(2): 386-410.

Amemiya, T., and T. MaCurdy (1986) "Instrumental-Variable Estimation of an Error-Components Model," *Econometrica* 54, 869-81.

Baker, M. and D. Benjamin (1997) "The Role of the Family in Immigrants' Labor-Market Activity: An Evaluation of Alternative Explanations." *American Economic Review* 87(4): 705-727.

Baker, M. and D. Benjamin (1994) "The Performance of Immigrants in the Canadian Labor Market." *Journal of Labor Economics* 12(3): 369-405.

Baltagi, B., and S. Khanti-Akom (1990) "On Efficient Estimation with Panel Data: An Empirical Comparison of Instrumental Variables Estimators," *Journal of Applied Econometrics* 5, 401-06.

Beggs, J. and B. Chapman (1988) "Immigrant Wage Adjustment in Australia: Cross Section and Time Series Estimates." *Economic Record* 64(186): 161-167.

Bloom, D., G. Grenier and M. Gunderson (1995) "The changing labour market position of immigrants." *Canadian Journal of Economics* 28(4b): 987-1005.

Borjas, G. (1996) "The earnings of Mexican immigrants in the United States." *Journal of Development*

Economics 51(1): 69-98.

Borjas, G. (1995) "Assimilation and Changes in Cohort Quality Revisited: What Happened to Immigrant Earnings in the 1980s?" *Journal of Labor Economics* 13(2): 201-245.

Borjas, G. (1994) "Long-Run Convergence of Ethnic Skill Differentials: The Children and Grandchildren of the Great Migration." *Industrial and Labor Relations Review* 47(4): 553-573.

Borjas, G. (1993a) "The Intergenerational Mobility of Immigrants." *Journal of Labor Economics* 11(1): 113-135.

Borjas, G. (1993b) "Immigration Policy, National Origin, and Immigrant Skills: A Comparison of Canada and the United States." In D. Card and R. B. Freeman, *Small Differences That Matter* (21-43). Chicago: University of Chicago Press.

Borjas, G. (1992) "National Origin and the Skills of Immigrants in the Postwar Period." In G. J. Borjas and R. B. Freeman (Eds.), *Immigration and the Work Force* (17-47). Chicago: University of Chicago Press.

Borjas, G. (1989) "Immigrant and Emigrant Earnings: A Longitudinal Study." *Economic Inquiry* 27: 21-37.

Borjas, G. (1987) "Self-Selection and the Earnings of Immigrants." *American Economic Review* 77(4): 531-553.

Borjas, G. (1985) "Assimilation, Changes in Cohort Quality, and the Earnings of Immigrants." *Journal of Labor Economics* 3(4): 463-489.

Bound, J., D. Jaeger, and R. Baker (1995) "Problems with Instrumental Variables Estimation When the Correlation Between the Instruments and the Endogenous Explanatory Variable is Weak," *Journal of the American Statistical Association* 90, no.430, 443-50.

Breusch, T., G. Mizon, and P. Schmidt (1989) "Efficient Estimation Using Panel Data," *Econometrica* 57, 695-700.

Butcher, K. (1994) "Black Immigrants in the United States: A Comparison with Native Blacks and Other Immigrants." *Industrial and Labor Relations Review* 47(2): 265-184.

Carliner, G. (1980) "Wages, Earnings and Hours of First, Second, and Third Generation American Males." *Economic Inquiry* 18(1): 87-102.

Chiswick, B. (1978) "The Effects of Americanization on the Earnings of Foreign-Born Men." *Journal of Political Economy* 86(5): 897-921.

Chiswick, B. (1977) "Sons of Immigrants: Are They at and Earnings Disadvantage?" *American Economic Review* 67 (Supplement): 376-380.

Chiswick, B. and P. Miller (1985) "Immigrant Generation and Income in Australia." *Economic Record*

61(172): 540-553.

Cobb-Clark, D. (1993) “Immigrant Selectivity and Wages: The Evidence for Women.” *American Economic Review* 83(4): 986-993.

Cornwell, C., and P. Rupert (1988) “Efficient Estimaton with Panel Data: An Empirical Comparison of Instrumental Variables Estimators,” *Journal of Applied Econometrics* 3, 149-55.

Duleep, H. and M. Regets (1997a) “Immigrant Entry Earnings and Human Capital Growth: Evidence from the 1960-80 Censuses.” In S. W. Polachek (Ed.), *Research in Labor Economics*. Volume 16 (297-317). Associate Editor: J. Robst. Greenwich, Conn.: JAI Press.

Duleep, H. and M. Regets. (1997b) “Measuring Immigrant Wage Growth Using Matched CPS Files.” *Demography* 34(2): 239-249.

Duleep, H. and M. Regets (1992) “Some Evidence of the Effects of Admissions Criteria on Immigrant Assimilation.” In B. R. Chiswick (Ed.), *Immigration, Language, and Ethnicity: Canada and the United States*. Washington, DC: AEI Press.

Field-Hendrey, E. and E. Balkan (1991) “Earnings and assimilation of female immigrants.” *Applied Economics* 23(10): 1665-1672.

Friedberg, R. (2000) “You Can’t Take it With You? Immigrant Assimilation and the Portability of Human Capital.” *Journal of Labor Economics* 18(2): 221-251.

Funkhauser, E., and S. Trejo (1995) “The Labor Market Skills of Recent Male Immigrants: Evidence from the Current Population Survey.” *Industrial and Labor Relations Review* 48(4): 792-811.

Grant, M. (1999) “Evidence of new immigrant assimilation in Canada.” *Canadian Journal of Economics* 32(4): 930-955.

Halvorsen, R., and R. Palmquist (1980) “The Interpretation of Dummy Variables in Semilogarithmic Equations,” *American Economic Review* 70, 474-75.

Hausman, J. (1978) “Specification Tests in Econometrics,” *Econometrica* 46, 1251-72.

Hausman, J. and W. Taylor (1981) “Panel Data and Unobservable Individual Effects,” *Econometrica* 49, 1377-98.

Hu, W. (2000) “Immigrant Earnings Assimilation: Estimates from Longitudinal Data.” *American Economic Review* 90(2): 368-372.

Hum, D. and W. Simpson (1999) “Wage Opportunities for Visible Minorities in Canada.” *Canadian Public Policy* 25(3): 379-394.

Hum, D., and W. Simpson (2000) “Closing the Wage Gap: Economic Assimilation of Canadian Immigrants Reconsidered,” *Journal of International Migration and Integration* 1, 427-441

Kalmijn, M. (1996) "The Socioeconomic Assimilation of Caribbean American Blacks." *Social Forces* 74(3): 911-930.

Kee, P. (1995) "Native-Immigrant Wage Differentials in the Netherlands: Discrimination?" *Oxford Economic Papers* 47: 302-317.

Kossoudji, S. (1988). "Immigrant Worker Assimilation: Is It a Labor Market Phenomenon?" *Journal of Human Resources* 24(3): 494-527.

LaLonde, R. and R. Topel. (1992) "The Assimilation of Immigrants in the U.S. Labor Market." In G. J. Borjas and R. B. Freeman (Eds.), *Immigration and the Work Force* (67-92). Chicago: University of Chicago Press.

LaLonde, R. and R. Topel. (1991) "Immigrants in the American Labor Market: Quality, Assimilation, and Distributional Effects." *American Economic Review* 81(2): 297-302.

Long, J. (1980) "The Effect of Americanization on Earnings: Some Evidence for Women." *Journal of Political Economy* 88(3): 620-629.

McDonald, J. and C. Worswick (1999) "The Earnings of Immigrant Men in Australia: Assimilation, Cohort Effects, and Macroeconomic Conditions." *The Economic Record* 75(228): 49-62.

McDonald, J. and C. Worswick. (1998) "The Earnings of Immigrant Men in Canada: Job Tenure, Cohort, and Macroeconomic Conditions." *Industrial and Labor Relations Review* 51(3): 465-482.

McManus, W., W. Gould and F. Welch (1983) "Earnings of Hispanic Men: The Role of English Language Proficiency." *Journal of Labor Economics* 1(2): 101-130.

Meng, R.. (1987) "The earnings of Canadian immigrant and native-born males." *Applied Economics* 19: 1107-1119.

Miller, P. (1992) "The Earnings of Asian Male Imimgrants in the Canadian Labor Market." *International Migration Review* 26(4): 1222-1247.

Reimers, C. (1997) "The Progress of Mexican and White Non-Hispanic Immigrants in California and Texas, 1980 to 1990." *Quarterly Review of Economics and Finance* 37(Special Issue): 315-343.

Shamsuddin, A.(1998) "The double-negative effect on the earnings of foreign-born females in Canada." *Applied Economics* 30: 1187-1201.

Yuengert, A. (1994) "Immigrant Earnings, Relative to What? The Importance of Earnings Function Specification and Comparison Points." *Journal of Applied Econometrics* 9(1): 71-90.

Fig.1: SLID Panels, 1993-98

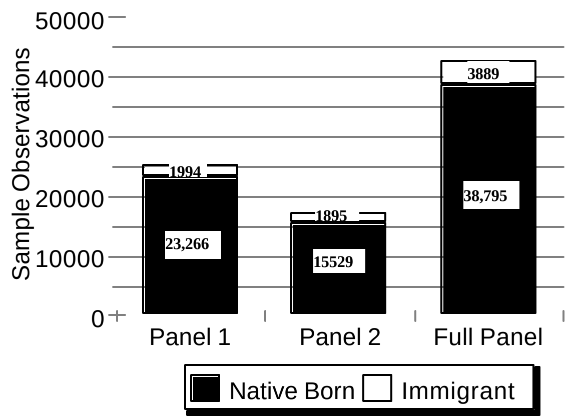

Fig. 2: Log Wage Immigrant Status Gap
Based on Random Effects Estimates

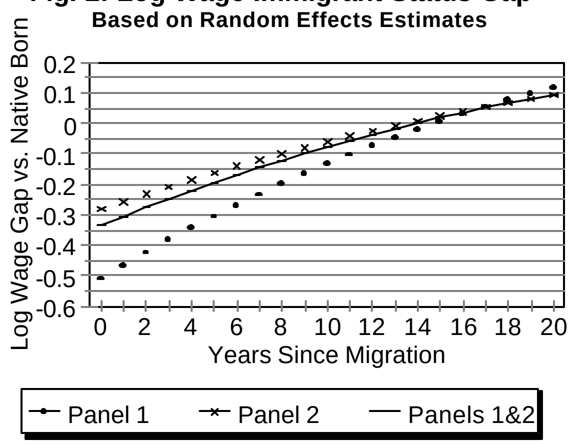

Table 1. Random Effects Estimates of Immigrant Status on the Log Wage for Men
(p-values in parentheses)

	Panel 1: 1993-98	Panel 2: 1996-98	Panels 1&2 Pooled
Const	2.70 (0.00)	2.74 (0.00)	2.75 (0.00)
Immigrant? (γ_0)	-0.51 (0.00)	-0.28 (0.00)	-0.35 (0.00)
Yrs since migration (γ_1)	0.044 (0.00)	0.025 (0.00)	0.031 (0.00)
Yrs squared (γ_2)	-0.00062 (0.00)	-0.00032 (0.00)	-0.00045 (0.00)
Panel 1 dummy			-0.027 (0.00)
χ^2	97.75 (0.00)	88.85 (0.00)	296.33 (0.00)
σ_α^2	0.44	0.45	0.40
σ_η^2	0.21	0.20	0.29
(t) test γ_3=0	1.40 (0.16)	0.08 (0.94)	0.37 (0.71)
NT	25,260	17,424	42,684

Notes: (1) GLS estimates of equation [2] of the form

$$y_{it} = b_0 + I_i \sum_{k=0} {}_i g_k h_i^k + a_i + h_{it}$$

where β_0 represents the mean log earnings of native born workers and $\gamma(0)=\gamma_0$ represents the entry effect.

(2) The between effects estimates are virtually identical and are not reported.

Table 2a. Random Effects (RE) and Fixed Effect (FE) Estimates of Immigrant Status on Log Wage with Control Variables, Men, Panel 1 (p-values in parentheses)

	Using Actual Work Experience		Using Potential Work Exp.	
Variable	RE	FE	RE	FE
Constant	1.59 (0.00)	1.52 (0.00)	1.34 (0.00)	1.14 (0.00)
Immigrant? (γ_0)	-0.25 (0.00)		-0.33 (0.00)	
Yrs since migration (γ_1)	0.020 (0.00)		0.024 (0.00)	
Yrs squared (γ_2)	-0.00034 (0.00)		-0.00038 (0.01)	
Yrs of schooling	0.046 (0.00)	0.043 (0.00)	0.057 (0.00)	0.066 (0.00)
Yrs experience	0.048 (0.00)	0.055 (0.00)	0.048 (0.00)	0.056 (0.00)
Exp. squared	-0.00075 (0.00)	-0.00066 (0.00)	-0.00066 (0.00)	-0.00067 (0.00)
Weeks worked	0.0012 (0.00)	0.00045 (0.03)	0.0016 (0.00)	0.00057 (0.01)
Visible minority?	-0.061 (0.07)		-0.089 (0.01)	
Eng mother tongue	0.030 (0.18)		0.036 (0.11)	
Fr mother tongue	0.023 (0.39)		0.023 (0.38)	
χ^2/F	χ^2=5317.2(0.00)	F=127.9(0.00)	χ^2=5236.2(0.00)	F=125.3 (0.00)
σ_α^2	0.33	0.40	0.33	0.39
σ_η^2	0.20	0.20	0.20	0.20
test σ_α^2=0 (χ^2[1])	21,410.9 (0.00)		21,281.2 (0.00)	
(t) test γ_3=0	1.60 (0.11)		1.46 (0.14)	
χ^2[3]test $\gamma_0=\gamma_1=\gamma_2=0$	15.10 (0.00)		21.72 (0.00)	
χ^2[2] test $\gamma_1=\gamma_2=0$	15.08 (0.00)		21.52 (0.00)	
(t) test for vis.min.*imm interaction	1.33 (0.19)		2.07 (0.03)	
Hausman test RE vs. FE (χ^2[15])	314.86 (0.00)		360.58 (0.00)	

Table 2b. Random Effects (RE) and Fixed Effect (FE) Estimates of Immigrant Status on Log Wage with Control Variables, Men, Panel 2 (p-values in parentheses)

	Using Actual Work Experience		Using Potential Work Exp.	
Variable	RE	FE	RE	FE
Constant	1.75 (0.00)	1.51 (0.00)	1.47 (0.00)	0.83 (0.01)
Immigrant? (γ_0)	-0.079 (0.09)		-0.22 (0.00)	
Yrs since migration (γ_1)	0.0080 (0.04)		0.019 (0.00)	
Yrs squared (γ_2)	-0.00015 (0.05)		-0.00034 (0.00)	
Yrs of schooling	0.041 (0.00)	0.035 (0.12)	0.053 (0.00)	0.074 (0.00)
Yrs experience	0.044 (0.00)	0.065 (0.00)	0.044 (0.00)	0.070 (0.00)
Exp. squared	-0.00071 (0.00)	-0.00076 (0.00)	-0.00062 (0.00)	-0.00085 (0.00)
Weeks worked	0.0017 (0.00)	-0.00015 (0.58)	0.0022 (0.00)	0.000016 (0.96)
Visible minority?	-0.11 (0.00)		-0.14 (0.00)	
Eng mother tongue	0.017 (0.38)		0.023 (0.23)	
Fr mother tongue	0.011 (0.66)		0.013 (0.61)	
χ^2/F	χ^2= 4414.8(0.00)	F=34.61 (0.00)	χ^2=4227.5(0.00)	F=35.66 (0.00)
σ_α^2	0.34	0.45	0.35	0.43
σ_η^2	0.19	0.19	0.19	0.19
test $\sigma_\alpha^2=0$ ($\chi^2[1]$)	7554.77 (0.00)		7502.57 (0.00)	
(t) test $\gamma_3=0$	0.77 (0.44)		1.30 (0.20)	
($\chi^2[3]$) test $\gamma_0=\gamma_1=\gamma_2=0$	4.66 (0.20)		26.15 (0.00)	
$\chi^2[2]$ test $\gamma_1=\gamma_2=0$	4.55 (0.10)		24.70 (0.00)	
(t) test for vis.min.*imm	1.43 (0.15)		1.74 (0.08)	
Hausman test RE vs. FE ($\chi^2[15]$)		274.87 (0.00)		350.32 (0.00)

Notes: (1) Random effects (GLS) and fixed effects (within) estimates of equation [2] of the form

$y_{it} = X_{it}\beta + Z_i\gamma' + I_i \sum_{j=0} \gamma_j h_i^j + \alpha_i + \eta_{it}$, where β_0 represents the mean log earnings of native born workers, $\gamma(0)=\gamma_0$ represents the entry effect, and X and Z represents control variables that are time-variant and time-invariant respectively.

(2) In addition to the control variables shown, seven dummy variables were included to capture region of residence (Atlantic, Quebec, Ontario, Manitoba / Saskatchewan, Alberta, British Columbia) and the size of community (large, medium, small). The full set of results are available from the authors upon request.

(3) Potential experience is defined as age minus years of schooling minus 5.

Table 3a. Instrumental Variable Estimates (Hausman-Taylor, Amemiya-MaCurdy, and Breusch-Mizon-Schmidt) of Immigrant Status on Log Wage, Men, Panel 1 (p-values in parentheses)

	Using Actual Work Experience			Using Potential Work Experience		
Variable	H-T	A-M	B-M-S	H-T	A-M	B-M-S
Constant	3.56 (0.00)	1.61 (0.00)	0.87 (0.01)	3.57 (0.00)	1.35 (0.00)	0.22 (0.35)
Immigrant? (γ_0)	-1.05 (0.04)	-0.11 (0.60)	0.061 (0.75)	-1.32 (0.02)	-0.23 (0.27)	0.25 (0.11)
Yrs since mig. (γ_1)	-0.016 (0.43)	-0.0065 (0.47)	-0.011 (0.22)	-0.013 (0.61)	-0.00045 (0.96)	0.00088 (0.92)
Yrs squared (γ_2)	0.00012 (0.73)	0.000008(0.96)	0.00014 (0.36)	0.000086(0.84)	-0.00006(0.68)	-0.00004(0.76)
Yrs of schooling	0.073 (0.00)	0.081 (0.00)	0.13 (0.00)	0.092 (0.00)	0.095 (0.00)	0.12 (0.00)
Yrs experience	0.046 (0.00)	0.046 (0.00)	0.0 (0.00)	0.047 (0.00)	0.047 (0.00)	0.046 (0.00)
Exp. squared	-0.00046 (0.00)	-0.00046 (0.00)	-0.00049(0.00)	-0.00048 (0.00)	-0.00048 (0.00)	-0.00049 (0.00)
Weeks worked	0.00018 (0.53)	0.00017 (0.56)	0.00023 (0.46)	0.00031(0.27)	0.00032 (0.29)	0.00033 (0.28)
Visible minority?	-0.48 (0.01)	-0.16 (0.05)	-0.14 (0.06)	-0.61 (0.00)	-0.23 (0.00)	-0.079 (0.19)
Eng mother tongue	-2.35 (0.00)	-0.42 (0.24)	-0.19 (0.53)	-2.70 (0.00)	-0.43 (0.23)	0.47 (0.02)
Fr mother tongue	-2.37 (0.00)	-0.50 (0.16)	-0.24 (0.43)	-2.72 (0.00)	-0.51 (0.14)	0.39 (0.05)
χ^2	1050.97 (0.00)	1309.33 (0.00)	1505.66 (0.00)	1018.54 (0.00)	1301.36 (0.00)	1290.55 (0.00)
σ_α^2	0.79	0.31	0.31	0.98	0.30	0.30
σ_η^2	0.18	0.18	0.18	0.18	0.18	0.18
(t) test γ_3=0	1.75 (0.08)	1.51 (0.13)	1.74 (0.08)	1.51 (0.13)	1.39 (0.16)	1.39 (0.16)
χ^2[3]test $\gamma_0=\gamma_1=\gamma_2=0$	9.36 (0.02)	6.68 (0.08)	2.58 (0.46)	9.46 (0.02)	4.20 (0.24)	4.80 (0.19)
χ^2[2] test $\gamma_1=\gamma_2=0$	2.85 (0.24)	6.04 (0.05)	2.48 (0.29)	1.30 (0.52)	2.89 (0.24)	0.54 (0.76)
Mean R^2 for IVs	0.253	0.257	0.650	0.253	0.257	0.650
(Hausman) test IV vs. FE (χ^2[11])	3.03 (0.99)	91.72 (0.00)	47.40 (0.00)	n.a.	86.64 (0.00)	52.17 (0.00)

Table 3b. Instrumental Variable Estimates (Hausman-Taylor, Amemiya-MaCurdy, and Breusch et al) of Immigrant Status on Log Wage, Men, Panel 2 (p-values in parentheses)

	Using Actual Work Experience			Using Potential Work Experience		
Variable	H-T	A-M	B-M-S	H-T	A-M	B-M-S
Constant	1.02 (0.17)	0.70 (0.23)	0.34 (0.47)	0.74 (0.32)	0.39 (0.50)	0.27 (0.54)
Immigrant? (γ_0)	-0.17 (0.67)	-0.044 (0.89)	-0.15 (0.59)	-0.56 (0.16)	-0.40 (0.20)	-0.22 (0.37)
Yrs snc mig. (γ_1)	0.0050 (0.57)	0.0036 (0.65)	0.012 (0.12)	0.023 (0.01)	0.021 (0.01)	0.018 (0.01)
Yrs squared (γ_2)	-0.00022 (0.14)	-0.00019 (0.18)	-0.00025 (0.07)	-0.00049 (0.00)	-0.00045 (0.00)	-0.00037 (0.00)
Yrs of schooling	0.098 (0.00)	0.11 (0.00)	0.15 (0.00)	0.13 (0.00)	0.14 (0.00)	0.13 (0.00)
Yrs experience	0.066 (0.00)	0.065 (0.00)	0.05 (0.00)	0.071 (0.00)	0.070 (0.00)	0.069 (0.00)
Exp. squared	-0.00078 (0.00)	-0.00078 (0.00)	-0.00087(0.00)	-0.00085 (0.00)	-0.00085 (0.00)	-0.00096 (0.00)
Weeks worked	0.00016 (0.64)	0.00015 (0.64)	0.00026 (0.47)	0.00033 (0.34)	0.00032 (0.35)	0.00025 (0.45)
Visible minority?	-0.11 (0.55)	-0.052 (0.73)	-0.081 (0.54)	-0.28 (0.15)	-0.20 (0.19)	-0.11 (0.37)
Eng mother tongue	-0.33 (0.63)	-0.10 (0.85)	-0.087 (0.85)	-0.63 (0.36)	-0.33 (0.53)	0.015 (0.97)
Fr mother tongue	-0.42 (0.52)	-0.16 (0.75)	-0.16 (0.72)	-0.71 (0.28)	-0.40 (0.44)	-0.067 (0.87)
χ^2	831.75 (0.00)	796.08 (0.00)	1148.11 (0.00)	807.95 (0.00)	784.55 (0.00)	898.08 (0.00)
σ_α^2	0.36	0.41	0.36	0.37	0.43	0.37
σ_η^2	0.19	0.19	0.19	0.18	0.18	0.18
(t) test γ_3=0	0.69 (0.49)	0.41 (0.68)	0.39 (0.70)	1.13 (0.26)	0.83 (0.41)	0.26 (0.79)
χ^2[3] test $\gamma_0=\gamma_1=\gamma_2=0$	15.32 (0.00)	12.25 (0.01)	3.95 (0.27)	14.35 (0.00)	11.92 (0.01)	10.41 (0.02)
χ^2[2] test $\gamma_1=\gamma_2=0$	11.28 (0.00)	9.82 (0.01)	3.78 (0.15)	14.33 (0.00)	11.89 (0.00)	9.15 (0.01)
Mean R^2 for IVs	0.253	0.256	0.603	0.238	0.240	0.571
(Hausman) test IV vs. FE (χ^2[11])	13.69 (0.25)	6.92 (0.80)	91.28 (0.00)	20.89 (0.03)	11.22 (0.42)	22.19 (0.02)

Notes: (1) Variables instrumented are: schooling, experience and its square, weeks worked, and language (English and French mother tongue). Instrumental variables are formulated according to Hausman and Taylor (1981), Amemiya and MaCurdy (1986) and Breusch, Mizon and Schmidt (1989) as indicated
(2) Hausman test not available (n.a.) when test value <0, i.e. model estimated on these data fails to meet the asymptotic assumptions of the Hausman test

Table 4a. Random Effects, Fixed Effects and Instrumental Variable Estimates of Immigrant Status on Log Wage, Men, Panel 1 for actual experience (p-values in parentheses)

	Panel 1 (Using Actual Work Experience)					
	Immigrants			Native Born		
Variable	RE	FE	IV (AM)	RE	FE	IV (HT)
Constant	1.47 (0.00)	0.95 (0.06)	2.01 (0.02)	1.55 (0.00)	1.56 (0.00)	3.36 (0.00)
Yrs since migr	0.020 (0.00)		-0.0017 (0.94)			
Yrs squared	-0.00036 (0.00)		-0.00017 (0.68)			
Yrs schooling	0.045 (0.00)	0.074 (0.05)	0.024 (0.68)	0.046 (0.00)	0.040 (0.00)	0.082 (0.00)
Yrs experience	0.035 (0.00)	0.049 (0.00)	0.051 (0.00)	0.050 (0.00)	0.056 (0.00)	0.045 (0.00)
Exp. squared	-0.00046 (0.00)	-0.00043 (0.00)	-0.00047 (0.00)	-0.00078 (0.00)	-0.00070 (0.00)	-0.00047 (0.00)
Weeks worked	0.0021 (0.00)	0.0012 (0.11)	0.0012 (0.30)	0.0011 (0.00)	0.00040 (0.06)	0.00013 (0.66)
Visible minority?	-0.10 (0.03)		-0.25 (0.22)	-0.0013 (0.48)		-0.30 (0.08)
English	0.0080 (0.85)		-0.40 (0.43)	0.050 (0.07)		-2.25 (0.01)
Fr mother tongue	0.048 (0.68)		0.10 (1.00)	0.047 (0.13)		-2.25 (0.00)
χ^2/F	364.96 (0.00)	12.66 (0.00)	135.17	4950.92 (0.00)	117.65 (0.00)	956.08 (0.00)
σ_α^2	0.36	0.49	0.80	0.33	0.39	0.67
σ_η^2	0.19	0.19	0.18	0.20	0.20	0.18
(t) test γ_3=0	1.39 (0.17)		1.15 (0.25)			
χ^2[2]test $\gamma_1=\gamma_2=0$	13.35 (0.00)		1.77 (0.41)			
Hausman test vs. FE (χ^2[12])	62.44 (0.00)		8.10 (0.21)	269.60 (0.00)		3.64 (0.82)

Table 4b. Random Effects, Fixed Effects and Instrumental Variable Estimates of Immigrant Status on Log Wage, Men, Panel 2 for actual experience (p-values in parentheses)

	Panel 2 (Using Actual Work Experience)					
	Immigrants			Native Born		
Variable	RE	FE	IV (HT)	RE	FE	IV (AM)
Constant	1.88 (0.00)	-0.086 (0.94)	-1.14 (0.51)	1.75 (0.00)	1.68 (0.00)	0.76 (0.19)
Yrs since migr	0.0086 (0.05)		0.0012 (0.97)			
Yrs squared	-0.00016 (0.06)		-0.00026(0.68)			
Yrs schooling	0.035 (0.00)	0.16 (0.05)	0.22 (0.20)	0.041 (0.00)	0.022 (0.33)	0.11 (0.00)
Yrs experience	0.040 (0.00)	0.060 (0.00)	0.070 (0.00)	0.044 (0.00)	0.066 (0.00)	0.064 (0.00)
Exp. squared	-0.00067 (0.00)	-0.00057 (0.05)	-0.00071 (0.00)	-0.00072 (0.00)	-0.00079 (0.00)	-0.00079 (0.00)
Weeks worked	0.00064 (0.45)	-0.0010 (0.30)	0.00025 (0.79)	0.0018 (0.00)	-0.00005(0.86)	0.00018 (0.61)
Visible minority?	-0.10 (0.01)		0.050 (0.90)	-0.057 (0.24)		0.021 (0.90)
English	0.055 (0.09)		0.31 (0.81)	-0.011 (0.66)		-0.15 (0.79)
Fr mother tongue	0.052 (0.63)		-0.050 (0.98)	-0.013 (0.66)		-0.18 (0.74)
χ^2/F	40,004 (0.00)	4.36 (0.00)	76.16 (0.00)	4073 (0.00)	31.90 (0.00)	727.12 (0.00)
σ_α^2	0.37	0.70	2.32	0.34	0.45	0.38
σ_η^2	0.21	0.21	0.19	0.19	0.19	0.18
(t) test γ_3=0	0.60 (0.55)		0.14 (0.89)			
χ^2[2] test $\gamma_1=\gamma_2=0$	4.04 (0.13)		1.99 (0.37)			
Hausman test vs. FE	41.36 (0.00)		2.63 (0.99)	242.86 (0.00)		6.46 (0.84).

Notes: In addition to the control variables shown, seven dummy variables were included to capture region of residence (Atlantic, Quebec, Ontario, Manitoba/Saskatchewan, Alberta, British Columbia) and the size of community (large, medium, small). The full set of results are available from the authors upon request.

Table 5. Random Effects, Fixed Effects and Instrumental Variable Estimates of Immigrant and Second Generation Status on Log Wage, Men, Panel 2 for Actual Experience (p-values in parentheses)

	Full Sample			Native Born Only		
Variable	RE	FE	IV (AM)	RE	FE	IV (AM)
Constant	1.73 (0.00)	1.51 (0.00)	0.71 (0.25)	1.73 (0.00)	1.68 (0.00)	0.78 (0.21)
2nd Generation	0.037 (0.00)		-0.049 (0.47)	0.030 (0.03)		-0.059 (0.45)
Immigrant (1st Generation)	-0.062 (0.18)		-0.076 (0.83)			
Yrs since migr	0.0078 (0.04)		0.0041 (0.64)			
Yrs squared	-0.00014 (0.06)		-0.00020 (0.18)			
Yrs schooling	0.040 (0.00)	0.035 (0.12)	0.11 (0.00)	0.041 (0.00)	0.022 (0.33)	0.11 (0.00)
Yrs experience	0.044 (0.00)	0.065 (0.00)	0.065 (0.00)	0.044 (0.00)	0.066 (0.00)	0.064 (0.00)
Exp. squared	-0.00072 (0.00)	-0.00076 (0.00)	-0.00078 (0.00)	-0.00072 (0.00)	-0.00079 (0.00)	-0.00079 (0.00)
Weeks worked	0.0017 (0.00)	-0.00015 (0.58)	0.00015 (0.64)	0.0018 (0.00)	-0.00005(0.86)	0.00018 (0.45)
Visible minority?	-0.11 (0.00)		-0.054 (0.73)	-0.067 (0.17)		0.034 (0.82)
English	0.024 (0.20)		-0.13 (0.83)	0.00047 (0.94)		-0.19 (0.77)
Fr mother tongue	0.023 (0.35)		-0.20 (0.73)	0.0019 (0.95)		-0.24 (0.71)
χ^2/F	4425.05 (0.00)	34.61 (0.00)	797.67 (0.00)	4079.86 (0.00)	31.90 (0.00)	727.48 (0.00)
σ_α^2	0.34	0.45	0.41	0.34	0.45	0.39
σ_η^2	0.19	0.19	0.19	0.19	0.19	0.18
χ^2[3] test $\gamma_0=\gamma_1=\gamma_2=0$	5.34 (0.15)		12.15 (0.01)	242.75 (0.00)		6.77 (0.81)
			0.01 (0.93)			
Hausman test vs. FE (χ^2[12])	274.41 (0.00)		7.12 (0.79)	242.75 (0.00)		3.64 (0.82)

Appendix: Summary of Studies on Immigrant Integration for Wages and Earnings

Author	Data Source	Specification and Explanatory Variables	Estimator	Results	Comments
Abbott & Beach (1993)	Job Mobility Survey (1973)	$r = Xb + u$ Explanatory variables: HC (actual experience), D, I, YSM, Age Some specifications add interaction terms for I and YSM	OLS	Entry effect: 16.4-19.8%; Assimilation after 9 years (more for younger, more recent immigrant)	Pools immigrants and natives
Allensworth (1997)	US Census 1990	$r = Xb + u$ Explanatory variables: HC, L, I (dummies for adult and child migrants), YSM, Citizen	OLS	Entry effect: $2299 for women, $4255 for men (9-11 years ed.); Assimilation rate: -$264/yr. for women, -$8/yr. for men	Sample of Mexican immigrants, evaluated relative to US-born Mexicans 25-35 for 7 states
Baker & Benjamin (1997)	Canadian Survey of Consumer Finances, 1986 and 1991	$w = Xb + \sum_{l=1}^{L} m_l + at + u$ Explanatory variables: HC (own and spouse's), L (own and spouse's), D, YSM, Coh, t	Estimator not stated (presumably OLS)	Entry effect: 35-45% (husbands); 28-43% (wives) Initial assimilation rate: 2.2% (husbands), 2.4% (wives)	
Baker & Benjamin (1994)	Canadian Census 1971, 1981 and 1986	$r_{i,t} = X_t b_t + u_{i,t}$ $r_{n,t} = X_t b_{n,t} + u_{n,t}$ (*i* indexes cohorts, *t* indexes time) Explanatory variables: HC, D (marital status only), Dummy for blacks	Estimator not stated (presumably OLS)	Assimilation rate: -3% to 3% over 10 years for most cohorts	Also estimates holding source country composition constant and excluding child migrants

Beggs & Chapman (1988)	Social Sciences Mobility survey 1973 and Australian Census 1981	$w^N_{1973} = Xb^N_{1973} + u$ $w^I_{1973} = Xb^I_{1973} + u$ $w^N_{1981} = Xb^N_{1981} + u$ $w^I_{1981} = Xb^I_{1981} + u$ Explanatory variables: HC^h, HC^a, D (marital status only), YSM	OLS	Earnings gap 2.4% in 1973 for 1965 cohort (Eng.-speaking countries), 7.7% (non-Eng. Countries); Assimilation 4.4% over 1973-1981 (Eng.-speaking countries), 2.2% (non-Eng. Countries)	Separate estimates for natives, immigrants from English-speaking countries and immigrants from non-English-speaking countries
Bloom, Grenier & Gunderson (1995)	Canadian Census 1971, 1981 and 1986	$r = Xb + aI + dYSM + Coh\Theta + u$ Explanatory variables: HC, D (marital status only), I, YSM, Coh	Estimator not stated (presumably OLS)	Entry effect: 33.8% for men, 17.3% for women (1981-86 cohort) Assimilation rate: 0.3% for men, 0.2% for women	Pooled sample of natives and immigrants; separate estimates by region of origin
Borjas (1996)	US Census 1970, 1980 and 1990	$w_i = Xb_i + d_i A + aYSM + \sum j\, Coh + qM + g^0_i t^0 + g^1_i t^1 + u_i$ $w_n = Xb_n + d_n A + g^0_n t^0 + g^1_n t^1 + u_n$ $g^0_i = g^0_n, g^1_i = g^1_n, d_i = d_n$ (*M* is age at migration) Explanatory variables: HC (Age to 3[rd] power), I YSM, Coh, Age at migration, t	Estimator not stated (presumably OLS)	Entry effect: 6 to 19%, depending on cohort (19% for 1985-89 cohort); No assimilation in the long run	Sample of Mexican immigrants
Borjas (1995)	US Census 1970, 1980 and 1990	$w_i = Xb_i + aYSM + Coh\Theta + g^1_i t^{1970} + g^2_i t^{1980} + u_i$ $w_n = Xb_n + g^1_n t^{1970} + g^2_n t^{1980} + u_n$ Explanatory variables: HC (cubic in Age), D (metropolitan residence only), YSM (cubic), Coh, t	Estimator not stated (presumably OLS)	Entry effect: 15.2 to 21.7% (1985-89 cohort arriving at age 20); Assimilation rate: less than 10% over 20 years	Pooled sample of 3 censuses; also estimates cohort effects and assimilation rates for 4 ethnic groups

Borjas (1993b)	Canadian Census 1971 and 1981, US Census 1970 and 1980	$w_i = Xb_i + a_1 YSM + a_2 YSM^2 + \sum qCoh + g_i t + u_i$ $w_n = Xb_n + +g_n t + u_n$ Explanatory variables: HC, D, H (for US regressions)	Estimator not stated (presumably OLS)	Canada: entry effect 18.4%; assimilation rate negligible (YSM = 10); US: entry effect 22.9%; assimilation rate 0.5% (YSM = 10; 1975-80 cohort)	Differences in national origin account for most of differ-ence in immi-grant outcomes between Can-ada and US
Borjas (1989)	Survey of Natural and Social Sci-entists and Engi-neers 1974, 1978	$r_i = Xq_i + a_1 YSM + a_2 YSM^2 + b_1 Coh + b_2 Coh^2 + g_i t + u_i(t)$ $r_n = Xq_n + g_n t + u_n(t)$ Explanatory variables: HC, D, Occ (current job science-related), YSM, Coh	GLS (allows a constant covariance across time periods)	Entry effect: 21.7%; Initial assimi-lation rate: 1.0% (1970 cohort)	Longitudinal data
Borjas (1987)	US Census 1970 and 1980	$w(t) = Xb_t + dI + a_1 I * YSM + a_2 I * YSM^2 + g_1 I * Coh + g_2 I * Coh^2 + u$ Explanatory variables: HC, D, H, I, YSM, Coh	1970 and 1980 regress-ions jointly estimated	Entry effect: 27.9-53.3%, depending on country and year; Assimilation rate 1.0% to 3.2% (YSM=10)	Separate esti-mates for 41 source count-ries; predict outcomes from source country characteristics

Borjas (1985)	US Census 1970 and 1980	$w_{70,i} = Xb_{70,i} + Cohq_{70} + u$ $w_{80,i} = Xb_{80,i} + Cohq_{80} + u$ $w_{70,n} = Xb_{70,n} + u$ $w_{80,n} = Xb_{80,n} + u$ Explanatory variables: HC, D, H, Coh	GLS (joint estimation of 4 equations)	Entry effects not reported; Assimi-lation rates low (sum of YSM and aging effects for Whites in 1965-69 cohort is 9.3% over 10 years)	Separate estimates for 6 racial groups; each immi-grant group compared to corresponding native group
Butcher (1994)	US Census 1980	$r = Xb + u$ Explanatory variables: HC, D, L, I (dummies for 4 black immigrant groups and for white immigrants), dummy for native "black movers"	OLS	Entry effect 32.9% (rel. to native blacks; greater for highly educated). Assi-milation after 15-20 years	Focus on black immigrants; sample of blacks and pooled sample of blacks and whites
Chiswick (1978)	US Census 1970	$r_i = Xb_i + a_1 YSM + a_2 YSM^2 + u$ $r_n = Xb_n + u$ Explanatory variables: HC, D, I, YSM, Org, Citizen	Estimator not stated (presumably OLS)	Entry effect: 16.4% Initial assimilation rate: 1.5% (cross-over at about 13 YSM)	Pooled sample of natives and immigrants as well as separ-ate samples; base regression for white men

Cobb-Clark (1993)	Current Population Survey 1983	$w_s^W = \sum_{j=1}^{J} a_j X_j + I \times$ $[bGDP + (a_s \Delta R + b_s P)(\sum_{k=1}^{J} g_k Y_k)^2]$ *GDP* is home country GDP relative to US, ΔR is home country return to education relative to US, *P* is percentage of immigrants entering under occupational preference), X=[HC, D, YSM, Presence and age of children], Y=[*GDP*, Income inequality rel. to US, ΔR , *P*, dummy for household immigrants, distance to US, compatriots in US, Visa backlog]	Estimator: OLS and selectivity-corrected NLLS	Assimilation rate: -2.8 to 4.9%, depending on specification and estimator	Sample of married women
Duleep & Regets (1997a)	US Census 1960-1990	Dependent variable: Annual earnings Explanatory variables: HC, Org	Non-parametric techniques	Entry effect 51.4-58.3% (1975-80 cohort in 1979) Earnings gap 11.4-25.0% by 1989 (Figures based on median earnings)	Negative correlation between entry earnings and assimilation rate;

Field-Hendrey & Balkan (1991)	US Census 1970 and 1980	$w = bX + u$ Explanatory variables: HC (actual experience), D, H, I, YSM	Selectivity-corrected OLS	Entry effect: 14.4% (1970), 3.3% (1980) Initial assimilation rate: 1.5% (1970), 1.1% (1980)	Pools immigrant and native women; correction for likelihood of participation
Friedberg (2000)	Israeli Census 1972 and 1983	$r = Xb + u$ Dependent variable is monthly earnings Explanatory variables: HC_h, HC_a, I (interacted with HC_h)	Estimator not stated (presumably OLS)	Entry effect: 25.3% Assimilation rate: 0.8% when all HC treated the same; -0.6% when HC_h, HC_a distinguished	Results from 1983 cross-section only (quasi-panel estimates indicate cohort effects are unimportant)
Funkhauser & Trejo (1995)	Current Population Survey 1979, 1983, 1986, 1988, 1989	$w = Xb + u$ Explanatory variables: HC, I, Coh, YSM Also race/region of birth or source country GNP in some specifications	Estimator not stated (presumably OLS)	Entry effect: 14.5 to 22.1%, depending on cohort Initial assimilation rate: 1.4%	Pooled sample of natives and immigrants

Grant (1999)	Canadian Census 1981, 1986, 1991	$r_t = X_t b_t + \sum_i d_{i,t} Coh + u_t$ $r_{n,t} = X_{n,t} b_{n,t} + d_{n,t} + u_{n,t}$ Explanatory variables: HC, D (marital status only), Coh, Dummy for blacks	Estimator not stated (presumably OLS)	17.2% assimilation over 1986-91 for 1981-85 cohort	
Hu (2000)	Health and Retirement Survey (sample of US population born 1931-41) and US Cen-sus 1970, 1980, 1990	$r = Xb + u$ Explanatory variables: HC, I (interacted with all variables except t), YSM, Coh, t (interacted with HC)	Censored least-absolute-deviations	Entry effect: $17,000 for Hispanics, $11,000 for non-Hispanics (1975-79 cohort) Assimilation after 36 yrs for Hispanics; non-Hispanics lose $500/year rel. to natives	Longitudinal data; results are for HRS estimates; estimated by eye from graphs

Hum & Simpson (1999)	Survey of Labour and Income Dynamics 1993	$w = Xb + u$ Explanatory variables: HC_h, HC_a, D (marital status only), L, Occ, Race, I, YSM	Selectivity-corrected OLS	Entry effect: 37% for visible minority (VM) males, 9% for other males, 26% for VM females, 14% for other females. Initial assimilation rate: 3% for VM males, 1% for other males, 2.6% for VM females, 0.2% for other females	Also estimate separate regressions for natives and immigrants
Kalmijn (1996)	US Census 1990	$w = Xb + Org * g^1 + Org * I * g^2 + Org * I * YSM * g^3 + u$ Explanatory variables: HC, D, L	OLS	Entry effect: 6.2 to 26.5%, depending on country of origin Assimilation rate: 0.5 to 1.2%	Compares Caribbean immigrant with US-born Caribbeans and US-born blacks

Kossoudji (1988)	SIE 1976	$Occ_j = 1$ if $Z_j g_j > u_j^1$ $= 0$ otherwise $r_j = X_j b_j + u_j^2$ (*j* indexes occupations) Explanatory variables: HC_h, HC_a (experience only), D (marital status only), L, H, selectivity variable	Selectivity-corrected OLS	Entry effect: 9.1 to 77.0% earnings advantage for immigrants at US exp. = 0; advantage disappears after 6-12 years (assumes fluent English)	Separate samples of US-born whites, foreign-born East Asians and foreign-born Hispanics
LaLonde & Topel (1992)	US Census 1970 and 1980	$r_{i,t} = Xb_{i,t} + a_{i,t} + b_{i,t} + u_i$ $r_{n,t} = Xb_{n,t} + b_{n,t} + u_n$ (*i* indexes cohorts, *t* indexes time) (*a* is accumulated US-specific HC, *b* is time effects). Explanatory variables: HC (quartic in experience, interaction of experience with education), YSM	Estimator not stated (presumably OLS)	Entry effect: 20 to 66%, depending on year and origin. Initial assimilation rate: 10 to 31% over 1970-80 for 65-69 cohort	Separate estimates for 5 regions of origin; natives and earlier immigrants both used as base group
LaLonde & Topel (1991)	US Census 1970 and 1980	$w = Xb + u$ Explanatory variables: HC (quartic in experience, interaction with education)	Estimator not stated (presumably OLS)	Entry effect: 5% (Europe) to 40% (Middle East). Assimilation rate: 8% (Europe) to 42% (Middle East) over 10 years	Separate estimates for 5 region of origin groups

Long (1980)	US Census 1970	$r = Xb + u$ Explanatory variables: HC, D, I, YSM, Number and age of children, Labour force participation 5 years earlier, dummy for vocational training	Estimator not stated (presumably OLS)	Entry effect: 13% advantage for immigrants Initial assimila-tion rate: -0.7% (lower for marr-ied women)	Pooled sample of natives and immigramt women as well as separate samples
McDonald & Worswick (1999)	Income Distribution Surveys 1982, 1986 and 1990	$w = Xb + Coh \times Ea + Coh \times Ng$ $+ d_E YSM_E + d_N YSM_N + n\ t$ $+ n_E tE + n_N tN + u$ E = Immigrant from English-speaking background; N = Immigrant from non-English-speaking background Explanatory variables: HC, D, I, YSM, Coh, t	Estimator not stated (presumably OLS)	Entry effect: insignificant for E, 10.8% for N Assimilation rate: insignificant in basic specifica-tion; may inc-rease with unem-ployment rate at entry for N	Pooled sample of natives and immigrants; dependent variable is weekly earnings
McDonald & Worswick (1998)	Survey of Consumer Finances (Canadian); 11 surveys over 1981-1992	$r = Xb + u$ Explanatory variables: HC, D, L, Ind, Occ, I, YSM, Coh Some specifications add job tenure and current unemployment rate, both interacted with immigrant variables	Estimator not stated (presumably OLS)	Entry effects vary widely by specifi-cation; no evi-dence of declin-ing cohort quality Initial assimila-tion rate: 0.8 - 1.9% (slower for recent cohorts when macroeco-nomic conditions are poor)	Dependent variable is weekly earn-ings; pooled sample of im-migrants and natives from 11 surveys

Meng (1987)	Canadian National Mobility Survey 1973	$r = Xb + u$ Explanatory variables: HC (actual experience), Parents' HC, D, L, I, Class, YSM, Employment History	Estimator not stated (presumably OLS)	Entry effect: 15% Assimilation after 14 years	Uses actual (not potential) experience
Miller (1992)	Canadian Census 1981 and 1986	$r = Xb + u$ Explanatory variables: HC, D, L, Ori, YSM, Citizen Cross-sectional analysis (cohort effects confounded with YSM)	Estimator not stated (presumably OLS)	Initial assimilation rate: 0.7% to 2.5%, depending on year and specifi-cation	Estimates for natives, all immigrants and Asian immigrants;
Reimers (1997)	US Census 1980 and 1990	$w = Xb + u$ Explanatory variables: HC, L, Citizen	OLS	Entry effect (1975-79 cohort in 1980): 31.6% disadvantage to 2.3% advantage (depending on gender, race and state) After 10 yrs, 2.7 to 16.2% disadvantage	Separate estimates for Mexican immi-grants, non-Hispanic white immigrants and natives in Texas and California only
Shamsuddin (1998)	Income, Assets and Debts of Economic Families and Unattached Individuals, 1983-84	$B = Za + e$ $r^* = Xb + u$ $r = r^*$ if $B > 0$ $r = 0$ if $B \leq 0$ X = HC, D, Coh, I Z = HC, D, Coh, I, Children, Nonlabour income, Family debt	Tobit (Maximum Likelihood)	Assimilation over 1981-1984: 22.9% for males, 8.7% for females (inferred from cohort coefficients)	Sample of married couples

Yuengert (1994)	US Census 1970 and 1980	$r_n = Xb_n + u$ (immigrant earnings function not estimated) Explanatory variables: HC (quartic in experience, interaction with ed., controls for education quality)	OLS	Entry effect: 7.7% (1965-69 cohort in 1970) Assimilation rate: 17.9% over 10 years	Also calculates immigrant outcomes for individual national-origin groups

Studies limited to those providing estimates of entry and assimilation effects, either direct or indirect.

r = (log) annual earnings, w = (log) hourly wage, y = (log) income, HC = human capital (education, experience, weeks worked, typical hours/week, part-time status), HC_h = human capital acquired in home country, HC_a = human capital acquired abroad (for immigrants), D = demographic controls (location, marital status), L = language controls, H = health or disability controls, Occ = occupational controls, Ind = industry controls, Class = class of worker (self-employed, public/private sector), Size = size of workplace, I = immigrant (additive dummy), YSM = years since migration, Coh = controls for cohort (additive dummies), Org = country/region of origin (additive dummies), u = error term