Earnings Inequality and Earnings Instability of Immigrants in Canada

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Abstract

The deterioration of immigrants' entry earnings in Canada in the past three decades has been well documented. This study provides further insights into the changing fortunes of immigrants in Canada by focusing on their earnings inequality and earnings instability. The analysis is based on a flexible econometric model, which decomposes earnings inequality into current and long-term components. In addition to constructing earnings inequality and earnings instability profiles for different arrival cohorts, we also examine the underlying causes of earnings inequality including the impact of foreign education, birthplace and the ability to speak English or French.

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I. Introduction

Most of the literature on the evolution of immigrant earnings and economic progress of immigrants relies on a convenient benchmark such as, for instance, the earnings (income, wealth, employment rates, etc.) of the native-born. In many cases, this is an informative comparison, although matching immigrants to the native-born in a way that would make such a comparison meaningful is not always straightforward. In addition to the characteristics that immigrants and non-immigrants share, the economic performance of immigrants may depend on the age at immigration (Schaafsma and Sweetman, 2001; Ferrer and Riddell, 2003), language ability (Dustmann and Van Soest, 2002), share of foreign schooling and foreign experience in the total educational attainment and experience (Chiswick, 1978; Betts and Lofstrom, 2000; Friedberg, 2000; Green and Worswick, 2002; Smith, 2006) and country of birth (Jasso, Rosenzweig and Smith, 2000; Aydemir and Skuterud, 2005; Smith, 2006).

An altogether different approach to the issue of economic well-being of immigrants, which so far has received little attention in the literature is to look at the over-time changes in the distribution of immigrants' earnings and more specifically at the dynamics of *earnings inequality* and *earnings instability among immigrants*. Compared to the standard "immigrants vs. native-born" framework, this approach does not require the native-born as a reference point. Instead, it relies on the familiar lifecycle/permanent income theory and the concepts of permanent and transitory income components. An increase in income inequality is usually associated with a reduction in social welfare, although its impact must be considered in conjunction with earnings trends (Deaton, 1996; p. 136). A rise in earnings instability may lead to greater uncertainty and lower consumption, particularly if consumption smoothing is costly or impossible due to liquidity constraints (Browning and Lusardi, 1996; Browning and Crossley, 2001). Hence, an analysis of immigrant earnings inequality and earnings instability is a natural extension of the analysis of immigrant labour market outcomes. Combined with previous studies that compare labour market outcomes of immigrants with those of the native-born, an analysis of immigrant earnings instability and earnings inequality may provide further insights into immigrants' welfare dynamics and help assess the effectiveness of recent immigration policies.

A key feature of this study is that it distinguishes between current and long-term inequality in a way consistent with the recent studies on earnings inequality and earnings instability in Canada and the US (Gottschalk and Moffitt, 1994; Baker, 1997; Haider, 2001; Moffitt and Gottschalk, 2002; Baker and Solon, 2003, Beach *et al*., 2003). These studies incorporate several features of lifecycle earnings profiles such as, for instance, the heterogeneity of entry earnings and earnings growth rates. None of these studies, however, focuses specifically on immigrants.

Although an analysis of immigrants' inequality and instability dynamics may be informative in itself, ultimately we are interested in their underlying causes. In particular, it should be useful to relate earnings inequality and earnings instability to immigrants' education, language ability and cultural background. Such a link is particularly interesting since most of the immigrants to Canada came through the "skilled immigration" program which evaluates potential immigrants based on their age, education level, work experience and language proficiency. Hence, another critical aspect of this study is to gauge the effects of these variables on immigrants' earnings inequality and instability. All this is made possible thanks to a truly unique Statistics Canada data set described below.

Our major findings indicate that recent immigrant cohorts have higher levels of earnings inequality than those who came to Canada in the early 1980s. Although foreign education, the ability to speak one of the official languages and birthplace explain a large part of immigrants' earnings inequality, much of it remains unexplained by these factors. The transitory component of immigrant earnings volatility (earnings instability) dominates the permanent component (the long-term inequality) in the first several years after the arrival; later, however, the roles are reversed.

The paper begins with a brief overview of recent trends in immigrant assimilation in Canada (Section II). Section III discusses recently used models of instability and their relevance to this study. The estimation methods used in this study are presented in Section IV. Section V describes the data and

sample selection. Descriptive results are presented in Section VI followed by the estimation results in Section VII. Finally, Section VIII highlights major findings and offers possible conclusions.

II. Recent trends in immigrant worker assimilation in Canada

The economic performance of immigrants to Canada in the past 25 years has been a subject of numerous studies with mixed results. Immigrants to Canada are generally noted to be more educated but have less work experience compared to the Canadian-born (Frenette and Morissette, 2003). Increasingly, immigrants to Canada come from "non-traditional" sources and are members of visible minorities. Baker and Benjamin (1994) find that, similar to the US experience, the immigrants who arrived to Canada during the 1970s were not as successful in integrating into the Canadian labour market as those who had arrived in the previous decade; the entry earnings and assimilation rates of the former were considerably lower. They conclude that their picture of immigrant experience in the Canadian labour market is "fairly pessimistic" (p. 400). Grant (1999), on the other hand, shows that immigrants who came to Canada during the 1980's had better fortunes than previous cohorts; the entry level earnings were about the same at the beginning and end of the decade and the assimilations rates of immigrants in the 1980s were higher than the assimilation rates experienced by their predecessors. Frenette and Morissette (2003), who use the 1980-2000 census data to analyze the convergence rates of immigrant and non-immigrant earnings, argue that the relative entry earnings of immigrants declined drastically during this period and this trend was only partially offset by the greater relative earnings growth of recent immigrants. Despite an increasing number of university graduates among immigrants the relative earnings of immigrants did not improve between 1990 and 2000 and the low-income rates among immigrants rose substantially by the end of the decade.

The deterioration of immigrant entry earnings in Canada is further documented by Aydemir and Skuterud (2005) who explore its causes using the same census data as the previous study. They find that about one-third of the deterioration in immigrants' entry earnings can be explained by the shifting ethnic composition of immigrant cohorts. Although they find little evidence of the decline in the returns to foreign education, they find a strong evidence of the decline to the foreign labour market experience, which may account for somewhere between one-quarter and one-half of the overall deterioration in the entry earnings of immigrants.

In sum, the picture emerging from these and other studies seems to show the immigrants' integration into the Canadian labour market is becoming increasingly difficult. These results raise further questions which so far have not been answered. In particular, have these difficulties translated into growing inequality *among immigrants*? Have falling entry earnings been accompanied by increases in earnings instability among immigrants? What was the impact of changes in immigrant cohort composition on the changes in earnings inequality and earnings instability since the early 1980s? Although the immigrant wage dynamics are a very important indicator of immigrant economic progress, the picture is not complete without looking into other aspects of immigrant earnings dynamics, such as earnings inequality and earnings instability.

The distinction between current (cross-sectional) inequality and long-term inequality, however, is crucial in the analysis of earnings inequality and earnings instability. Changes in earnings inequality are usually related to fundamental skill-based technological changes, which make certain skills obsolete while creating a demand for new skills (worker attributes). Changes in earnings instability, on the other hand, are mostly related to increased competition, institutional changes or changes in trade regulations. Clearly, a snapshot of earnings inequality obtained from cross-sectional data confounds permanent and transitory components of earnings, so the source of current earnings inequality cannot be identified. Such separation can only be possible with panel data models; some of such models relevant to this study are discussed in the next section.

III. Models of earnings inequality

A general mechanism of examining earnings inequality and earnings instability was introduced by Gottschalk and Moffitt (1994) in a study of the growth of earnings instability in the US. It was further developed in Baker (1997), Haider (2001), Moffitt and Gottschalk (2002), and Baker and Solon (2003), who added considerably more flexibility into the earlier models.

The basic idea of the approach is that individual earnings (or rather log-earnings) in period t can be thought of as a sum of two orthogonal components, permanent and transitory, which evolve independently over time. A simple life-cycle model that incorporates dynamic changes in both components can be written as

$$y_{it} = p_t \alpha_i + \lambda_t v_{it}, \tag{1}$$

where y_{it} represents the (log) earnings of an individual i in period t, α_i and v_{it} are permanent and transitory components, and p_t and α_t are period-specific factor loading on each of these components. Note that $Cov(v_{it}, v_{is}) = 0$ in (1) implies that, unlike $Var(y_{it})$, $Cov(y_{it}, y_{is})$ does not depend on λ_t, so the source of cross-sectional inequality can be identified in a dynamic context from changes in autocovariances (Baker and Solon, 2003). Put otherwise, an increase in p_t leads to an increase in earnings inequality, both current and long term; an increase in λ_t, on the other hand, does not imply a long term effect. Such an increase can be thought of as an increase in person's earnings instability. Assuming that the permanent component measures the life-time earnings potential or skill, p_t can be interpreted as the price of skill which changes with changes in demand and supply for skill due to technological transformation or other types of economic restructuring (Moffitt and Gottschalk, 2002). In the context of immigrants' earnings, changes in p_t may reflect the general "quality" of immigrants' human capital, affecting their ability to adjust to technological changes in the host country as well as the diversity of immigrants' skills determined by immigration policies.

The model above can incorporate several additional features of earnings growth. For instance, the first term in (1) can incorporate heterogeneity in individual growth rates (Haider, 2001), or a random walk component that would allow for permanent changes (Moffitt and Gottschalk, 2002), or both (Baker and Solon, 2003), so (1) may take the following form

$$y_{it} = p_t(\alpha_i + \beta_i x_{it} + u_{it}) + \varepsilon_{it}, \tag{2}$$

where x_{it} is a set of variables determining growth rates, $u_{it} = u_{i,t-1} + r_{it}$ and ε_{it} represents the transitory component. The last term in (2) can also take a more flexible specification. Baker and Solon (2003) allow for serial correlation in the transitory component

$$\varepsilon_{it} = \rho \varepsilon_{i,t-1} + \lambda_t v_{it}, \tag{3}$$

and model the variance of v_{it} as a quartic function of age. Haider (2001), and Moffitt and Gottschalk (2002), on the other hand, assume an ARMA (1,1) specification.

By specifying the functional form of y_{it}, we also specify the functional form of the variance-covariance matrix of individual earnings, Ω, so that each element in Ω is expressed as $\omega_i = f(x_i; \theta)$, where θ is a set of parameters which includes p_t and λ_t. Crucially, unlike the model in (2), θ does not include individual specific parameters α_i and β_i. Instead, it includes $\sigma_\alpha^2, \sigma_\beta^2$ as well as $\sigma_{\alpha\beta}$. The parameters of the resulting model are usually estimated using the generalized method of moments (GMM) based on minimizing the distance between the observed sample moments (elements of $\hat{\Omega}$) and $f(x_i; \hat{\theta})$. The parameter estimates $\hat{\theta}$ are used to construct the profiles of earnings inequality and earnings instability.

IV. Estimation method

Consider now an immigrant *i* who arrived in year *c* (a member of arrival cohort *c*) at the age of *j*. The earnings of this person in year *t* can be described with a fair degree of flexibility by

$$\log Y_{cjit} = \mu_{cjt} + y_{cjit}, \tag{4}$$

where μ_{cjt} is the mean log earnings in each *cjt* cell. Equation (4) is the first stage estimation equation which extracts the individual earnings component from the earnings dynamics of the arrival cohort. A two stage approach is standard in the literature on earnings inequality and earnings instability; however, in some studies $\hat{y}_{cjit}$ are obtained by regressing log-earnings on an age polynomial (Haider, 2001; Beach *et al.,* 2003; Morissette and Ostrovsky, 2005). The approach above appears more flexible in the context of this study.

After obtaining, $\hat{y}_{cjit}$ from the first stage regression, the variance of $\hat{y}_{cjit}$ can be decomposed into between and within components. In the descriptive part of this study, it is simply assumed (as in Beach *et al.,* 2003, for instance) that $y_{cjit} = \mu_{cji} + v_{cjit}$, and both variance components are computed following the formulas in Johnston (1984)[2]. As different arrival cohorts are observed for a different number of years (for instance, the 1980-1982 cohort is observed for 22 years, while the 1998-2000 cohort is observed for only 4 years) it would be difficult to make a cross-cohort comparison of inequality and instability if calculations were made for all *t*'s in which a cohort is observed. To make results comparable across cohorts, the decomposition is computed for a fixed number of post-arrival periods: *t=4* (all cohorts), *t=7* (all cohorts except 1998-2000) and *t=10* (all cohorts except 1995-1997 and 1998-2000). For instance, if *t=4* then the variance for the 1980-1982 arrival cohort is computed based on 1983, 1984, 1985 and 1986; the variance for the 1983-1985 arrival cohort is computed based on 1986, 1987, 1988 and 1989; and so on. The resulting panels are unbalanced because, for instance, in four-year panels those who were present for only two or three periods are also included; similarly, seven-year panels include those who were observed for five or six periods and ten-year panels include those who were observed for eight or nine periods.

As mentioned in the introduction, the goal of this study is not only to document immigrant earnings inequality and earnings instability but to analyse their potential causes, in particular the role of pre-arrival education, language ability and country of birth. The effects of these variables can be estimated by adding control variables into the first stage equation, re-estimating y_{cjit} and using the new estimates of y_{cjit} on the second stage. More specifically, equation (4) takes the following form

$$\log Y_{cjit} = \mu_{cjt} + \phi_{cjt}\Theta(X_{cji}, L_{cji}, B_{cji}) + y_{cjit}, \tag{5}$$

where X_{cjit} is foreign education measured by the years of schooling, L_{cji} is a set of dummy variables reflecting the ability to speak either official language or both, and B_{cji} is the set of dummies related to the place of birth. A model which includes either X_{cjii}, L_{cjit}, B_{cjit}, or the full set can be estimated. Hence, we can not only compare measures of earnings inequality and earnings instability across different arrival cohorts and arrival ages but also see the degree to which the earnings inequality and instability of each cohort are influenced by these variables. In the context of the Canadian immigrant selection process based on a point system that rewards foreign education and the ability to speak one of the official Canadian languages, such analysis may be particularly useful.

Although this is a very simple and intuitive method of analysing inequality and instability, it has obvious drawbacks. First, and most importantly, it does not allow for overtime changes in either permanent or transitory components. Second, it does not allow for the heterogeneity in earnings growth (as opposed to the heterogeneity in the levels of earnings). Finally, it ignores serial correlation in the

[2] See also Morissette and Ostrovsky (2005).

transitory component. Hence, we will consider a more flexible model similar to the models in Haider (2001) and Baker and Solon (2003).

We proceed as follows. Similar to (2), individual earnings of the members of c^{th} arrival cohort who were *j*-years old at arrival are assumed to follow

$$y_{cjit} = p_t(\alpha_{cji} + \beta_{cji}t_c + \gamma_{cji}Z_{cji} + u_{cjit}) + \varepsilon_{cjit}, \quad (6)$$

where $u_{cjit} = u_{cji,t-1} + r_{cjit}$ and $\varepsilon_{cjit} = \rho\varepsilon_{cji,t-1} + \lambda_t v_{cjit}$. Hence, total experience is broken down into two components: (1) "Canadian experience", t_{cj}, which is the same for all members of the c^{th} arrival cohort, and (2) potential foreign experience Z_{cji}, simply defined as the age at arrival minus 25. From the residuals in (4), a sample auto-covariance matrix is constructed for each cohort and arrival age. For instance, for those who arrived during the 1980-1982 period at the age of 30, this will be a 22×22 matrix (t=1983, 1984, …, 2004); for those who arrived during the 1995-1997 period at the age of 30 this will be a 7×7 matrix (t=1998, 1999, …, 2004). The size of the matrix will depend on both c and j; as the total number of arrival cohorts is seven, then for $j \in [25,49]$ there will be 7×25=175 auto-covariance matrices Ω_{cj} in total, which will produce 13615 sample moments.

Let $\omega_{cj} = \left(\omega_{cj11}, \omega_{cj12}, ..., \omega_{cj1M}, \omega_{cj22}, \omega_{cj23}, ..., \omega_{cj2M}, ..., \omega_{cjMM}\right)'$ be a vector of unique elements in Ω_{cj},, where $M \times M$ is the size of each Ω_{cj} matrix depending on c and j. All ω_{cj} can be stacked into a single vector Ω so that each diagonal element ω_{cjt} in Ω_{cj} can be written as

$$\omega_{cjt} = p_t^2(\sigma_{\alpha_c}^2 + \sigma_{\beta_c}^2 \cdot t_c^2 + 2\sigma_{\alpha\beta} \cdot t_c + \sigma_\gamma^2 Z_{cj}^2 + 2\sigma_{\beta\gamma_c} Z_{cj} t_c + 2\sigma_{\alpha\gamma_c} Z_{cj} + t_c\sigma_r^2) + \sigma_{\varepsilon_t}^2 \quad (7)$$

and each off-diagonal element ω_{cjts} as

$$\omega_{cjt} = p_t p_s(\sigma_{\alpha_c}^2 + \sigma_{\beta_c}^2 \cdot t_c s_c + \sigma_{\alpha\beta} \cdot (t_c + s_c) + \sigma_\gamma^2 Z_{cj}^2 + \sigma_{\beta\gamma_c} Z_{cj}(t_c + s_c) + 2\sigma_{\alpha\gamma_c} Z_{cj} + t_c\sigma_r^2) + \sigma_{\varepsilon_t\varepsilon_s}, s \geq t. \quad (8)$$

The transitory variance component $\varepsilon_{cjit} = \rho\varepsilon_{cji,t-1} + \lambda_t v_{cjit}$ takes the form of

$$\sigma_{\varepsilon_t}^2 = \rho^{2t}\sigma_{\varepsilon_0}^2 + \rho^{2(t-1)}\lambda_1^2\sigma_{v_1}^2 + \rho^{2(t-2)}\lambda_2^2\sigma_{v_2}^2 + \rho^{2(t-3)}\lambda_3^2\sigma_{v_3}^2 + ... + \rho^2\lambda_{t-1}^2\sigma_{v_{t-1}}^2 + \lambda_t^2\sigma_{v_t}^2 \quad (9)$$

and the covariance takes the form of $\sigma_{\varepsilon_t\varepsilon_s} = \sigma_{\varepsilon_t}^2 \cdot \rho^{(s-t)}, s \geq t$ As in Baker and Solon (2003), σ_v^2 can be modelled as a quadratic or quartic function of t and Z_{cj}. In particular, it may be written as

$$Var(v_{cjt}) = g_0 + g_1 t_c + g_2 t_c^2 + g_3 t_c^3 + g_4 t_c^4 + mZ_{cj}. \quad (10)$$

Assuming that $\Omega^* = f(t,s,Z;\theta)$ is the population analog of Ω, we can now estimate the set of model parameters $\theta = (p_t, \sigma_\alpha^2, \sigma_\beta^2, \sigma_{\alpha\beta}, \sigma_\gamma^2, \sigma_{\alpha\gamma}, \sigma_{\beta\gamma}, \lambda_t^2, \sigma_v^2, \sigma_{\varepsilon_c}^2, \rho, g_0, g_1, g_2, g_3, g_4, m)$ by the generalized method of moments (GMM) using 13,615 sample moment corresponding to 13,615 elements in Ω

$$E\left[\Omega - f(t,s,Z;\hat{\theta})\right] = 0. \quad (11)$$

The parameters in (11) can be estimated using a GMM minimum distance estimator which chooses on optimal set of parameter estimates $\hat{\theta}$ by minimizing

$$\Delta = \left[\Omega - f(t,s,Z;\hat{\theta})\right]' W \left[\Omega - f(t,s,Z;\hat{\theta})\right]. \quad (12)$$

Haider (2001) and Baker and Solon (2003) point out the advantages of using an identity matrix as a weighting matrix in place of W (see also Altonji and Segal, 1996; Clark, 1996). One particular source of efficiency loss in equally-weighted minimum distance estimator is that it ignores the fact that ω_{cj} elements of Ω are based on a different number of observations. A more efficient estimator may be obtained if sample moments are weighted in proportion to the size of each *cj* cell. The estimation results

in this study are based on a minimum-distance estimator that uses both an identity matrix as a weighting matrix and a weighting matrix which weights the sample moments according to their sample sizes.

It can be seen from (7) that setting $p_{1983}=1$ ($t=0$) identifies σ^2_{α} in a model with a single σ^2_{α} parameter in the growth term. In a full model with cohort-specific parameters $\sigma^2_{\alpha_c}$ in the growth term, it is assumed that $\alpha_i = \frac{\alpha^*_i}{p_{t^*}}$, where t^* is the first loading factor for the cohort to which i belongs. For instance, for the 1980-1982 cohort t^*=1983; for the 1983-1985 cohort t^*=1986; and so on. A diagonal element in Ω_{cjt} can now be expressed as

$$\omega_{cjt} = p_t^2\left[\frac{\sigma^2_{\alpha^*_c}}{p^2_{t^*}} + \sigma^2_{\beta_c}\cdot t_c^2 + 2\sigma_{\alpha\beta_c}\cdot t_c + \sigma^2_{\gamma}Z^2_{cj} + 2\sigma_{\beta\gamma_c}Z_{cj}t_c + 2\sigma_{\alpha\gamma_c}Z_{cj} + t_c\sigma^2_r\right] + \sigma^2_{\varepsilon_t}.$$

Hence, assuming $Z_{cj}=0$, the permanent variance component for the 1980-1982 cohort in year 1983 ($t=0$) is $p^2_{1983}\sigma^2_{\alpha_{1980-1982}} = p^2_{1983}\left[\frac{1}{p^2_{1983}}\sigma^2_{\alpha^*_{1980-1982}}\right] = \sigma^2_{\alpha^*_{1980-1982}}$; for the 1983-1985 cohort it is $p^2_{1986}\sigma^2_{\alpha_{1983-1985}} = \sigma^2_{\alpha^*_{1983-1985}}$, and so on. Put otherwise, all $\sigma^2_{\alpha^*_c}$ "absorb" the first loading factor for the cohorts they represent. The estimates of $\sigma^2_{\alpha^*_c}$ can be used instead of $\hat{\sigma}^2_{\alpha_c}$ to construct cohort-specific profiles of immigrant earning inequality.

V. Data and sample

The Longitudinal Administrative Database (LAD) is the 20% random sample based on annual information provided on personal tax returns. Once selected, individuals are in the sample whenever they file a tax return. To keep the sample current, a part of each year's sample consists of individuals who file for their returns for the first time. For instance, the first year of LAD is 1982, so the 1982 LAD is simply a 20% sample of all files in 1982. The 1983 sample consists of those selected in 1982 who also filed in 1983 plus a sample of those who filed for the first time in 1983. The total of these two groups is a 20% sample of all filers in 1983. This scheme allows annual increases in LAD sample parallel the annual increases in the Canadian population.

Merged with LAD, the Longitudinal Immigration Database (IMDB) provides a direct link between immigration records and the economic performance of immigrants. A person is included in the database only if he or she obtained their landed immigrant status since 1980 and filed at least one tax return after becoming a landed immigrant. Each year the IMDB is updated with a new cohort of landings. Moreover, in each new tax year there are new entrants from previous landing cohorts, not just the newly added cohort, who have filed (or are matched) for the first time. There are also those immigrants who have filed previously, but have not filed in that year. These immigrants remain in the IMDB as they could file in future years. By linking IMDB (1980-2000) with LAD (1982-2004) we can observe the earnings of those who became landed immigrants during the 1980-2000 period from 1982 to 2004. Seven immigrant cohorts are considered: 1980-1982, 1983-1985, 1986-1988, 1989-1991, 1992-1994, 1995-1997, 1998-2000. The three year band is chosen based on a trade-off between the size of each cohort and the total number of cohorts.

The earnings variable used in the study is as a sum of two LAD variables. The first variable is the employment income from T4 slips issued to the individual; that is all paid-employment income (except self-employment income) including wages, salaries and commissions before deductions. The second variable is the so-called 'other employment income', which captures taxable employment income other than wages, salaries and commissions (tips, gratuities or director's fee that are not reported on a T4 slip).

The immigrant's years of schooling at landing are the number of years of formal schooling (top coded at 25 years) successfully completed by the time of arrival to Canada. The official languages ability indicator is the self-reported ability to communicate in either French or English, or both. Finally, the immigrant's country of birth is identified based on a list of countries, including countries that no longer exist or recognized as a nation state[3]. All countries are divided into nine regions of birth based on religious, ethnic and historical considerations (Appendix A).

The sample includes all male immigrants in IMDB, who were at least 24 years old in the year they became landed immigrants and had positive earnings in the year following the last year in the cohort band[4]. This restriction insures that the persons in the sample had done all or most of their schooling outside Canada and entered the Canadian labour market soon after arrival. Persons were kept in the sample for as long as they had positive earnings and were under 55 years old, for a minimum of 2 periods. The structure of the resulting panel is similar to the one adopted by Haider (2001). Although it has its drawbacks, the alternatives – a fully balanced or a fully unbalanced panel – appear to be worse. A fully balanced panel, for instance, would require immigrants from the 1980-1982 cohort to have 22 years of positive earnings to be in the sample, leaving us with a very narrow sample of immigrants from this cohort: those who entered the Canadian labour market at a young age and had a strong attachment to the labour market. At the other extreme, immigrants from the 1998-2000 cohort would only need four years of positive earning to be in the sample and would include those who came to Canada in their late forties. These differences in the "age-at-arrival" distributions would make cross-cohort comparisons very difficult. A fully unbalanced panel, on the other hand, which would allow for a later entry and/or re-entry into the sample of those who had zero earnings in some years, would also allow for a possibility of school attendance during these years. At a minimum, a "delayed entry" of those who attended school in Canada *prior to* entering the labour market would create differences in the timing of the earnings profiles within each arrival cohort, making cohorts' inequality and instability profiles difficult to interpret. There is also evidence that the earnings profiles of immigrants who attended school in Canada may be quite different from the earnings profiles of those with only foreign education (see Schaafsma and Sweetman, 2001, for a discussion).

As we focus on immigrants whose main income source is employment income (wages and salaries), we exclude immigrants with self-employment income greater than $100 (in 2004 dollars) in absolute terms. Some immigrants report very small annual earnings. Retaining these observations in the sample would allow some zero earners to escape deletion "on technicality". To avoid this, annual earnings of less than $50 were reset to zero. The summary of sample averages and percentages of immigrants in different categories is given in Appendix Table B1.

VI. Descriptive analysis

We begin by estimating the individual component of immigrant earnings in (4). To obtain y_{cjit} we simply demean $\log Y_{cjit}$ within each *cjt* (cohort×arrival age×year) cell by regressing $\log Y_{cjit}$ on a constant. Later, additional explanatory variables will be added to this regression to determine their effect on earnings inequality and earnings instability. In what follows, computations are performed for each *c* and *j* separately so subscripts *c* and *j* are dropped to simplify notation. Table 1 shows the results of variance decomposition for all immigrants in each cohort and for different arrival age groups within each cohort (the results in the table are for *t=4* and *t=10* only; a full table for *t=7* is available from the author [Supplementary Appendix Table C1]). The between and within variances do not sum up to the total variance because the panels are unbalanced. For all cohorts, the between component is larger than the within component, although the between-within difference differs from cohort to cohort.

[3] The list, for instance, includes the Czech Republic, the Slovak Republic and Czechoslovakia.

[4] For instance, if the person arrived between 1983 and 1985, he would be included in the sample if he filed for tax return and had positive earnings in 1986.

The first notable result sheds some light on the issue of *whether earnings inequality among recent immigrants is higher than among those who arrived to Canada in the past*? The between variance component computed for the first four periods after arrival (*t=4*) is 46 percent higher for the 1998-2000 cohort and 28 percent higher for the 1995-1997 than for the 1980-1982 cohort. For *t=7* the comparison between 1998-2000 and 1980-1982 is not available; however, the between variance computed for the 1995-1997 period is 27 percent higher than for the 1980-1982 period (0.424 compared to 0.335).

Table 1. "Between-within" variance decomposition of immigrant earnings, by arrival cohort and age at arrival

		1980-1982		1983-1985		1986-1988		1989-1991		1992-1994		1995-1997	1998-2000
Arrival age		*t=4*	*t=10*	*t=4*	*t=10*	*t=4*	*t=10*	*t=4*	*t=10*	*t=4*	*t=10*	*t=4*	*t=4*
all	**St. dev(u)**	0.67	0.52	0.72	0.56	0.76	0.52	0.88	0.54	0.85	0.57	0.87	0.97
	between	0.46	0.30	0.47	0.31	0.44	0.28	0.54	0.29	0.56	0.33	0.58	0.67
	within	0.26	0.22	0.30	0.25	0.37	0.24	0.42	0.26	0.37	0.25	0.36	0.39
25-29	**St. dev(u)**	0.65	0.51	0.69	0.58	0.75	0.51	0.85	0.52	0.80	0.54	0.88	0.92
	between	0.43	0.28	0.41	0.29	0.42	0.26	0.49	0.27	0.49	0.29	0.57	0.63
	within	0.27	0.24	0.33	0.29	0.38	0.25	0.44	0.26	0.38	0.25	0.38	0.35
30-34	**St. dev(u)**	0.63	0.49	0.66	0.46	0.71	0.50	0.88	0.54	0.80	0.55	0.82	1.03
	between	0.41	0.28	0.45	0.27	0.42	0.27	0.55	0.29	0.56	0.32	0.55	0.69
	within	0.26	0.22	0.25	0.20	0.34	0.24	0.42	0.26	0.34	0.23	0.36	0.43
35-39	**St. dev(u)**	0.66	0.52	0.74	0.60	0.74	0.54	0.88	0.54	0.88	0.60	0.91	0.97
	between	0.48	0.34	0.50	0.36	0.42	0.30	0.56	0.30	0.56	0.35	0.63	0.68
	within	0.23	0.18	0.29	0.25	0.39	0.25	0.39	0.25	0.39	0.26	0.34	0.38
40-44	**St. dev(u)**	0.75	0.56	0.84	0.61	0.82	0.54	0.93	0.62	0.92	0.59	0.85	0.96
	between	0.54	0.35	0.62	0.39	0.48	0.33	0.58	0.36	0.65	0.36	0.58	0.67
	within	0.25	0.21	0.26	0.22	0.38	0.21	0.41	0.26	0.38	0.24	0.37	0.39
45-49	**St. dev(u)**	0.81	-	0.79	-	0.93	-	0.96	-	1.01	-	0.94	0.91
	between	0.55	-	0.52	-	0.61	-	0.62	-	0.71	-	0.61	0.64
	within	0.32	-	0.34	-	0.41	-	0.45	-	0.41	-	0.39	0.35

Source: Longitudinal Administrative Databank, 1983-2004; Immigration Database, 1980-2000

Finally, for *t=10* the between variance is about 9 percent higher for the 1992-1994 cohort than for the 1980-1982 cohort. This is considerably lower than the 16 percent difference between these cohorts computed for *t=7* (0.389 compared to 0.335) and 23 percent difference computed for *t=4* (0.560 compared to 0.456). Judging by these results, more recent immigrant cohorts experience much higher earnings inequality in the first several years after arrival than previous cohorts; however, in the longer run the cross-cohort differences may not be as pronounced and all immigrant cohorts eventually reach comparable levels of earnings inequality.

The within variance component appears to follow more pro-cyclical paths. For instance, those who arrived during the 1989-1991 period and entered the labour market in the midst of the 1990-1993 recession, have the highest four-year within variance. Not surprisingly, however, computed for seven and ten-year periods, the within variances for this cohort are almost the same as the within variances of two previous cohorts. Generally, those who entered the labour market in the mid-1980s have substantially

smaller $\sigma^2_{within,t=4}$ than those who entered the labour market later. As may be expected, the cross-cohort differences are smaller for *t=7* and *t=10* although even in these cases the within variance computed for the 1980-1982 cohort is considerably lower than for any other cohort.

Breaking these trends down by arrival age groups, we find that while for the earlier cohorts the between variance is considerably higher for older immigrants than for younger ones, there is little cross-age difference for the recent cohorts. The cross-age equalization appears to be mostly due to the rising between variance among younger immigrants. The $\sigma^2_{between,t=4}$ is 47 percent higher for the 1980-1982 cohort than for the 1998-2000 cohort (0.627 compared to 0.427) in the 25-29 category, 68 percent higher in the 30-34 category (0.692 compared to 0.413) and only 16 percent higher in the 45-49 age category (0.635 compared to 0.549). Hence it appears that cross-cohort differences in between variance are mostly driven by the rising inequality among immigrants who arrived at younger ages. The between variances computed for *t=7* and *t=10* follow similar patters.

Table 2. The "between-within" variance decomposition of immigrant earnings for models with no controls and with controls for foreign schooling, language ability and origin; by arrival cohort

		1980-1982		1983-1985		1986-1988		1989-1991		1992-1994		1995-1997	1998-2000
		t=4	*t=10*	*t=4*	*t=10*	*t=4*	*t=10*	*t=4*	*t=10*	*t=4*	*t=10*	*t=4*	*t=4*
No	**st. dev(u)**	0.67	0.52	0.72	0.56	0.76	0.52	0.88	0.54	0.85	0.57	0.87	0.97
conrols	**between**	0.46	0.30	0.47	0.31	0.44	0.28	0.54	0.29	0.56	0.33	0.58	0.67
	within	0.26	0.22	0.30	0.25	0.37	0.24	0.42	0.26	0.37	0.25	0.36	0.39
Contr.	**st. dev(u)**	0.63	0.47	0.69	0.52	0.73	0.49	0.87	0.52	0.82	0.53	0.83	0.94
for	**between**	0.42	0.26	0.44	0.27	0.42	0.26	0.53	0.27	0.53	0.29	0.55	0.64
educ.	**within**	0.26	0.22	0.30	0.25	0.37	0.24	0.42	0.26	0.37	0.25	0.36	0.39
lang.	**st. dev(u)**	0.61	0.46	0.69	0.53	0.72	0.49	0.86	0.53	0.83	0.55	0.85	0.94
ability	**between**	0.40	0.25	0.45	0.28	0.41	0.26	0.52	0.28	0.54	0.31	0.56	0.63
	within	0.26	0.22	0.29	0.25	0.37	0.24	0.42	0.26	0.37	0.25	0.36	0.39
origin	**st. dev(u)**	0.58	0.44	0.64	0.51	0.70	0.48	0.83	0.52	0.79	0.53	0.82	0.92
	between	0.37	0.23	0.39	0.26	0.39	0.25	0.49	0.27	0.50	0.29	0.53	0.62
	within	0.26	0.22	0.30	0.25	0.37	0.24	0.42	0.26	0.37	0.25	0.36	0.39
all	**st. dev(u)**	0.55	0.41	0.62	0.47	0.66	0.45	0.81	0.48	0.75	0.49	0.77	0.87
	between	0.34	0.20	0.37	0.23	0.35	0.22	0.46	0.23	0.46	0.25	0.49	0.57
	within	0.26	0.22	0.29	0.25	0.37	0.24	0.42	0.26	0.37	0.25	0.36	0.39

Source: Longitudinal Administrative Databank, 1983-2004; Immigration Database, 1980-2000

Table 2 shows the effect of education, language ability and origin on earnings inequality and earnings instability. As mentioned above, this is achieved by adding each of these explanatory variables into the first-stage regression and then re-computing variance decomposition. Although controlling for education, language and origin has a clear impact on inequality, it has very little effect on instability. This is not surprising considering the differences in the sources for inequality and instability. Education, language and cultural background are skill related characteristics which are absorbed into the persistent component of earnings variability and have a long-term effect. Controlling for the birthplace brings about

the largest reduction in $\sigma^2_{between,t=4}$ for all arrival cohorts. The relative effect of education and language ability, on the other hand, is different for different cohorts. For most cohorts, the effects of foreign education and language ability are similar for *t=4*; the impact of foreign education is somewhat weaker for the 1980-1982 and 1986-1988 cohorts but stronger for the 1995-1997 cohort. On the other hand, the effect of foreign education seems to grow when we consider $\sigma^2_{between,t=10}$. For instance, for the 1989-1991 and 1992-1994 cohorts, $\sigma^2_{between,t=4}$ is about the same both categories, while $\sigma^2_{between,t=10}$ is smaller for foreign education.

These results provide an interesting insight into the role of foreign education in the economic progress of immigrants. Although shortly after arrival foreign education may have less impact on labour market prospects of immigrants than more easily recognizable skills such as the ability to speak English or French, in the longer run, immigrants to Canada with higher educational attainment have a greater ability to adjust to the demands of the Canadian labour market.It is also worth pointing out that even after controlling for all three factors, a large part of immigrant earnings inequality remains unexplained. For *t=4*, controlling for all three variables reduces the between variance by 14-26 percent, depending on a cohort; for *t=10*, the reduction is between 20 and 35 percent. Furthermore, the combined effect of language, education and birthplace appears to be stronger for earlier cohorts. For the 1980-1982 cohort, for instance, controlling for al three variables reduces $\sigma^2_{between,t=4}$ by 26 percent (35% for *t=10*) compared to 17 percent for the 1992-1994 cohort (24% for *t=10*) and 15 percent for the 1998-2000 cohort.

Differences in education, the ability to speak one of the official languages or ethnic background can be broadly viewed as differences in cohorts' human capital, so the impact of these variables should be absorbed in the between variance component. The within variance component, on the other hand, measures the 'unexplained' earnings variation which is not skill related. It may be related, among other things, to local labour market fluctuations or seasonal oscillations in the demand for goods and services. Although the within variance may be affected indirectly by the changes in the cohort skill composition, controlling for education, language and ethnic background should not have any direct effect on the within variance. Indeed, Table 2 shows that *the between variance component absorbs virtually all the effect of controlling for extra variables in the first-stage regressions*. This result holds both for *t=4* and *t=10*.

In sum, the descriptive results seem to indicate that (1) earnings inequality accounts for a larger portion of the immigrant earnings dispersion than earnings instability, (2) earnings inequality is higher for more recent cohorts than for those who arrived in the early 1980s, (3) earnings instability is pro-cyclical: immigrants who arrived just before or during the recession in the early 1990s have experienced higher levels of earnings instability than earlier cohorts, (4) the region of birth has the strongest impact on earnings inequality, while the impacts of foreign education and the ability to speak an official language vary from cohort to cohort and across arrival age groups, (5) although controlling for education, language ability and origin reduces earnings inequality it has very little effect on earnings instability, and (6) even after controlling for education, language and birthplace, a large portion of immigrant earnings inequality remains unexplained. In the next section, we will examine cohorts' earnings inequality and earnings instability dynamics using a more flexible econometrics model.

VII. Estimation results

The $\hat{y}_{it}$'s obtained from the first stage estimation regression described in the previous section can be used to estimate parameters of a more flexible model discussed in Section IV using a GMM minimum distance estimator in (12).

We first consider three models with common $\sigma^2_\alpha, \sigma^2_\beta, \sigma_{\alpha\beta}, \sigma_{\alpha\gamma}$ and $\sigma_{\beta\gamma}$ for all cohorts. This specification is almost identical to the specification in Baker and Solon (2003) but with a different set of explanatory variables. Instead of "potential experience" used in most earnings inequality and earnings

instability studies, the set of explanatory variable is chosen to be more consistent with the context of immigrant studies. The total potential experience is divided into "Canadian experience" (also the age of the cohort) and "potential foreign experience", simply defined as the age at arrival minus 25.

Tables 3 and 4 show estimation results for a model in which $var(v_{it})$ is defined according to (10) (a model in which $var(v_{it})$ depends only "Canadian experience" produces very similar results). For identification, the first-year factor loadings are normalized to 1 (that is $p_{1983}=1$ and $\lambda_{1984}=1$).

Table 3. Parameter estimates related to the permanent component for models with common variances in the growth term

	EW: Equaly weighted		*SW:S ample-size weighted*	
	coef	**st. error**	**coef**	**st. error**
p1984	0.939	0.031	0.950	0.024
p1985	0.909	0.031	0.923	0.025
p1986	0.888	0.027	0.896	0.022
p1987	0.892	0.027	0.903	0.022
p1988	0.884	0.027	0.904	0.023
p1989	0.865	0.025	0.867	0.019
p1990	0.881	0.025	0.862	0.019
p1991	0.938	0.026	0.916	0.021
p1992	0.921	0.025	0.903	0.019
p1993	0.907	0.025	0.882	0.019
p1994	0.911	0.025	0.864	0.019
p1995	0.898	0.025	0.886	0.018
p1996	0.904	0.025	0.903	0.019
p1997	0.927	0.025	0.905	0.019
p1998	0.917	0.025	0.917	0.019
p1999	0.883	0.024	0.895	0.019
p2000	0.861	0.024	0.886	0.018
p2001	0.870	0.024	0.909	0.019
p2002	0.861	0.024	0.900	0.019
p2003	0.864	0.024	0.909	0.019
p2004	0.874	0.024	0.934	0.019
sr	0.010	0.002	0.011	0.001
sig2_α	0.299	0.017	0.293	0.012
sig2_β	5.4E-04	9.4E-05	5.4E-04	7.2E-05
sig2_γ	2.7E-05	3.6E-05	6.7E-10	2.7E-05
sig_αβ	-7.0E-03	7.5E-04	-7.6E-03	5.2E-04
sig_αγ	3.5E-03	5.1E-04	4.2E-03	3.6E-04
sig_βγ	-2.1E-05	3.4E-05	-1.4E-04	2.8E-05

Source: Longitudinal Administrative Databank, 1983-2004; Immigration Database, 1980-2000

Consider first the coefficients related to the permanent variance component, which include $\sigma_\alpha^2, \sigma_\beta^2, \sigma_\gamma^2, \sigma_{\alpha\beta}, \sigma_{\beta\gamma}, \sigma_{\alpha\gamma}, \sigma_r^2$ and p_t (Table 3). The first parameter, σ_α^2, reflects the intercept heterogeneity in (10) and is assumed to be common for all cohorts. Given the $p_{1983}=1$ normalization, it also represents the 1983 permanent variance component for immigrants from the 1980-1982 arrival cohort who had no potential foreign experience (t and Z equal zero and $p_t=1$ in (10)). The estimates of $\sigma_\alpha^2, \sigma_\beta^2, \sigma_{\alpha\beta}$ and σ_r^2 are significant at the 95% level. Consistent with previous studies on earnings

inequality, the estimates of $\sigma_{\alpha\beta}$ are significantly negative. In the immigrant context this trade-off between entry earnings and subsequent earnings growth is quite intuitive: those whose entry wages are higher may expect lower earnings growth rates. The estimate of the variance of the random walk component is 0.010-0.011 in all models.

Table 4. Parameter estimates related to the transitory component for models with common variances in the growth term

	Equaly weighted		*Sample-size weighted*	
	coef	**st. error**	**coef**	**st. error**
λ1985	0.946	0.077	0.870	0.058
λ1986	0.883	0.077	0.941	0.058
λ1987	1.059	0.063	1.020	0.047
λ1988	1.098	0.067	1.059	0.053
λ1989	1.176	0.071	1.194	0.056
λ1990	1.192	0.065	1.149	0.045
λ1991	1.429	0.075	1.386	0.053
λ1992	1.526	0.081	1.520	0.058
λ1993	1.354	0.070	1.347	0.048
λ1994	1.279	0.069	1.301	0.049
λ1995	1.267	0.071	1.270	0.050
λ1996	1.270	0.067	1.230	0.045
λ1997	1.152	0.065	1.189	0.046
λ1998	1.147	0.068	1.116	0.046
λ1999	1.272	0.067	1.254	0.046
λ2000	1.262	0.068	1.225	0.046
λ2001	1.356	0.073	1.297	0.050
λ2002	1.422	0.072	1.406	0.050
λ2003	1.404	0.073	1.374	0.050
λ2004	1.408	0.076	1.332	0.051
ρ	0.456	0.008	0.468	0.005
s0_1983	0.427	0.029	0.399	0.021
s0_1986	0.496	0.023	0.484	0.020
s0_1989	0.353	0.022	0.320	0.015
s0_1992	0.649	0.022	0.634	0.012
s0_1995	0.707	0.022	0.678	0.012
s0_1998	0.726	0.022	0.715	0.012
s0_2001	0.808	0.021	0.808	0.012
g0	0.338	0.033	0.347	0.024
g1	-0.056	0.007	-0.059	0.006
g2	0.006	0.001	0.006	0.001
g3	-2.7E-04	7.8E-05	-3.2E-04	7.2E-05
g4	4.9E-06	1.9E-06	6.3E-06	1.8E-06
m	-8.4E-04	2.4E-04	-1.4E-03	2.1E-04

Source: Longitudinal Administrative Databank, 1983-2004; Immigration Database, 1980-2000

Arriving to a new country at an older age may affect the economic progress of immigrants in more ways than one. The estimates of $\sigma_{\alpha\gamma}$ in the third model are negative and significant, meaning that arrival age is negatively correlated with entry earnings: those who arrive at an older age are more likely to

have lower entry earnings. The interpretation of the negative and significant estimates of $\sigma_{\beta\gamma}$ is also straightforward: the earnings of those who arrive at an older age are likely to grow at a slower pace than the earning of those who arrive at a younger age. The direct effect of the arrival age heterogeneity on earnings variance appears to be weak. In both models, the estimates of σ_{γ}^2 are very small and not significant at the 95% level.

The profile of yearly factor loadings p_t gives us some idea about the changes in the persistent variance component of immigrants' earnings during the 1983-2004 period. All models show declining yearly effects during the 1980s, rising sharply during the recession of the early 1990s. The results based on equally-weighted (EW) MD estimators suggest a substantial decline in inequality in the late1990s; the results based on sample-weighted (SW) estimators show a smaller decline in the late 1990s and subsequent rise in earning inequality at the beginning of the 2000s.

Although a single profile of p_t can be easily interpreted, it also has a serious drawback. The three starting points of the profile, for instance, are estimated only on those immigrants, who arrived to Canada in 1980-1982, and just entered the labour market. The last three points, on the other hand, are estimated on the mix of all arrival cohorts in the sample: those who arrived recently as well as those who had lived in Canada for a considerable period of time. Hence, although it appears that the early 1980s were years with high levels of earnings inequality, compared to the mid- and late 1990s, this result is clearly related to the fact that this portion of the profile is estimated on cohorts, which arrived just prior to this period. Hence, given the nature of the sample, a common p_t-profile, for instance, provides a somewhat misleading picture of immigrant earnings inequality dynamics. An alternative, is to focus on cohort-specific profiles by considering a more flexible model with cohort-specific $\sigma_{\alpha}^2, \sigma_{\beta}^2, \sigma_{\alpha\beta}, \sigma_{\alpha\gamma}$ and $\sigma_{\beta\gamma}$.

Before we consider a more flexible specification which allows for cohort specific parameters in the permanent variance component, let us examine the parameters related to the transitory variance component (Table 4). This variance component is determined by the "initial variances" $\sigma_{\varepsilon_0}^2$, factor loadings λ_2, parameters g_0, g_1, g_2, g_3 and g_4, and parameter m in the second model. By allowing cohort-specific initial variances, we are effectively separating cohort effects captured by $\sigma_{\varepsilon_0}^2$ from yearly effects captured by λ_t.The initial variances capture the earnings instability of immigrants in each arrival cohort in the first post-arrival year (that is 1983 for the 1980-1982 cohort, 1986 for the 1983-1985 cohort and so on). More recent cohorts appear to have much larger initial variances than earlier cohorts; in fact, the estimates of the $\sigma_{\varepsilon_{2001}}^2$ are about twice as large as the estimates of $\sigma_{\varepsilon_{1983}}^2$. The estimate of the autoregressive parameter is around 0.46-0.47, which is slightly lower than the parameter estimate reported by Baker and Solon (2003) and Haider (2001) for all workers. The estimates of g_0 and g_2 are positive and significant in all models; the estimate of g_1 and g_3 are negative and significant. The estimates of g_4 are positive and not significant. The estimates of m are negative for both EW and SW.

The shape of the λ_t profile appears highly pro-cyclical (λ_{1984} is 1 for identification), much more so than the factor loading profile of the persistent variance component. The profile peaks in 1992 (λ_{1992} is about 1.53 for EW models and 1.51-1.52 for SW models); λ_t declines between 1992 and 1998 and rises in 1999-2004. The λ_t profile, however, does not tell the whole story of immigrant earnings instability. As initial variances which determine the starting point of each cohort's profile vary considerably, it is clear that cohort-specific profiles will be different.

We now turn to the models with a more flexible specification for the permanent variance component. Just as in the models above we assumed cohort specific initial variances, we can also consider

a model with cohort specific variances and covariances in the permanent variance component, as discussed in Section IV. The estimation results based on the full model using EW and SW estimators can be obtained from the author [Supplementary Appendix Table C2]. Table 5 shows the permanent and transitory variance component profiles computed for a hypothetical immigrant from each arrival cohort with five years of potential foreign experience ($Z_{cji}=5$) using the SW parameter estimates. There seems to be considerable evidence of *cohort effects in earnings inequality*, which is consistent with the descriptive results that show the presence cohort effects and higher levels of earnings inequality for more recent cohort. Compared to the earnings inequality (permanent component) profiles of the pre-1992 cohorts, the earnings inequality levels of the post-1992 cohorts are substantially higher in the first year after the arrival and remain higher in the next several years during which these cohorts are observed. The inequality levels of all pre-1992 cohorts rose during the first two years of the 1990s and then declined during the 1993-1995 period. For all immigrants in the sample with the exception of the 1980-1982 and 1998-2000 arrival cohorts, the permanent variance was rising during the first four years of the current decade. Unlike the earlier cohorts, the earnings inequality of recent cohorts appears to be rising slowly but steadily after declining during the first post-arrival years.

Table 5. The variance components of individualo earnings, by year and cohort (SW)

	1980-1982		**1983-1985**		**1986-1988**		**1989-1991**		**1992-1994**		**1995-1997**		**1998-2000**	
	Perm	***Trans***	***Perm***	***Trans***	***Perm***	***Trans***	***Perm***	***Trans***	***Perm***	***Trans***	***Perm***	***Trans***	***Perm***	***Trans***
1983	0.27	0.50												
1984	0.28	0.42												
1985	0.26	0.30												
1986	0.25	0.28	0.31	0.41										
1987	0.25	0.27	0.29	0.40										
1988	0.26	0.24	0.29	0.34										
1989	0.26	0.23	0.28	0.33	0.23	0.33								
1990	0.27	0.24	0.28	0.33	0.23	0.47								
1991	0.32	0.30	0.31	0.40	0.27	0.58								
1992	0.33	0.32	0.32	0.42	0.28	0.59	0.33	0.63						
1993	0.33	0.26	0.31	0.32	0.27	0.45	0.30	0.63						
1994	0.32	0.23	0.30	0.28	0.26	0.37	0.28	0.54						
1995	0.32	0.21	0.30	0.25	0.26	0.33	0.28	0.46	0.33	0.59				
1996	0.33	0.19	0.31	0.21	0.27	0.27	0.28	0.37	0.33	0.54				
1997	0.33	0.17	0.31	0.18	0.28	0.22	0.28	0.30	0.32	0.43				
1998	0.33	0.15	0.31	0.16	0.27	0.19	0.28	0.24	0.31	0.35	0.39	0.60		
1999	0.32	0.16	0.30	0.17	0.27	0.20	0.27	0.24	0.30	0.34	0.36	0.52		
2000	0.31	0.16	0.30	0.16	0.27	0.18	0.27	0.21	0.29	0.28	0.35	0.42		
2001	0.33	0.17	0.32	0.17	0.29	0.18	0.30	0.21	0.32	0.27	0.36	0.39	0.61	0.41
2002	0.32	0.20	0.32	0.18	0.29	0.19	0.30	0.22	0.32	0.27	0.36	0.37	0.50	0.54
2003	0.32	0.22	0.33	0.19	0.29	0.19	0.31	0.21	0.33	0.25	0.37	0.34	0.42	0.49
2004	0.32	0.22	0.34	0.18	0.30	0.18	0.32	0.19	0.35	0.23	0.39	0.29	0.38	0.41

Source: Longitudinal Administrative Databank), 1983-2004; Immigration Database, 1980-2000

The earnings instability profiles can also be computed for each cohort (second column). Most profiles show that *earnings instability is particularly high among immigrants just entering the labour market but falls sharply during the next two or three years*. As in previous models, the instability profiles are highly pro-cyclical. The 1989-1991 cohort, which consists of immigrants who arrived right before or

during the recession of the early 1990s, has the highest initial transitory variance (0.63); the 1986-1988 has the lowest (0.33). For all cohorts, transitory variance declines sharply in the first two-three years after entering the labour market (a notable exception is the 1986-1988 cohort which entered labour market right before the recession). The 1980-1982 and 1983-1985 cohorts observed for the longest period of time show rising instability at the end, which is likely to be related to the aging of these cohorts[5].

Table 6. The variance components of individualo earnings, by year and cohort (SW)

	1980-1982		1983-1985		1986-1988		1989-1991		1992-1994		1995-1997		1998-2000	
	Total	*Actual*	*Total*	*Actual*	*Total*	*Actual*	*Total*	*Actual*	*Total*	*Actual*	*Total*	*Actual*	*Total*	*Actual*
1983	0.77	0.77												
1984	0.70	0.71												
1985	0.57	0.58												
1986	0.53	0.54	0.72	0.77										
1987	0.52	0.51	0.69	0.73										
1988	0.50	0.48	0.63	0.66										
1989	0.49	0.49	0.60	0.63	0.57	0.61								
1990	0.51	0.47	0.60	0.70	0.70	0.71								
1991	0.61	0.58	0.71	0.80	0.84	0.86								
1992	0.65	0.71	0.74	0.75	0.87	0.87	0.96	0.93						
1993	0.58	0.61	0.63	0.65	0.72	0.78	0.94	0.95						
1994	0.54	0.62	0.57	0.64	0.63	0.61	0.82	0.84						
1995	0.53	0.51	0.55	0.60	0.59	0.60	0.74	0.75	0.93	0.96				
1996	0.52	0.51	0.52	0.51	0.54	0.55	0.65	0.69	0.86	0.90				
1997	0.50	0.51	0.49	0.50	0.50	0.50	0.58	0.55	0.75	0.81				
1998	0.48	0.45	0.47	0.53	0.46	0.50	0.52	0.53	0.65	0.67	0.99	1.01		
1999	0.49	0.46	0.48	0.50	0.47	0.49	0.52	0.49	0.64	0.65	0.88	0.91		
2000	0.47	0.46	0.46	0.47	0.45	0.42	0.49	0.49	0.58	0.64	0.77	0.75		
2001	0.50	0.46	0.49	0.44	0.47	0.43	0.50	0.55	0.59	0.60	0.75	0.76	1.02	1.07
2002	0.52	0.53	0.51	0.57	0.48	0.46	0.52	0.54	0.59	0.57	0.74	0.74	1.03	1.04
2003	0.53	0.49	0.52	0.53	0.48	0.49	0.52	0.51	0.58	0.59	0.71	0.71	0.91	0.92
2004	0.54	0.56	0.52	0.49	0.48	0.49	0.52	0.52	0.58	0.57	0.68	0.67	0.79	0.81

Source: Longitudinal Administrative Databank, 1983-2004; Immigration Database, 1980-2000

Table 6 shows the predicted total variance (the sum of permanent and transitory components) and the unconditional variance of $\hat{y}_{cjit}$. Overall, the cohort profiles of the predicted total variance are similar to the profiles of $var(\hat{y}_{cjit})$ (see Fig. 1). Clearly, *the total earnings variance in the first several post-arrival years is mostly driven by the transitory component*, while the permanent component becomes predominant as immigrants settle down in their new country. Hence, it is not surprising that the recession of the early 1990s had a greater impact on the total earnings volatility of the 1989-1991 and 1986-1988 cohorts than on previous cohorts; for these recently arrived cohorts, the transitory component played a more important role in their total earnings volatility.

An interesting question is to what degree immigrants share larger trends in earnings inequality and earnings instability in Canada, and whether immigrant profiles are similar to the profiles of the Canadian-born workers who entered the labour market at around the same time. Morissette *et al.* (1994), Beach *et al.* (2003) and Baker and Solon (2003) show that, generally, earnings inequality in Canada fell

[5] Higher earnings instability of older immigrants is consistent with generally higher levels of earnings instability of older male workers (see Beach *et al.,* 2003).

Table 7. The cohort specific permanent variance components for the SW model

cohort		***no controls***	***educ.***	*decline %*	***lang.***	*decline %*	***origin***	*decline %*	***all***	*decline %*
1980-1982*	**1983**	0.27	0.24	*-10.9*	0.22	*-19.4*	0.21	*-22.2*	0.18	*-32.1*
	1986	0.25	0.22	*-14.2*	0.21	*-15.1*	0.19	*-25.4*	0.17	*-33.9*
	1989	0.26	0.22	*-15.7*	0.22	*-16.7*	0.20	*-22.6*	0.17	*-34.0*
	1992	0.33	0.26	*-21.2*	0.25	*-24.6*	0.23	*-30.0*	0.18	*-44.2*
	1995	0.32	0.25	*-22.1*	0.25	*-20.1*	0.23	*-28.6*	0.18	*-42.6*
	1998	0.33	0.25	*-22.4*	0.27	*-19.0*	0.23	*-30.4*	0.19	*-43.2*
	2001	0.33	0.25	*-23.9*	0.27	*-17.4*	0.23	*-30.0*	0.18	*-43.9*
	2004	0.32	0.25	*-23.0*	0.27	*-15.2*	0.22	*-30.7*	0.18	*-42.8*
1983-1985*	**1986**	0.31	0.28	*-9.1*	0.30	*-2.2*	0.25	*-19.1*	0.23	*-25.1*
	1989	0.28	0.25	*-10.7*	0.26	*-5.8*	0.23	*-17.2*	0.20	*-26.5*
	1992	0.32	0.27	*-16.8*	0.27	*-16.7*	0.24	*-26.6*	0.19	*-39.9*
	1995	0.30	0.24	*-18.0*	0.26	*-13.4*	0.22	*-26.4*	0.18	*-40.1*
	1998	0.31	0.25	*-18.4*	0.27	*-13.4*	0.22	*-29.1*	0.18	*-42.2*
	2001	0.32	0.26	*-19.7*	0.28	*-12.7*	0.23	*-29.1*	0.18	*-43.7*
	2004	0.34	0.28	*-18.4*	0.30	*-11.3*	0.24	*-29.9*	0.19	*-43.0*
1986-1988*	**1989**	0.23	0.23	*-2.3*	0.23	*-3.1*	0.21	*-8.3*	0.20	*-15.2*
	1992	0.28	0.25	*-9.0*	0.24	*-14.2*	0.23	*-16.7*	0.20	*-29.6*
	1995	0.26	0.23	*-10.7*	0.23	*-11.0*	0.22	*-14.8*	0.19	*-28.7*
	1998	0.27	0.24	*-11.9*	0.24	*-11.3*	0.23	*-16.9*	0.19	*-30.4*
	2001	0.29	0.25	*-14.2*	0.26	*-11.1*	0.24	*-16.6*	0.20	*-31.9*
	2004	0.30	0.26	*-13.6*	0.27	*-10.1*	0.25	*-17.8*	0.21	*-31.2*
1989-1991*	**1992**	0.33	0.31	*-4.7*	0.30	*-9.1*	0.29	*-11.4*	0.26	*-20.0*
	1995	0.28	0.25	*-8.6*	0.26	*-6.4*	0.25	*-10.4*	0.22	*-21.7*
	1998	0.28	0.25	*-11.3*	0.26	*-7.9*	0.24	*-13.1*	0.21	*-25.7*
	2001	0.30	0.25	*-13.9*	0.27	*-8.6*	0.26	*-12.8*	0.21	*-28.0*
	2004	0.32	0.28	*-12.7*	0.30	*-8.5*	0.28	*-14.0*	0.24	*-27.0*
1992-1994*	**1995**	0.33	0.31	*-7.8*	0.31	*-6.5*	0.30	*-10.7*	0.27	*-19.9*
	1998	0.31	0.27	*-11.6*	0.28	*-8.4*	0.26	*-14.4*	0.23	*-25.6*
	2001	0.32	0.26	*-16.2*	0.29	*-9.6*	0.27	*-14.9*	0.22	*-30.3*
	2004	0.35	0.29	*-16.9*	0.32	*-10.0*	0.29	*-16.4*	0.24	*-31.2*
1995-1997*	**1998**	0.39	0.36	*-6.5*	0.35	*-10.1*	0.34	*-10.8*	0.31	*-20.6*
	2000	0.35	0.30	*-13.2*	0.32	*-8.6*	0.31	*-10.9*	0.26	*-25.7*
	2002	0.36	0.30	*-16.9*	0.33	*-9.2*	0.32	*-12.7*	0.25	*-30.1*
	2004	0.39	0.32	*-18.7*	0.35	*-11.0*	0.34	*-12.8*	0.26	*-32.4*
1998-2000	**2001**	0.61	0.59	*-4.0*	0.58	*-5.1*	0.57	*-6.2*	0.50	*-17.5*
	2002	0.50	0.46	*-7.0*	0.47	*-6.0*	0.45	*-8.3*	0.40	*-19.1*
	2003	0.42	0.38	*-9.3*	0.38	*-8.0*	0.37	*-11.3*	0.32	*-23.6*
	2004	0.38	0.34	*-9.6*	0.34	*-9.5*	0.34	*-8.8*	0.29	*-23.4*

Source: Longitudinal Administrative Databank, 1983-2004; Immigration Database, 1980-2000
*** selected years**

gradually in the mid-1980s, and increased rapidly in the late 1980s and early 1990s, which is consistent with the trends in earnings inequality of immigrants found in this study. The comparison for the 1992-2004 period is more difficult. Beach *et al.* find only slight increase in earnings inequality in 1990-1997 compared to 1982-1989 for young men entering the labour market, while Morissette and Ostrovsky (2005) show that the *family* earnings inequality and earnings instability was generally higher in 1996-2001 than in 1986-1991, although the increase was not universal across different age and income groups. In sum, the information about general trends in earnings inequality and earnings instability in Canada in 1990s and 2000s appears to be insufficient to make a more thorough comparison with the immigrant trends. Such a comparison may be a subject of future research.

The effects of foreign education, language ability and the place of birth

Although the profiles of immigrant earnings inequality and earnings instability are interesting in themselves, the linkage between LAD and IMDB allows us to take the analysis a step further and consider the effects of foreign education, the ability to speak an official language and the place of birth on immigrant earnings inequality and earnings instability. Given that these variables are available for immigrants, we can estimate the full model with cohort-specific variances and covariances in the permanent growth component using the four samples described in Section VI: the first sample is based on the residuals from the first stage regression with foreign education as a control variable, the second sample is based on the regression with the ability to speak one of the official languages as a control variable, the third sample is based on the first stage regression with the place of birth as a control variable, and, finally, the fourth sample is based on the first stage regression in which all the abovementioned variables are controlled for. The estimation results are shown in Table 7. Using the coefficient estimates in Appendix Table B3 we can now construct five earnings inequality profiles for each arrival cohort (Table 7). Fig. 2 helps visualize the effect of foreign education, ability to speak an official language and birthplace on earnings inequality. Each of these variables has an impact on immigrant earnings inequality and the effect of the birthplace is generally the largest. However, Fig. 2 also illustrates the importance of a dynamic analysis. In contrast to the descriptive analysis, the dynamic models allow us to observe how the effects of different variables on earnings inequality change with time.

Table 7 also shows the percentage decline in the permanent variance component after controlling for education, language and birthplace. Consistent with the descriptive results, the place of birth has the strongest overall impact on inequality. Controlling for immigrants' origins reduces the permanent variance component of the 1980-1982 cohort by 22-31 percent depending on the period. However, the effect of birthplace is clearly less strong for more recent cohorts; for all post-1992 cohorts the effect of birthplace is less than or equal 18 percent in any given period and for the 1995-1997 cohort the effect is less than 16 percent. The place of birth is, of course, not just a geographic location; it is a proxy for ethnic, religious and cultural attributes. Interestingly, the effect of the immigrant origins generally increases in the first several years and *remains strong long after entering the labour market*. For the earlier cohorts, which are observed for the longest periods of time we see that the birthplace effect is actually stronger 10-20 years after the arrival than in the first several years.

Table 7 also shows that although foreign education has a relatively small impact on inequality in the first several years after the arrival, its importance is increasing as the age of the cohort is increasing. For the 1980-1982 cohort, for instance, controlling for language ability reduces the permanent variance component by 16.7-19.4 percent in the first three years after arrival, while controlling for foreign education leads only to a 10.9-13.7 percent reduction. In all years after 1992, however, the effects of education are greater than the effects of language ability. Similar to the birthplace, the effect of education is somewhat weaker for more recent cohorts although its relative importance is greater. For the most recent cohorts, after several years, education plays as important a role in reducing earnings inequality as the birthplace. All in all, these results seem to indicate that although education may not have as much immediate recognition on the labour market as, for instance, the ability to speak English or French, foreign schooling has a positive long-term effect and, *plays an increasing role in reducing earnings*

Table 8. The cohort specific transitory variance components for the SW model with no controls and with controls for foreign schooling, language ability and origin.

		No controls	Educ.	Lang.	Origin	All
1980-1982 cohort (selected years)	**1983**	0.50	0.49	0.48	0.43	0.42
	1986	0.28	0.28	0.27	0.27	0.26
	1989	0.23	0.22	0.21	0.21	0.20
	1992	0.32	0.32	0.30	0.31	0.30
	1995	0.21	0.22	0.19	0.20	0.20
	1998	0.15	0.15	0.12	0.14	0.13
	2001	0.17	0.17	0.13	0.16	0.15
	2004	0.22	0.23	0.17	0.22	0.20
1983-1985 cohort (selected years)	**1986**	0.41	0.41	0.41	0.38	0.38
	1989	0.33	0.32	0.31	0.30	0.29
	1992	0.42	0.41	0.40	0.40	0.39
	1995	0.25	0.26	0.23	0.24	0.24
	1998	0.16	0.16	0.14	0.15	0.15
	2001	0.17	0.16	0.14	0.15	0.15
	2004	0.18	0.18	0.14	0.17	0.16
1986-1988 cohort (selected years)	**1989**	0.33	0.33	0.33	0.31	0.30
	1992	0.59	0.58	0.59	0.57	0.56
	1995	0.33	0.32	0.31	0.31	0.31
	1998	0.19	0.19	0.18	0.18	0.18
	2001	0.18	0.18	0.16	0.17	0.17
	2004	0.18	0.18	0.15	0.16	0.16
1989-1991 cohort (selected years)	**1992**	0.63	0.62	0.62	0.59	0.58
	1995	0.46	0.46	0.46	0.44	0.44
	1998	0.24	0.24	0.24	0.24	0.23
	2001	0.21	0.21	0.20	0.20	0.20
	2004	0.19	0.19	0.17	0.18	0.18
1992-1994 cohort (selected years)	**1995**	0.59	0.59	0.59	0.56	0.56
	1998	0.35	0.35	0.35	0.34	0.34
	2001	0.27	0.27	0.26	0.26	0.26
	2004	0.23	0.23	0.21	0.22	0.22
1995-1997 cohort (selected years)	**1998**	0.60	0.59	0.62	0.55	0.56
	2000	0.42	0.42	0.43	0.41	0.40
	2002	0.37	0.37	0.37	0.37	0.37
	2004	0.29	0.29	0.28	0.28	0.28
1998-2000 cohort	**2001**	0.41	0.36	0.37	0.35	0.35
	2002	0.54	0.54	0.55	0.52	0.53
	2003	0.49	0.49	0.50	0.49	0.49
	2004	0.41	0.41	0.42	0.40	0.40

Source: Longitudinal Administrative Databank, 1983-2004; Immigration Database, 1980-2000

inequality. In contrast to education, the effect of the language ability does not change much as immigrants settle in their new country; it appears to be the strongest in the recession years. It also seems weaker for immigrants who arrived in the late 1980s and 1990s compared to earlier cohorts.

The last two columns in Table 7 show the combined effect of including all three explanatory variables in the first stage regression. The cohort effects noted earlier remains strong: even after controlling for foreign education, the ability to speak an official language and birthplace, the most recent cohorts have generally higher levels of earnings inequality than those who arrived in the 1980s. Not surprisingly, the total effect is smaller that the sum of individual effects because of collinearity. Although controlling for all three variables leads to a substantial reduction in the permanent variance component, most of the immigrant earnings inequality remains unexplained. It is interesting to note that for the pre-1992 arrival cohorts, the combined effect of the three variables on the *permanent variance component increased during the recession years and remained high during the post-recession period*.

Finally, the cohort profiles of the transitory variance components based on all five samples are presented in Table 8. Including extra explanatory variables into the first stage regression has generally little effect on the dynamics transitory variance component although we notice the diversions between the first (no controls) and the third (language) column for the 1980-1982 and 1983-1985 cohorts. However, as with the descriptive analysis, there is a noticeable drop in instability when all additional variables are controlled for. The similarity of the earnings instability profiles in Table 8 is consistent with our understanding of the nature of earnings instability: the transitory component of the variance of immigrants' earnings is a residual variance component; changes in the skill composition of immigrant cohorts (broadly defined to include education, official language ability as well as religious and cultural attributes) will affect immigrant earnings inequality but will have little direct effect on earnings instability.

VIII. Conclusions

This study examines the dynamics of immigrant earnings inequality and earnings instability using a unique data set based on Canadian administrative and immigration records. Our goal is to complement the existing immigrant literature, which mostly focuses on immigrant wage dynamics, by examining the second moments of the wage distribution. The key feature of the approach used in this study is that it allows for distinguishing between current and long-term inequality in a way consistent with the recent literature on general earnings inequality in Canada and the US. The parameter estimates of a flexible econometric model obtained using a GMM method are used to construct the earnings inequality and earnings instability profiles for immigrant cohorts which arrived to Canada between 1980 and 2000. The results of the study indicate the presence of cohort effects in earnings inequality: more recent immigrant cohorts generally experienced higher levels of earnings inequality than older ones, particularly the cohort which arrived to Canada in the early 1980s. When immigrants enter the labour market, the total volatility of immigrants' earnings is largely determined by the short-term earnings volatility (earnings instability). A significant policy implication of this result is that the changes in immigration policies aimed at attracting immigrants with higher levels of human capital (for instance changes in the point system currently in place in Canada) will probably have little impact on immigrants' earnings volatility during the first several years, as it is mostly driven by the transitory component. After several years, however, inequality becomes a dominant factor. It should also be noted that while immigrants' earnings instability generally decreases during the first several years of their careers, it also appears to be highly pro-cyclical, rising rapidly during the recession years in the early 1990s and falling in subsequent years.

An important part of the study examines the role of foreign education, the ability to speak one of the official languages and immigrants' origins on immigrant earnings inequality. Our analysis sheds light not only on the overall impact of these variables but also on the changes in their relative importance as immigrants adjust to the labour market demands in Canada. Consistent with findings in previous studies (Aydemir and Skuterud, 2005), the place of birth, which may be thought of as a proxy for cultural, religious and ethnic characteristics of immigrants, has the strongest impact on immigrants' earnings inequality; however, the ability to speak English or French as well as foreign education also play

important roles. There is also some evidence that the effect of foreign education on earnings inequality is gradually increasing as immigrants adjust to the labour market in their new country. Yet, although language, foreign education and birthplace explain a large part of immigrant earnings inequality, most of it is not explained by these factors.

Overall, taken together with previous studies of immigrants' labour market outcomes, the results seem to support the prevailing view in the immigrant literature that the economics fortunes of immigrants in Canada in the recent years have declined.

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Appendix A. The regions are defined as following:

1. USA, UK, Ireland, Australia, NZ and South African Republic.
2. Western Europe.
3. Eastern, Southern and Central Europe; Russia.
4. Latin America and the Caribbean.
5. North Africa and the Middle East.
6. India, Sri Lanka, Bhutan, Nepal and Bangladesh.
7. China (mainland), Hong Kong, Taiwan and Macao.
8. South East Asia and Oceania.
9. Africa (except North Africa and SAR).

A detailed list of countries included in each region is available from the author.

Appendix Table B1. Sample averages

	1980-1982	1983-1985	1986-1988	1989-1991	1992-1994	1995-1997	1998-2000
Age at immigration	32.4	32.5	33.2	33	33.5	34.4	34.2
Years of foreign schooling	12.7	12.7	12.6	12.8	13.1	14.3	15.1
% of immigrants who							
speak English	52.4	48.9	59.9	54.4	64.8	70.0	65.5
speak French	4.1	5.9	2.9	5.4	5.3	6.5	6.7
speak both	5.4	6.8	4.8	6.7	6.7	5.6	7.7
% by region of origin*							
Region1	22.5	11.6	10.6	6.5	5.9	4.7	5.1
Region2	10.3	8.0	9.5	7.4	4.9	4.1	4.7
Region3	16.8	20.0	15.0	17.1	13.8	14.7	14.9
Region4	5.4	8.8	8.8	12.1	9.6	16.5	17.5
Region5	2.2	4.3	5.5	5.2	6.9	5.2	5.0
Region6	5.3	7.0	9.9	9.0	15.3	17.8	16.7
Region7	6.7	6.5	10.1	12.8	12.3	15.4	19.7
Region8	9.7	17.1	15.8	15.5	17.0	9.9	7.6
Region9	21.2	16.8	14.9	14.4	14.3	11.8	8.9

Source: Longitudinal Administrative Databank (LAD), 1983-2004; Immigration Database (IMDB), 1980-200
*** see Appendix A for definitions**

Fig. 1. Variance (actual and predicted) and variance components' profiles (permanent and transitory) for different cohorts; based on estimates in Table 6 and Table 7.

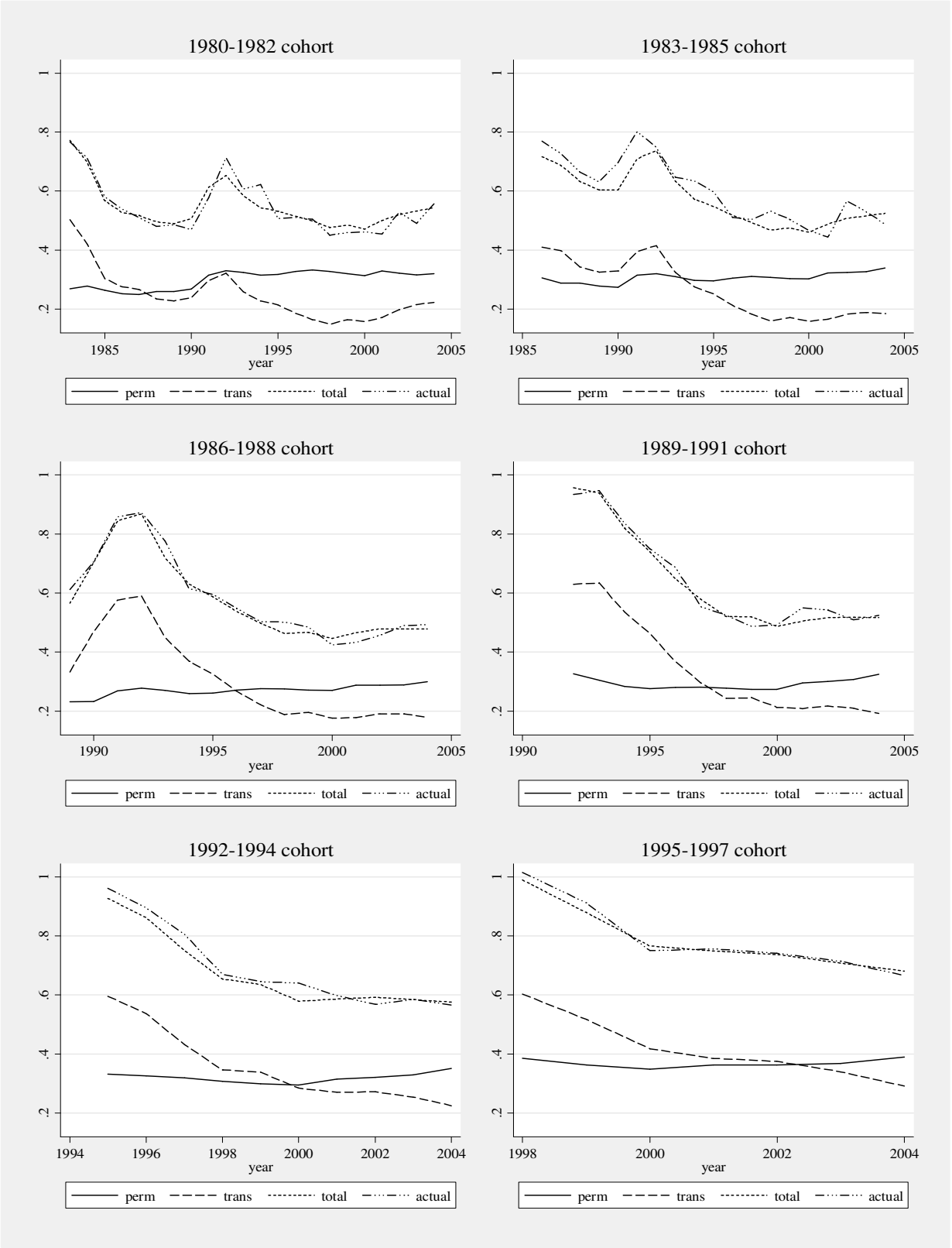

Fig. 2. The permanent variance component profiles for the model with no controls and with controls for foreign schooling, language ability and birthplace