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by

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Dynamics of Employment- and Earnings-Assimilation of First-Generation Immigrant Men in Sweden,1990-2000*

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Abstract

The employment- and earnings-assimilation of first-generation immigrant men in Sweden was estimated using a dynamic random-effects sample-selection model with eleven waves of unbalanced panel-data during 1990-2000. Endogenous initial values were controlled for using the simple Wooldridge method. Local market unemployment-rates were used as a proxy in order to control for the effect of changing macroeconomic conditions. Significant structural (true) state-dependence was found both on the employment-probabilities and on the earnings of both immigrants and native Swedes. The size of structural state-dependence differed between immigrants and Swedes. Failure to control for the structural state-dependence could have caused bias not only in the assimilation measures but also in the cohort-effects. For example, standard (classic) assimilation model seriously overestimates short-run marginal assimilation-rates and underestimates long-run marginal assimilation-rates. The model controlling for structural state-dependence shows that the earnings of all immigrants in Sweden (except Iraqies) eventually converge to those of native Swedes, but only Nordics and Westerners are able to reach the employment-probability of native Swedes.

Keywords: *Dynamic random-effects sample-selection model, employment and earnings assimilation, initial values problem, wage-curve method.*

J.E.L Classification: C33, J15, J61.

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1 Introduction

In recent decades many studies have assessed the economic assimilation of immigrants, e.g., for North America: Chiswick, 1978; Borjas, 1985 and 1995; LaLonde and Topel, 1991 and 1992; Baker and Benjamin, 1994; and Duleep and Regets, 1999; for Europe: Aguilar and Gustafson, 1991 and 1994; Ekberg, 1999; Scott, 1999; Edin et al., 2000; Bauer and Zimmermann, 1997; Longva and Raaum, 2002 and 2003; Aslund and Rooth, 2003; Barth et al., 2002a, 2002b, and 2004; and Gustafson and Zheng, 2006. The focus of these studies has been to determine to what extent immigrants attain employment- and earnings-parity with native-born residents as years since immigration increase. The crucial issue is finding an unbiased way to measure how long employment- and earnings-assimilation takes, as an input to immigration policy debates.

Immigrants arrive in a new country with a particular skill-endowment and confront there a new set of skill-requirements. The rate at which their skills converge to those required in their new home determines their rate of earnings-assimilation. Among Western countries Sweden has particularly many immigrants and their assimilation is one of the main policy-issues for the government. Recent studies show that there has been a decline in the amount of human capital (education, training, skills, and relevant working experience) of newly-arrived immigrants.[1] The poor outcomes of recent immigrants has increased the interest whether immigrants can assimilate into Swedish labour market.

The first objective here is to empirically analyze the dynamics of the economic assimilation of immigrants in Sweden. The labour-force participation decisions and the development of earnings were analyzed simultaneously using a high-quality register-based longitudinal individual data-set (LINDA) during 1990-2000. The second objective here is to compare the classical (static) assimilation model, which has been widely applied in previous studies, with the dynamic model used here.

Employment- and earnings-outcomes can be understood as the result of the investment program in human capital by individual workers (Ashenfelter, 1978). But employers and other conditions of the labour-market can distort the program and the outcomes. For example, employers might use past unemployment as a signal of low productivity, while of course unemployment can also lead to skill-losses. These factors can create *persistence* of the employment-status and earnings of both immigrants and natives. Ignoring these dynamic aspects of human-capital accumulation can lead to biased estimates of immigrants' economic assimilation.

[1] See Hammarstedt (2001), Rashid (2003), and Gustafson and Zheng (2006), for comprehensive reviews of assimilation in Sweden.

Earlier studies on the economic assimilation of immigrants have either been based on a single cross-section of immigrants and natives, or (better) based on a succession of cross-sections, using the *synthetic-panel* (*or quasi-panel*) *approach* (Borjas, 1985, 1987 and 1995; Longva and Raaum, 2001; Barth et al., 2004). The synthetic panel approach has been standard for assimilation-studies, but even it cannot overcome the problems dealt with in this paper; it cannot accommodate unobserved individual-specific characteristics, sample-selection bias, nor genuine dynamic behavior. Analyzing the dynamics behind the employment and earnings of immigrants together with selection-bias and unobserved individual characteristics requires a genuine *panel data method* including *lagged* employment-status and earnings, as was done here. One can then distinguish *structural* (*or true*) *state-dependence* -which is the persistence of an individual's experience based only on their past experience-, from *spurious state-dependence*, based on time-invariant unobserved individual-specific characteristics.

Another often neglected source of possible bias is the equality-restriction on period-effects (assumed representative of overall macroeconomic conditions), which has also been widely assumed in previous studies. However, if the employability and earnings of immigrants respond differently from natives' to a trend or temporary shock in economy-wide conditions then a assimilation model which uses equal-period-effects restriction can produce biased estimates of years-since-migration and cohort-effects. In studying immigrants' and natives' earnings in Norway, Barth et al., (2004) used local unemployment rates to at least partially eliminate this bias.

To address these potential biases, a dynamic random-effects sample-selection model was used in which both observed and unobserved individual-characteristics were controlled in order to analyze the dynamics of the employment and earnings of the immigrants simultaneously. The equal-period-effects restriction was imposed, but a *wage-curve model* was used based on local unemployment-rates, as was suggested by Barth et al., (2004).

In the analysis, immigrants were categorized by seven regions and seven specific countries of origin, since they were not homogenous. The results suggest that immigrants and natives experienced different levels of both structural and spurious state-dependence and also responded differently to varying macroeconomic conditions, different even across immigrant groups. The classic (static) assimilation model predicts higher marginal assimilation-rates during immigrants' first years after arrival, but in fact the rates quickly turned to negative, as both the employment probabilities and earnings of immigrants diverged widely (with some exceptions) from those of native Swedes. Thus, the classic (static) assimilation model seems to *overstate* short-run employment probabilities and earnings, and *understate* the long-run. The model used here predicts much less earnings-disadvantage upon arrival, low short-run assimilation-rates and higher long-run assimilation-rates.

The classic (static) assimilation model predicted that immigrants from Middle East, Asia and Africa were not able to reach earnings-parity with comparable native Swedes. However, with the dynamic model, it was found that all regions and countries of origin (except Iraq) were able to reach the parity, although it usually took longer than one individual's working life. A similar result was found by classic (static) and dynamic models in employment probabilities. Immigrants from no region or country of origin were able to reach the employment probabilities of native Swedes, except for those from Nordic Countries and the rest of Western Europe.

The next section discusses the hypotheses. Section 3 then presents the dynamic random-effects sample-selection model and discusses issues which can create bias in the measures of assimilation. Section 4 then presents data, and Section 5 the empirical results. Section 6 summarizes and draws conclusions.

2 Hypotheses

Economic assimilation studies focus on whether there is a difference in the economic performance of otherwise identical individuals who differ solely in terms of being an immigrant or a native; and if there is, how this difference changes for an immigrant with time spent in the host-country.

The difference in performance of immigrants and natives has been considered as a function of, first, the differences between the human-capital endowments of the immigrants and those of otherwise identical natives, and, second, the transferability of country-of-origin human-capital to the one required in host country. In other words, immigrants arrive with some human capital but they lack host-country-specific human capital; and they acquire the necessary knowledge to be as productive employees as natives are. Their productivity not only increases but they also become able to better communicate it to potential employers. Therefore, as years since migration increase, immigrants' employment-probabilities and earnings levels tend to catch up with those of otherwise identical natives (Chizwick, 1978; Borjas, 1987 and 1985; Price, 2001). This is the classic assimilation hypothesis that we mainly test here.

However, the development of host-country-specific human capital and the resulting economic performance of immigrants may be much more complicated, involving both structural and spurious state-dependence. Structural state-dependence is the persistence of an individual's experience (state) only because of their past experience. Spurious state-dependence, on the other hand, is caused by time-persistent unobserved individual characteristics, which, in this case, can influence the economic performance of individuals.

There can be many sources of structural state-dependence in the employment-probabilities and earnings of immigrants, so that persistence can start upon arrival or in any later period. Initial market-conditions and the resulting performance of the immigrants in the arrival period can be important in determining their future performance. For instance, high unemployment upon arrival can *scar* the economical performance of the immigrants in the future. If they are unable to get work initially or in a later period, they may not be able to develop host-country-specific human capital, and may continue to be offered only low paid jobs (if that) afterwards. Unemployment can also change preferences and search-costs, prices and cause skill-depreciation, all of which can reduce later employability and earnings (Heckman and Borjas, 1980). Employers often use past employment-status as a *screening device,* and consider past unemployment as a *signal* (or proxy) of unobservable low productivity (employers can believe that an individual who has been unemployed is not as productive as an identical individual who has not experienced the state of being unemployed, Hansen and Lofstrom, 2001). Thus, productivity, bargaining power and reservation-wage of those who persistently experience unemployment, would all be reduced.

To control for the effect of arrival-year macroeconomic conditions, Chiswick et al., (1997) suggested including arrival-year unemployment-rates in the analysis. The same strategy is adopted here as well. However, if the scarring effect is a result of an unemployment experience in a later period (even if the arrival-year macroeconomic conditions were good) then controlling only for arrival-year macroeconomic conditions would not be enough to identify the scarring effect that is a result of later unemployment experience. Thus, in order to capture overall scarring effects, the structural and spurious state-dependence must be controlled for in any assimilation model.

Immigrants in particular are vulnerable to possible labour-market *discrimination.* Employers may interpret signals differently from immigrants leading to differences in the scarring effect. In this case, the size of structural state-dependence in the employment and earnings may differ for immigrants and natives. Failure to control for structural state-dependence can thus lead to bias in measuring both short- and long-run assimilation-rates.

If there is statistically significant structural state-dependence in the employment and earnings of immigrants relative to natives, the wage-curve specification with local unemployment rates in the classic (static) assimilation-model may not be able to identify the true period-effects. As explained by Barth et al. (2004), the wage-curve effect (i.e., local-market unemployment elasticity) can be considered as a function of years since migration and, implicitly, the bargaining power, reservation wage, and marginal-productivity levels of immigrants and natives. Over time, economic integration of immigrants increase, the difference between the immigrants' and a comparable native's sensitivity to changing macroeconomic conditions will decrease. However, if there is structural state-dependence due to past unemployment, the sensitivity differences between immigrants and natives to changing macroeconomic conditions can also persist since structural state-dependence is also a function of bargaining power, reservation wage and others. Classic (static) assimilation model can overstates the size of local unemployment elasticities. It can lead biased assimilation measures depending on the difference between the sizes of structural state-dependence of immigrants and natives.

Immigrants can also differ in both time-invariant and time-variant unobserved individual characteristics (representing time-invariant and time-variant *preferences*) that influence their probability of employment and their earnings. If these unmeasured (because unobserved) variables are correlated over time and are not properly controlled for, then previous unemployment (or earnings) might appear to be a determinant of later unemployment (or earnings) solely because it was a proxy for those temporally correlated unobservables (Heckman and Borjas, 1980). Time-invariant unobserved characteristics could thus create a *spurious* state-dependence. Identification of the true (structural) state-dependence thus requires proper treatment of unobserved individual characteristics. Failure to control for structural state-dependence, on the other hand, could lead to overestimation of immigrants' and natives' individual-heterogeneity.

3 Econometric Specifications

3.1 Specification of the Dynamic Assimilation Model

The empirical approach used here aims to capture the dynamics of labour force participation decisions (employment) and resulting earnings simultaneously by identifying the structural state dependence for both. To do this, observed and unobserved individual characteristics must be controlled for. A full dynamic panel data random-effects sample-selection model was thus used (following Amemia, 1984, called a Tobit type 2 model), participation and resulting earnings were simultaneously determined (which is why the model called *full*).[2]

Sample-selection bias can arise either from self-selection by the individuals under investigation or from sample-selection decisions made by the analyst. Such bias can be a major problem with both cross-sectional as well as panel data (Matyas and Sevestre, 1995; Kyriazidou, 1997). It has been common in many economic analyses of panel-data to study only a balanced sub-panel without correcting for selection bias. The static version

[2] There are many possible variants of this model. For example, just the "participation", the selection-equation, could contain lagged decision, or it could contain the earnings in a *partial* framework. The model here includes both and is thus called a *full*y dynamic sample-selection model.

of the model used in this paper (without lagged employment-status and earnings), has been widely analyzed by Zabel (1992), Verbeek and Nijman (1992), Matyas and Sevestre (1995), Kyriazidou (1997), Vella (1998), Rochina-Barrachina, (1999), Vella and Verbeek (1999), and a similar dynamic model was analyzed by Kyriazidou (2001).

The income-generating process of immigrants (I) with the dynamic model based on first order state-dependence (one lag of dependent variables) is given by

$$d_{it}^{I}=1\left\{\begin{array}{c}\mathbf{Z}_{it}^{I}\beta^{I}+\lambda^{I}d_{i,t-1}^{I}+\phi^{I}AGE_{it}^{I}+\delta YSM_{it}\\+\sum_{j}\psi_{j}C^{j}+\sum_{k}\theta_{k}^{I}\Pi^{k}+\xi_{emp}^{I}\log UR_{it}^{mI}+\eta_{i}^{I}+\epsilon_{it}^{I}\geq 0\end{array}\right\} \tag{1}$$

$$y_{it}^{I}=\left\{\begin{array}{ll}\mathbf{X}_{it}^{I}\beta^{I}+\gamma^{I}y_{i,t-1}^{I}+\phi^{I}AGE_{it}^{I}+\delta YSM_{it} & \\ +\sum_{j}\psi_{j}C^{j}+\sum_{k}\theta_{k}^{I}\Pi^{k}+\xi_{inc}^{I}\log UR_{it}^{mI}+\alpha_{i}^{I}+u_{it}^{I} & d_{it}^{I}=1\\ 0 & d_{it}^{I}=0\end{array}\right\} \tag{2}$$

where d_{it} is a binary variable indicating whether an individual is employed during the current period; η_i and α_i are the additive unobserved individual-effects (such as work ability, motivation, etc.); The vectors $(\eta_i,\alpha_i)'$ are assumed independent from the error vectors $(\epsilon_{it},u_{it})'$. $\mathbf{Z}_{it}$ and $\mathbf{X}_{it}$ are vectors of current socio-demographic characteristics (such as educational attainment, marital status, and non-labour income); AGE denotes age; YSM is years since migration;[3] C^j denotes arrival-cohort j; Π^k denotes period-effects k; and UR_{it}^{m} is the local unemployment-rate in municipality m (where individual i lives in year t). In order to obtain the local unemployment elasticities on employment-probabilities (ξ_{emp}) and earnings (ξ_{inc}), this variable expressed in logarithms.

Equation (1) expresses that the current employment-status of individual i during period t is a function of previous employment-status $d_{i,t-1}$. This determines whether an individual is included in the sample on which the earnings equation (2) is based. The parameter λ captures the effect of past selection outcome $d_{i,t-1}$, i.e., structural state-dependence on employment-probabilities. In the earnings- equation (2), the logarithms of the earnings y_{it} are considered as a function of the logarithms of previous earnings ($y_{i,t-1}$) and thus γ is the parameter representing the structural state-dependence on earnings.[4] This parameter can thus be interpreted as the earnings elasticity of previous earnings on the current earnings.

[3] The model also includes the squared-age and squared-years since migration; and interactions of local unemployment-rates with both years since migration and squared-years since migration (but not shown for simplicity).

[4] Following Heckman (1981), this paper uses the term *structural* to refer to *true state-dependence* for both discrete and continuous outcomes.

The income-generating process of the native Swedes (N) is given

$$d_{it}^{N}=1\left\{\begin{array}{c}\mathbf{Z}_{it}^{N}\beta^{N}+\lambda^{N}d_{i,t-1}^{N}+\phi^{N}AGE_{it}^{N}\\ +\sum_{k}\theta_{k}^{N}\Pi^{k}+\xi_{emp}^{N}\log UR_{it}^{mN}+\eta_{i}^{N}+\epsilon_{it}^{N}\geq 0\end{array}\right\} \tag{3}$$

$$y_{it}^{N}=\left\{\begin{array}{cc}\mathbf{X}_{it}^{N}\beta^{N}+\gamma^{N}y_{i,t-1}^{N}+\phi^{N}AGE_{it}^{N} & \\ +\sum_{k}\theta_{k}^{N}\Pi^{k}+\xi_{inc}^{N}\log UR_{it}^{mN}+\alpha_{i}^{N}+u_{it}^{N} & d_{it}^{N}=1\\ 0 & d_{it}^{N}=0\end{array}\right\} \tag{4}$$

where, the variables which are not making sense such as years since migration (YSM) and cohort-effects (C) are excluded.

The model assumes that the error-terms ϵ_{it} and u_{it} are non-autocorrelated and that sample-selectivity would show up over the error-terms with the following relatively simple covariance structure

$$\Omega_{\epsilon u}=\begin{bmatrix}1 & \rho_{\epsilon u}\sigma_{u}\\ \rho_{\epsilon u}\sigma_{u} & \sigma_{u}^{2}\end{bmatrix}$$

where $\rho_{\epsilon u}$ is the correlation between the participation (selection) and earnings-equations; σ_u^2 is the variance of error terms in the earnings equation and the variance of the error term in participation equation has been normalized to unity due to identification.

3.2 Identification

The model above has two identification problems. First, a credible analysis of selection requires a robust instrument (an exclusion-restriction). The second problem arises because the model aims to separate years since migration, arrival-cohort, and period-effects.

Identification of selection-bias depends on the exclusion restriction or identifying instrument: At least one explanatory variable in the selection equation must be excluded from the earnings equation. In other words, some variable(s) must explain employment but not earnings. The number of variables usable for this purpose in empirical applications is very limited; it is not easy to find a defensible and robust identifying instrument. For instance, health status and language proficiency are two logical candidates but we do not have information on them. Other possible (but weak) candidates are number of children; marital status; and some components or compositions of non-labour income, in particular capital non-labour income. There are many possible types of non-labour income, including sickness payments and child care, welfare, capital income and others. The main one that can be linked with the human-capital investment and participation, and earnings is capital income. The restriction adopted here is that *temporary capital income* is assumed to only affect participation, whereas the *permanent* capital income can affect earnings, through human capital investment.

Capital income *per se* might be thought to only affect participation but not earnings. For instance, individuals with high capital income one specific year could reduce their labour supply for that year. However, capital income might affect earnings, indirectly. Individuals with high but variable capital income might choose to invest in human capital (i.e. education) as a means of buffering this variability. Individuals with permanently high capital income, or who expect to get high capital income in the future, might decide to use (or barrow against) this income to invest in human capital. Thus, depending on the amount and time-pattern, capital income could affect either just participation, or earnings; temporary changes in the amount of capital income could only be expected to affect the decision for hours worked, but only permanent (though not necessarily constant) capital income would affect earnings.

Consider the capital income y_{it}^{nl} of individual i during t, which can be split into two uncorrelated components, $\beta y_{it}^{nl} + \varphi \overline{y}_i^{nl}$, where $\overline{y}_i^{nl} = (1/T_i)\sum_1^{T_i} y_{it}^{nl}$ is the average over time. This can also be written as $\beta(y_{it}^{nl} - \overline{y}_i^{nl}) + (\beta + \varphi)\overline{y}_i^{nl}$. The first part of the expression is the difference from the within individual means, and represents *temporary shocks* on the capital income and the second part is *permanent capital income* or *level effect*. It was assumed that temporary shocks affected only current participation but not the earnings, and it was therefore excluded from the earnings equations and used as identifying restriction. Thus, by including $\overline{y}_i^{nl}$ to both employment and earnings equations the effect of permanent capital income in human capital investment was also controlled.

The available data supports this approach. The correlation between temporary capital income and the level of education was positive but quite low, only 0.0 and 0.1 for the various immigrant groups, while the correlation between permanent capital income and level of education was much higher, 0.05-0.25.

The other identification problem is that the period-effect Π in equations (1) and (2) is a linear combination of the effects of arrival-cohort and years since migration, since the calendar year at any cross-section is the sum of years since migration and the year in which the individual immigration occurred (i.e., the arrival-cohort). It is not possible to analyze the effects of years since migration, arrival-cohort, and period simultaneously. An additional restriction must be imposed, either that the period-effect, the impact of the transitory shocks in the overall macroeconomic conditions, is the same for both immigrants and native Swedes, or that the cohort-effect is the same across different arrival cohorts of immigrants. The changing pattern of immigration over time, generated by political conflicts in source-countries and changes in immigration policy in Sweden, makes constant cohort-effects unrealistic. Since the interest here is mainly to analyze the effect of the years since migration, the only reasonable way to deal with this identification problem is then to impose the restriction that period-effects are the same for immigrants and native Swedes in all periods (i.e., $\theta_k^I = \theta_k^N$).

This assumption would be credible if there was no change in macroeconomic conditions or even if it was changed, the responsiveness of immigrants and natives to these changes should be the same. Changing macroeconomic conditions might influence the price paid for skills of immigrants and natives differently. A change in relative employment-probabilities and earnings could then reflect price difference rather than differences in human capital (Borjas, 1995). Thus, if, in fact, the sensitivities of immigrants and native Swedes were different and if they were not equally affected by changing macroeconomic conditions, this restriction could lead to severe bias in estimates of the effects of arrival-cohort and years-since-migration (Barth et al., 2004).

Sweden (and other Nordic Countries) experienced a sharp economic downturn coinciding with the sample period, 1990-2000. Thus, the model which assumes equal-period effects could be biased. To attempt to control for this bias, at least partially, local market unemployment-rates were used by following the *wage-curve model* suggested in Card (1995) and Barth et al., (2002a, 2002b, and 2004). In order to include the changes in the sensitivities occuring with years spent in Sweden, the model was also augmented by interacting the years-since-migration and with local unemployment rates. The augmented wage-curve model was also restricted by equal-period-effects assumption. However, it was assumed that the period-effects could be identified (at least partially) by controlling for local unemployment rates.

3.3 The initial values problem, unobserved individual-effects and estimators

A fully parametrized random-effects approach was followed with simulated maximum likelihood-estimator. Such an approach requires correct specification of the distribution of initial values, conditioned on observed and unobserved individual-effects. It also requires correct specification of the distribution of those unobserved individual-effects themselves which are possibly correlated with the observed explanatory variables. Thus, these two issues are also related to each other.

Given the goal of disentangling structural (true) state-dependence from spurious state-dependence, the initial values are important (Blundell and Smith, 1991; Honore and Hu, 2004; Arellano and Hahn, 2005; Heckman, 1981; Hsiao, 2003; Wooldridge, 2005; Honore and Tamer, 2006). An *initial values problem* can emerge if the history of the underlying participation or earnings generating process is not fully observed, in which case it cannot be assumed that the initial observed sample-values are *exogenous* variables, given outside the process. Many immigrants (and of course native Swedes) entered the Swedish labour market much before the beginning of the study period in 1990. Thus, assuming exogenous initial values would be too strong, possibly causing biased and inconsistent estimators (Heckman, 1981). The sample initial observations must instead be considered *endogenous*, with a probability distribution conditioned on observed and unobserved individual characteristics.

But what about the distribution of the unobserved individual-effects, which are themselves possibly correlated with the observed individual characteristics (i.e. $E[\eta_i|x_{it}] \neq 0$ and $E[u_i|x_{it}] \neq 0$). For example, *work ability*, an unobserved factor influencing the employment probability and earnings, might be correlated with educational level, while *motivation* can be correlated with immigrant status. In this case, treating unobserved individual characteristics as i.i.d. errors would then also lead to biased and inconsistent estimators.

To avoid these problems a fixed-effects approach could be used instead. However, familiar *within* effects approach based on *differencing* out strategy for the unobserved individual characteristics would not work in this models. Instead one should have to construct a dummy variable for each individual and estimate a parameter for the effect of their unobserved individual characteristic. Considering the thousands of individuals in the data set, this would not be easy. Even if this computational problems were solved (with the *zig-zag* approach of Heckman and MaCurdy (1980) or with *brute-force* maximization of the likelihood function), *incidental-parameters problem* could create high bias and inconsistency (Neyman and Scott, 1948, Lancaster, 2000). The maximum-likelihood estimator inconsistently estimates parameters of individual-specific dummies, and for a small-T (T is duration of panel data) they would be seriously biased. Besides, inconsistency and bias are transmitted to other parameters in the model.

Alternatively, Kyriazidou (2001) suggests a semiparametric fixed-effects approach, in which the unobserved individual-effects are assumed to be fixed, and moment-restrictions are defined in order to construct *kernel-weighted GMM* estimators which are consistent and asymptotically normal. However, there are drawbacks to this approach as well. It would not allow average partial-effects to be calculated, and time-invariant variables would be *swept-away* (Wooldridge, 2005).

Here we prefer to deal with the initial values problem and follow random-effects approach. Therefore it was necessary to specify a conditional probability distribution for the initial values. There are two main methods for doing this: Heckman's reduced-form approximation (1981) and the simple method of Wooldridge (2005).[5]

Heckman suggested approximating the conditional-probability distribution, using avail-

[5] Another possibility is to assume that the conditional distribution of initial values is in steady-state. However, it would still be difficult to find a closed-form expression for the distribution, even for the simplest case where there were no explanatory variables (Heckman, 1981; Hsiao, 2003).

able pre-sample information, via a reduced-form equation defined for the initial sample period. This approximation allows a flexible specification of the relationships among initial sample values, observed and unobserved individual characteristics. The method is still not easy especially with unbalanced panel data (as here) with which initial values problem can be more serious (Honore, 2002).

Wooldridge (2005) introduced a simple alternative to Heckman's reduced-form approximation, in terms of both likelihood-computation and availability of commercial software. Wooldridge suggested that one can consider the unobserved individual characteristics conditional on the initial sample values and the time-varying exogenous variables. Specifying the distribution of the unobserved individual-effects on these variables can lead to very tractable functional forms in dynamic random-effects sample-selection models (as here), as well as in similar probit, censored regression, and Poisson models (Honore, 2002; Wooldridge, 2005).

Consider a fully parametric random-effects model in which the unobserved individual characteristics can be represented as a function of a constant, within means of time-variant explanatory variables and the initial sample value of relevant dependent variable. The initial values were defined for the immigrants, separately for participation- and earnings-equations, with the following auxiliary distribution of the unobserved individual characteristics

$$\eta_i^I = \pi_0 + \pi_1 d_{i1}^I + \pi_2 \overline{\mathbf{Z}}_i^I + \pi_3 AUR + \widetilde{\eta}_i^I \tag{5}$$

and

$$\alpha_i^I = \pi_0 + \pi_1 y_{i1}^I + \pi_2 \overline{\mathbf{X}}_i^I + \pi_3 AUR + \widetilde{\alpha}_i^I \tag{6}$$

where $\overline{\mathbf{Z}}_i$ and $\overline{\mathbf{X}}_i$ are vectors of within individual means of the time-variant explanatory variables (such as age, years since migration, number of children and local unemployment-rates) in participation- and earnings-equations, defined as $\overline{\mathbf{Z}}_i = (1/T_i)\sum_{t=1}^{T_i}\mathbf{Z}_{it}$ and $\overline{\mathbf{X}}_i = (1/T_i)\sum_{t=1}^{T_i}\mathbf{X}_{it}$; $\widetilde{\eta}_i$ and $\widetilde{\alpha}_i$ are new unobserved individual-effects assumed as $iidNormal\left[0, \sigma^2_{\widetilde{\eta}}\right]$ and $iidNormal\left[0, \sigma^2_{\widetilde{\alpha}}\right]$; and AUR is the arrival-year national unemployment-rate, and taken to represent initial labour-market conditions.

The auxiliary distribution for the native Swedes were

$$\eta_i^N = \kappa_0 + \kappa_1 d_{i1}^N + \kappa_2 \overline{\mathbf{Z}}_i^N + \widetilde{\eta}_i^N \tag{7}$$

and

$$\alpha_i^N = \kappa_0 + \kappa_1 y_{i1}^N + \kappa_2 \overline{\mathbf{X}}_i^N + \widetilde{\alpha}_i^N \tag{8}$$

A quasi-fixed effects approach would also be possible in which the fixed unobserved individual characteristics are specified for each individual as linear projection on the within individual means of time-varying explanatory via Mundlak's formulation (1978) or Chamberlain's (1984) *correlated-effects model*. However, the simple Wooldridge method also defines the auxiliary distribution similar to this approach. Thus, there should be no problem assuming that the distribution of the unobserved-individual effects is also fully specified with the simple Wooldridge method.

One of the aim of this paper is to estimate the employment- and earnings-assimilation. Two estimators are needed to measure, the marginal assimilation-rates and total years to assimilation based on the model used here. There are two type of approaches in the literature: Earnings assimilation can be considered to have occurred when immigrant earnings catch-up over time with the earnings of natives (following Borjas, 1985, 1987 and 1995), or it can be considered as a situation where immigrants' acquisition of country specific human capital lead to higher earnings (following Lalonde and Topel, 1992; Edin et al., 2000).

Here, the first was followed. An estimator of the *marginal assimilation rate* (MRA) was defined simply as (see Akay and Tsakas (2007) for details of the estimators)

$$\widehat{MRA_j}(t) = \frac{\partial E^I}{\partial t} - \frac{\partial E^N}{\partial t} \tag{9}$$

where E is the conditional expectation of the model either for the participation or the earnings-equation, t is a proxy for the time spent in the host country after arrival i.e., years-since-migration (YSM). Equivalently, in terms of estimated parameters,

$$\widehat{MRA_j}(t) = (\widehat{\delta}^I(t) + \widehat{\phi}^I(t_0 + t)) - \widehat{\phi}^N(t_0 + t) \tag{10}$$

where t_0 is the entry-age to the labour market.

The ultimate goal is to estimate *total years to assimilation* (TYA), the time needed to fully achieve equal employment-probability and earnings parity with otherwise identical native Swedes. TYA is thus the upper-limit of the integral which accumulates the MRA of each period, the time required in the host country before the age-employment probability or age-earnings curves of immigrants and native Swedes intersect.

4 The data

The study was based on the 1990-2000 panel of the Swedish register-based Longitudinal Individual Data-set (LINDA), which contains two distinct random samples: a population sample, which includes 3.35% of the entire population each year, and an immigrant sample, which includes almost 20% of immigrants to Sweden.[6]The sampling frame consists of everyone who lived in Sweden during a particular year, including those who were born or died, and those who immigrated or emigrated. The data is updated with current household information each year with data from the population and housing censuses and from the official Income Register, as well as a higher-education register. The Income Register data, based on filed tax returns, is contingent on the tax rules for that year (for more details on LINDA, see Edin and Frederiksson, 2001).

To avoid selection-problems due to retirement at age 65, the 33,504 immigrant men in LINDA aged 18-55 in 1990 were initially selected for the study, as well as an equal-sized control group of randomly-selected native Swedish men, matched for age and county (län) of residence.[7]An additional 20% of new immigrants, 2,000-4,000 were added each year, as well as an equal number of randomly-selected but matched native Swedes. By 2000, these unbalanced panels consisted of 65,800 immigrant men (generating 521,761 annual observations) and slightly more native Swedes.

Edin et al. (2000) point out that the measures of immigrant-assimilation can be distorted if a significant fraction of immigrants return back to their home country. This did not seem to be a problem since less than 5% disappeared from the data during the observation period. In any case it would be difficult to model return migration with this data since it is not possible to distinguish emigrants from those who died.[8]

The immigrants were categorized as being from other Nordic countries; other Western Europe (including the USA, Canada, Australia, and New Zealand), Eastern Europe, the Middle East, Asia, Africa, or Latin America.

The earnings-variable used was gross labour-income, measured in thousands of Swedish Krona (SEK) per year, inflated by the consumer price index (to 2000 prices). To eliminate those with short employment periods or part-time jobs with low pay, Antelius and Björklund (2000) were followed in considering as employed only those earning at least 36,400 SEK.[9] The employment-indicator (d_{it}) was defined as 1 if the individual was employed and 0 otherwise.

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6 Immigrants to Sweden enter the national register (and thus the sampling-frame) when they receive a residence permit. In general, immigrants may become Swedish citizen after a sufficient number of years.

7 The self-employed were excluded from the analysis since their employment- and earnings-conditions are considerably different from wage-earners.

8 Klinthäll (2003) found that 40% of immigrants arriving from Germany, Greece, Italy and the U.S. left Sweden within five years. His main hypothesis borrowed from the U.S. Emigration Studies, is that the least successful immigrants left. However, as pointed out by Arai (2000), even low-earning immigrants might have strong incentive to stay because of the relatively high living standard even in the lower range of the earnings-distribution compared to other countries. The difference in mean earnings between who disappeared (2,934 individuals) and those in the final sample was minimal.

9 This criterion, also adopted in LINDA is the "basic amount" that qualifies one for the earnings-related part of the public pension-system.

The key explanatory variables were age and age-squared; years since migration and squared; marital status (cohabiting was considered married); number of children living at home; highest education level; residence in Stockholm or elsewhere; capital non-labour income; arrival-cohort; local unemployment-rate and its interactions with years since migration and squared. Local unemployment rates were calculated by dividing the number of unemployed by the population in the municipality of residence, which was assumed to be exogenous to employment and earnings, though conditional on individuals' observed and unobserved characteristics.[10]

No data on work-experience was available. In most U.S. studies, this is handled by calculating *potential work experience* as age minus years of schooling minus six. But Swedish education-data is given in terms of highest level, not years, so such a calculation would introduce severe measurement-error.

Table 1 shows the mean values for these variables, for both immigrants and native Swedes.

Table 1 *about here*

Both the earnings and employment rates (83% vs. 36-74%) and were considerably higher for native Swedes. On the other hand, more immigrants were married or cohabiting (40% vs. 38-59%). Native Swedes were generally better educated: About 77% had at least upper-secondary education, compared to 61-77% for immigrants. The earlier immigrant arrival-cohorts each had 9-12% of the total, whereas 1985-89 had 18%, and 1990-94 had almost 25%. The Iran-Iraq war and various conflicts in former Yugoslavia occurred during the latter periods. The Nordic area accounted for 25% of all immigrants, followed by the Middle East (23%), Eastern Europe (21%), and Western Europe (14%). Asia, Africa, Latin America each had 5-6%.

The immigrant population was clearly not homogenous: Employment rates and earnings were much higher for those from Nordic or Western countries. Middle-Eastern and African immigrants were far less likely to be employed, and had lower earnings if they were. Immigrants from non-Nordic Western countries probably had more education than all other groups (nearly 32% had a university degree), followed by Eastern Europeans. Despite the fact that Nordic immigrants, most of them from Finland, had less education, they had a higher employment-rate and earned more than all other groups. All this is generally in accord with previous studies on immigrants in Sweden.

[10] Because of the immigrant-placement policies implemented in 1985, immigrants' country of origin and their municipality-of-residence can be correlated (Edin et al., 2002 and 2003; Åslund and Rooth, 2003).

5 Empirical analysis

5.1 Structural state-dependence, unobserved individual-effects, and local and arrival-year unemployment elasticities

The main interest here is the size of any structural state-dependence, in any spurious state-dependence, in the impact of observation period macroeconomic shocks, and in the relationship of these three to employment-probabilities and earnings. The results obtained from the dynamic assimilation model will also be compared with those from classical (static) model. The full estimation-results are not reported here, but in general, they are in line with those of previous studies. Employment-probabilities and earnings increased with age at a decreasing rate. Having high school or even more, a university degree raised employment-probabilities and earnings of all immigrant groups. And temporary capital income -used only in the participation equation- negatively affected the employment-probabilities.[11]

Table 2 presents the estimated marginal effects on employment-probabilities and earnings for both classic (static) and dynamic assimilation model. The classic (static) model is indicated by $S + CRE + WC$, where S denotes static, CRE adds the *correlated random effects* model of Mundlak (1978) and Chamberlain (1984); and WC indicates the wage-curve model. The dynamic model of main interest is indicated by $SD(1) + WC + WIV$, where $SD(1)$ indicates first order state dependence (one period lagged values of dependent variables as explanatory variable); and WIV indicates the simple Wooldridge method of dealing with initial values problem. Note that, since the Wooldridge method includes the within means of time-variant explanatory variables, similar to CRE approach, these two, classic (static) and dynamic assimilation models, can be directly compared.

The results are separately given for the jointly estimated participation-equation (as employment-probabilities) and earnings-equation (as earnings). Table 2 reports the estimated marginal effects of structural state-dependence for the employment-probabilities $\widehat{\lambda}$ and for earnings $\widehat{\gamma}$; the variances of the unobserved individual-effects ($\widehat{\sigma}_{\widetilde{\eta}}$ or $\widehat{\sigma}_{\widetilde{\alpha}}$); local unemployment elasticities for employment-probabilities $\widehat{\xi}_{emp}$ and for earnings $\widehat{\xi}_{inc}$. Arrival-year national unemployment elasticities are shown [in brackets]. The marginal effects of initial sample period employment-status and earnings are shown (in parentheses). The third row for each region or country of origin indicates the correlation between the error terms of the participation and earnings equations ($\widehat{\rho}_{\epsilon u}$).

Table 2 about here

[11] Full estimation-results and marginal effects will be provived by the author upon request.

Structural state-dependence ($\widehat{\lambda}$) in the employment-probabilities was all positive (in the range $0.30 - 0.70$) and highly statistically significant even after controlling for the observed and unobserved individual characteristics (i.e., in the dynamic model). The size of the structural state-dependence for Eastern Europeans (0.70) and Latin Americans (0.64) was slightly higher than for native Swedes (0.62). Middle Easterners (0.45) and in particular Iraqis (0.31) were lowest. However, in general, the impact on the current employment-probabilities of having been employed in the previous period was fairly consistent between immigrants and native Swedes, and across immigrant regions or countries of origin.

Similarly, there was statistically significant structural state-dependence in the earnings ($\widehat{\gamma}$), though smaller and varying more between immigrants and native Swedes. Structural state-dependence here indicates an elasticity of the previous period earnings on the current period. Based on structural state-dependence alone, Swedes had 6 SEK in current earnings for every 100 SEK of previous earnings, which was 2 to 3 times more than that of those from Middle East, Asia, or Latin America.

The marginal effect of being employed in 1990 was not large on the later employment-probabilities of native Swedes (0.017). However, the effect of the first year was much larger on immigrants mostly from non-European countries. Their later employment-probabilities were more influenced by initial employment-status and much less influenced by their own observed and unobserved characteristics. Conditional on working, the elasticity of initial earnings on the later earnings was larger for only the Nordics and other Western Europeans ($0.027 - 0.028$) compared to native Swedes (0.016); and other immigrant groups (mostly non-European) were lower ($0.004 - 0.015$). This results is an indication that the initial values problem is much important for immigrants compared to natives.

The other question is whether there is an effect of the macroeconomic conditions in the arrival-year of the immigrants and the observation period (especially the positive trend in unemployment rates after 1990) on the employment-probabilities and earnings, and whether the effect differs between immigrants and natives, and also across immigrant groups. The local unemployment elasticities were all negative, those on earnings being more statistically significant. They were not only different between natives and immigrants but also across immigrant groups. They were very small for native Swedes ($\widehat{\xi}_{emp} = -0.005$ and $\widehat{\xi}_{inc} = -0.010$) and not much larger for immigrants from Nordic countries ($\widehat{\xi}_{emp} = -0.007$ and $\widehat{\xi}_{inc} = -0.034$) and Western Europe ($\widehat{\xi}_{emp} = -0.018$ and $\widehat{\xi}_{inc} = -0.007$), but they were much larger for all others. For example, for immigrants from the Middle East was $\widehat{\xi}_{emp} = -0.225$, and -0.343 for those from Iraq. Thus, non-European immigrants were much more affected by changing macroeconomic conditions. Another important result is that there is not much difference on the local unemployment elasticities between the classic (static) and dynamic assimilation models.

Arrival year national unemployment elasticities [in brackets] on the employment-probabilities were all negative but small indicating that higher arrival-year unemployment rates correlated with lower employment-probabilities later, and statistically significant only for Middle Eastern immigrants. They were statistically significant on earnings for all immigrants-groups, however. And as with local unemployment-rates, the effect were larger on Middle Eastern, Asian, African and Latin American immigrants ($-0.028, -0.054$).

The variance of the unobserved individual-effects can be used to measure the extent of spurious state-dependence in both employment-probabilities and earnings. There was considerable unobserved individual-effects (heterogeneity) among immigrants and also natives. The size of the variance was large in the classic (static) models for both immigrants and native Swedes, smaller in the dynamic model controlling for structural state-dependence. The variance was also smaller for earnings than for employment, perhaps because of controlling for selection-bias. It could be expected that variance across individuals selected as working would be smaller than that when some individuals are working some are not.

We also observed that selection-bias was a problem independently from static or dynamic specifications: Simultaneous estimation of participation and earnings yielded statistically significant and negatively correlated error-terms, ($\rho = -0.30$ to -0.80). There was also a link between structural state-dependence and selection-bias. The high correlation found with the classic (static) model ($\rho = -0.32$ to -0.80) is reduced in the dynamic model ($\rho = -0.30$ to -0.73), even more so in case where structural state-dependence was large (the average reduction was about 0.10).

To check the sensitivity of the results to exclusion-restrictions, the models were estimated for various combinations of exclusion-restrictions (only number of children, or number of children + marital status, or number of children + marital status + transitory capital income). The results were quite robust to these restrictions, with some change which would not alter the results substantially.

5.2 Predicting employment- and earnings-assimilation from static and dynamic models

The results thus indicate that there is substantial structural state-dependence in the employment-probabilities and earnings, varying between the immigrants and native Swedes, and also across immigrant-groups. The static model, which does not control for the structural state-dependence, is thus potentially biased. That bias can be quantified by predicting the life-cycle employment-probabilities (Table 3a) and earnings (Table 3b) of immigrants and native Swedes. Since the immigrants are not homogenous, the results are reported separately for seven regions and seven specific countries of origin.

The first column of each table gives the differences in predicted initial employment-probability or earnings of immigrants vs. native Swedes (the *entry-effect*). These values were obtained by setting labour market entry (t_0) to age 20, years since migration to zero ($t = 0$) and almost all other variables (such as marital status and education levels etc.) to mean values. Local and arrival-year national unemployment-rates are the exceptions. As shown, the employment -probabilities and the earnings of immigrants were very sensitive to labour-market conditions, so that the values used in the estimation of the assimilation-measures could lead to misleading conclusions. For these variables, it was thus here to use sample medians, which are much more robust than means.

The next eight columns show similar values during $5-$year intervals for the next 40 years. The last column shows total years to assimilation (TYA), where the notation FA indicates $full\ assimilation$, the number of years needed to reach the employment-probability or earnings of an otherwise equivalent native Swede. The notation PA means *partial assimilation*, the number of years needed for the differences in employment-probability or earnings to reach their minimum, if full assimilation was newer reached.

Table 3a about here

5.2.1 Dynamic employment-assimilation of immigrants, by region and country of origin

Both classic (static) and dynamic assimilation models predict that immigrants from the Nordic Countries (and in particular, from Norway and Finland) and from Western Europe reach the employment-probability of native Swedes. The static model actually predicts Nordic immigrants as having higher employment-probability than Swedes upon arrival. However, in the dynamic model, they are 5.1 to 5.9 percentage-points less likely to gain immediate employment upon arrival. But their employment-probabilities continuously improved, converging to those of native Swedes at $29 - 32$ years. Although the large TYA measures might be seen longer in the first look, it is observed that the difference in the employment-probabilities of Nordics and Western Europeans are very small.

There is no other immigrant-group which is able to attain employment-probability level of native Swedes. For example, the Eastern Europeans are reduced the employment-probability gap from 76.1 to 23.7 percentage points at 20 years after arrival (classic (static) model predicts the same as 79.2 to 13.7 percentage-points at 17.2 years). These results are in line with those for Sweden in previous studies (Edin et al., 2000; Aslund and Rooth, 2003; Gustafson and Zheng, 2006), and also with those for Norway (Longva and Raaum, 2002; Barth et al., 2004).

Controlling for structural state-dependence on the predicted employment probabilities mainly appears on the rates of assimilation. Thus, the classic (static) model *overestimated* the short-run assimilation-rates and *underestimates* the long-run depending on the size of the structural state-dependence. The total years to assimilation TYA was much longer for the dynamic model implying positive assimilation-rates for longer periods. Figure 1a illustrates the impact of controlling for structural state-dependence on the marginal assimilation rates on employment-probabilities. The employment-probabilities of native Swedes were almost flat when estimated with dynamic model (solid curve), much more variable with classic (static) model (dashed curve).

Figure 1a about here

Estimates from the classic (static) model are also much more curved than those from the dynamic model for each of the immigrant-groups. For example, the employment-probabilities of Latin American immigrants reached their maximum 29 years after arrival (age $20 + 29 = 49$) when estimated with the dynamic model compared to 17 years with the classic (static) model (age $20 + 17 = 37$). The penalty of age for the immigrants is not as high as the one obtained from static model. The time point in which marginal assimilation rates turned to negative was almost 12 years shorter for Latin American immigrants with classic (static) model. Employment-probabilities do not fall off as fast with age when estimated with the dynamic model, indicating that accumulated human capital in the past was transferred to later ages and it helped immigrants keeping their employment-probability higher and more closer to those of native Swedes.

5.2.2 Dynamic earnings-assimilation of immigrants, by region and country of origin

Table 3b shows the relative earnings and years-to-assimilation of immigrants compared with otherwise identical native Swedes. The classic (static) model predicts that only immigrants from the Nordic countries, Western Europe, Eastern Europe, and Latin America attain earnings parity, in line with previous studies in Sweden. However, these results are biased, as comparison with the results from the dynamic model reveal.

Table 3b about here

The over all pattern in predicted relative earnings is similar to that for employment-probabilities, but the effect of controlling for structural state-dependence is much apparent. It is observed first that the initial earnings-differences is overestimated with classic (static) model. For instance, according to the classic (static) model, Eastern European immigrants are predicted to earn 0.88 log-points less than native Swedes upon arrival, but then to experience very fast earnings growth, catching-up earnings parity of native Swedes in about 18 years. It also predicts that their human capital depreciates fast and the earnings-difference then increases again even up to 0.61 log-points at $36 - 40$ years. This pattern is the same for all immigrant groups with the classic (static) assimilation model. The dynamic model, on the other hand, predicts a smaller initial earnings-difference (0.53 log-points), followed by smooth and continuous relative earnings-growth which attain parity after 37 year.

Briefly, the predictions of the static model is not plausible. It is biased in a way that it overestimates the speed of Sweden-specific human-capital accumulation in the short-run and it does not able to predict true rate of human-capital depreciation. In fact, all immigrant-groups (except those from Iraq) eventually attained earnings parity, in periods ranging from 12 years (Western Europe) to 55 years (Middle East).

Figure 1b shows the age-earnings profiles predicted by the classic (static) and dynamic models by region of origin.

Figure 1b about here

5.3 Cohort effects

Arrival-cohort effects are mostly interpreted as unobserved differences in the productivity of immigrants, i.e., their "quality", and these cohort-effects can be identified by both classic (static) and dynamic models used here. However, many factors can influence the estimates of these effects, and here we deal with many possible sources of bias on the estimates of cohort-effects on both the employment-probabilities and earnings of immigrants.

Macroeconomic conditions prevailing at the time of arrival might influence later outcomes, e.g., though human-capital accumulation; signalling effects; and "scarring" by unemployment. Similarly, immigration policies in effect at arrival might influence what kind of competition immigrants face, and the potential for statistical discrimination (e.g., for or against political refugees and immigration for work). Changes in general attitudes towards foreigners among the population or the eligibility criteria set by the immigration policy could also have an effect. Thus, the employment- probabilities and earnings potential of immigrant cohorts might depend on a host of factors which are also linked with the sources of the structural state-dependence, besides their own quality.

Controlling for the structural state-dependence, and for local unemployment-rates at the time of observation as well as for selection into employment at that time, and arrival-year national unemployment-rates, are important for getting cleaner estimates of the cohort-effects. For example, Barth et al., (2004) found that when unemployment was rising -as in Sweden during 1990s- the classical (static) assimilation model with equal-period-effects restriction and without controlling for local unemployment-rates, overestimated the labour-market success of early cohorts, and underestimated that of later. The dynamic model estimated here will allow to look at the "true" cohort-effects uncompromised by these other factors, and to compare those results with those from classic (static) model also estimated.

Seven cohorts of immigrants from each region (pre-1970, in five-year period, 1970-1974, 1975-1979, 1980-1984, 1985-1989, 1990-1994, six-years period, 1995-2000) were estimated, relative to the omitted pre-1970. Table 4 presents the cohort-effects on both employment-probabilities and earnings, from both classic (static) and dynamic models.

Table 4 about here

The dynamic model estimated all-negative cohort-effects on employment-probabilities, generally getting sequentially larger across cohorts for each regions of origin. This suggests unobserved employability of immigrants declined steadily relative to those who arrived before 1970. This result is in line with previous studies on immigrants in Scandinavian countries.

However, the dynamic estimates controlling for the structural state-dependence were smaller than the static estimates, where the negative trend across cohorts also appeared much more starkly. Much of the effect picked up by the static model was presumably captured as structural state-dependence in the dynamic model. Thus the *sharp* decline in employability of recent immigrants found by the static model, is not supported by the dynamic model. For example, the classic (static) model estimates that immigrants from Asia after 1970 were $20 - 69$ percentage-point less likely to be employed compared to pre-1970 arrivals. The dynamic model estimates them as only $5 - 28$ percentage-points less likely to be employed.

Both static and dynamic models find that earnings capacity of immigrants who arrived after 1970 from the Nordic countries, Western Europe and Eastern Europe were generally higher across cohorts. The cohort-effect on earnings was positive from the start for Nordic immigrants, and turned positive after 1984 even in the static model for Western and Eastern Europeans as well as Latin Americans. With the exception of immigrants from Asia, and those from Middle East after 1984, the dynamic model finds better earnings relative to those arrived before 1970 than does the classic (static) model.

The cohort-effects on earnings for immigrants from the Middle East, Asia, and Africa were generally increasingly negative, with the earnings of newly arrived immigrants considerably lower than those who arrived before 1970. The decline in the earnings-capacity for these immigrant-cohorts was much higher in the dynamic model. For example, Asian immigrants arrived after 1970 earned $0.18 - 0.35$ log-points less than pre-1970 arrivals in the classic (static) model, but $0.30 - 0.80$ less in the dynamic model.

6 Discussion and Conclusions

The dynamics behind the employment-probabilities and earnings-assimilation of immigrants were studied using high-quality register-based panel data covering 1990-2000. The primary question was the extent of structural state-dependence, and whether it differed between natives and immigrants, and also across immigrant groups. The link between the structural state-dependence and the cohort-effects was also investigated. Results from a dynamic random-effects sample selection model controlling for structural state-dependence in both participation and earnings, for selection-bias, and for unobserved individual-specific characteristics, were compared with results from a static model widely used in the previous studies. Employment-probabilities and earnings were simultaneously estimated, using local unemployment-rate as proxy for the changing economy-wide conditions to deal with a possible bias due to identification restrictions on the period-effects.

The simple method of Wooldridge (2005) was used considering that initial (sample) employment status and earnings are endogenous variables correlated with observed and unobserved individual characteristics to deal with the initial values problem. Arrival-year national unemployment-rates- which could affect the later success of immigrants- was used as a part of the conditional distribution of unobserved individual characteristics to link it by initial values problem.

Substantial structural and spurious state-dependence were found both in employment-probabilities and earnings of both immigrants and native Swedes. Structural state-dependence was larger in employment-probabilities than in earnings. The structural state-dependence found in employment-probabilities was slightly different for native Swedes as for immigrants, and also across immigrant groups. However, although smaller, the structural state-dependence found in earnings differed substantially between native Swedes and immigrants, and also across immigrant groups. Native Swedes had $2 - 3$ times more structural state-dependence than immigrants. Failure to control for structural state-dependence (i.e., using the classic (static) model instead of dynamic model) was found to cause serious overestimation of variance for the unobserved individual-effect.

The results suggest that the classical (static) model does not capture the actual behavior of human-capital accumulation with years spent in the host country. It seriously overstated the short-run marginal assimilation rates and understated the long-run ones. It thus overstates human-capital accumulation in the first years after arrival, but fast and high depreciation later, thus predicting the "penalty of age" too early for immigrants.

On the other hand, the dynamic model predicts a smaller initial-earnings disadvantage, and slower human-capital accumulation in the first years after arrival, but less depreciation later. Total years to assimilation (whether partial or full) - in both employment-probability and earnings- are thus longer in the dynamic than the static model, but more stable once achieved.

Both static and dynamic models found that no immigrants except those from Nordic and other Westerners European countries were able to reach the employment-probabilities of native Swedes. While the static model found that Middle Eastern, Asian, and African immigrants were not able to reach earnings parity with native Swedes, the dynamic model found that all (except immigrants from Iraq) eventually reach parity, though (for Middle Easterners) it could take up to 55 years.

Unobserved immigrant quality -i.e., cohort-effects- were also estimated in both models. The results suggest that the classic (static) model overstates the slope of the decline over succession of cohorts in the employability of the immigrants. This sharp decline in the cohort-effects is not supported by the dynamic model, much of the effect picked up by the static model is captured as structural state-dependence in the dynamic model.

The differences between the static and dynamic results for earnings by cohort were more complicated. Earnings-capacity of immigrants from Nordic and other Western European countries, Eastern Europe, and Latin America increased across cohorts, and this rise was underestimated by classic (static) model. But the earnings-capacity of immigrants from the Middle East, Asia, and Africa declined and this was also underestimated by the static model.

Policies based on the biased results of the classical (static) model may be questioned. There is significant state-dependence on employment-probabilities and earnings of both immigrants and natives. It appears that early-intervention policies which aim to change the living standards, income inequality, and poverty can alter the long-run outcomes both in employability and earnings. All immigrant groups in Sweden (except Iraqi immigrants) were found to be able to reach earnings parity, though not parity in employment-probabilities. Thus the question for Sweden is not whether the earnings of immigrants converge or not, but how many years it takes, and what policies might help them achieve employment-parity as well.

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Table 1. *Mean values of variables for native immigrants and Swedes, by region of origin, 1990-2000*

	Native Swedes	Nordic Countries	Western Europe	Eastern Europe	Middle East	Asia	Africa	Latin America
Log earnings	10.78 (3.73)	8.99 (5.14)	8.06 (5.51)	7.83 (5.71)	5.67 5.58)	7.54 (5.36)	6.27 (5.53)	7.84 (5.16)
Log lagged earnings	10.86 (3.60)	9.09 (5.05)	8.16 (5.44)	6.71 (5.72)	5.60 (5.57)	7.48 (5.35)	6.14 (5.52)	8.10 (5.15)
Log earnings in 1990	10.99 (3.19)	9.79 (4.43)	8.51 (5.12)	6.01 (5.73)	5.90 (5.51)	7.16 (5.28)	5.87 (5.48)	8.38 (4.89)
Employment	0.82 (0.37)	0.68 (0.47)	0.59 (0.49)	0.49 (0.50)	0.37 (0.48)	0.51 (0.50)	0.40 (0.49)	0.56 (0.49)
First lag of employment	0.83 (0.37)	0.69 (0.45)	0.60 (0.49)	0.47 (0.49)	0.36 (0.48)	0.50 (0.50)	0.39 (0.48)	0.55 (0.50)
Employment in 1990	0.83 (0.38)	0.74 (0.44)	0.61 (0.49)	0.42 (0.49)	0.38 (0.48)	0.44 (0.50)	0.36 (0.49)	0.56 (0.50)
Local unemployment rate	2.81 (1.18)	2.66 (1.01)	2.83 (1.26)	2.85 (1.11)	3.35 (1.55)	3.21 (1.48)	3.15 (1.34)	3.01 (1.41)
Age	38.7 (10.8)	40.7 (10.8)	39.2 (10.96)	38.9 (11.2)	35.6 (9.46)	33.3 (10.5)	33.1 (9.15)	35.4 (10.8)
Years since immigration		19.0 (9.40)	14.8 (9.76)	12.2 (9.64)	9.77 (6.49)	12.6 (7.62)	8.59 (6.32)	12.1 (6.80)
Married/cohabiting	0.40 (0.49)	0.39 (0.49)	0.47 (0.50)	0.59 (0.49)	0.55 (0.50)	0.47 (0.50)	0.44 (0.50)	0.38 (0.48)
Number of the children at home	1.78 (1.16)	1.61 (1.12)	1.66 (1.12)	1.81 (1.20)	1.97 (1.47)	1.70 (1.26)	1.58 (1.54)	1.69 (1.21)
Stockholm residence	0.22 (0.43)	0.35 (0.44)	0.39 (0.47)	0.22 (0.34)	0.37 (0.45)	0.30 (0.42)	0.40 (0.48)	0.43 (0.51)
Log capital (non-labor) income	0.74 (2.26)	0.49 (1.83)	0.56 (1.99)	0.45 (1.76)	0.54 (1.91)	0.62 (2.03)	0.27 (1.35)	0.30 (1.44)
Lower–secondary	0.23 (0.37)	0.31 (0.44)	0.32 (0.46)	0.23 (0.39)	0.45 (0.48)	0.39 (0.47)	0.32 (0.45)	0.40 (0.47)
Upper–secondary	0.51 (0.49)	0.43 (0.50)	0.36 (0.47)	0.51 (0.50)	0.39 (0.49)	0.37 (0.48)	0.46 (0.50)	0.47 (0.49)
University degree	0.26 (0.43)	0.26 (0.42)	0.32 (0.46)	0.26 (0.43)	0.26 (0.43)	0.24 (0.43)	0.22 (0.41)	0.23 (0.42)
Arrival Cohorts								
<1970		0.22 (0.44)	0.10 (0.23)	0.10 (0.29)	0.03 (0.17)	0.03 (0.19)	0.03 (0.20)	0.04 (0.25)
1970–74		0.23 (0.42)	0.17 (0.37)	0.14 (0.35)	0.04 (0.18)	0.10 (0.31)	0.04 (0.21)	0.05 (0.22)
1975–79		0.21 (0.40)	0.16 (0.36)	0.08 (0.26)	0.11 (0.31)	0.21 (0.41)	0.07 (0.26)	0.21 (0.40)
1980–84		0.09 (0.28)	0.13 (0.33)	0.10 0.30)	0.12 (0.32)	0.18 (0.39)	0.08 (0.27)	0.18 (0.38)
1985–89		0.13 (0.33)	0.18 (0.38)	0.14 (0.34)	0.35 (0.48)	0.19 (0.39)	0.30 (0.45)	0.33 (0.47)
1990–94		0.09 (0.29)	0.17 (0.37)	0.38 (0.48)	0.29 (0.45)	0.24 (0.43)	0.42 (0.50)	0.15 (0.36)
1995–2000		0.03 (0.17)	0.09 (0.17)	0.06 (0.24)	0.06 (0.24)	0.05 (0.22)	0.06 (0.23)	0.04 (0.20)
Sample size	540651	131647	67641	107124	121914	28381	28432	36547

Notes: (Standard deviations in parentheses)

Table 2. *Structural state dependence, unobserved individual-effects; local and arrival year unemployment-elasticities on employment-probabilities and earnings; obtained from jointly-estimated employment- and earnings-equations; by region and country of origin, 1990-2000.*

	Employment Probability					Earnings				
	S + CRE + WC		*SD*(1) + *WC + WIV*			*S + CRE + WC*		*SD*(1) + *WC + WIV*		
Region or country	$\hat{\sigma}_\eta$	$\hat{\xi}_{emp}$	$\hat{\lambda}$	$\hat{\sigma}_\eta$	$\hat{\xi}_{emp}$	$\hat{\sigma}_\alpha$	$\hat{\xi}_{inc}$	$\hat{\gamma}$	$\hat{\sigma}_\alpha$	$\hat{\xi}_{inc}$
Sweden										
	1.737	-0.004	**0.619***** (0.017)***	1.138	-0.005	0.435	-0.007***	**0.060***** (0.016***)	0.406	-0.010
ρ	-0.721			-0.380						
Nordic Countries										
	2.012	-0.003	**0.575***** (0.301)***	0.839	-0.007* [-0.002]	0.463	-0.036***	**0.044***** (0.028***)	0.411	-0.034*** [-0.001]***
ρ	-0.322			-0.322						
Norway										
	1.755	-0.018*	**0.540***** (0.312***)	0.757	-0.012* [-0.004]	0.497	-0.030***	**0.047***** (0.028***)	0.431	-0.038*** [-0.020***]
ρ	-0.464			-0.394						
Finland										
	2.044	-0.013	**0.580***** (0.459***)	0.828	-0.009 [-0.007]	0.395	-0.043***	**0.049***** (0.028***)	0.371	-0.036*** [-0.005***]
ρ	-0.399			-0.306						
Western Countries										
	1.920	-0.016***	**0.582***** (0.170***)	0.829	-0.018* [-0.004]	0.520	-0.017***	**0.046***** (0.027***)	0.487	-0.007** [-0.010***]
ρ	-0.470			-0.308						
Eastern Europe										
	1.529	-0.034	**0.698***** (0.246***)	0.156	-0.099** [-0.002]	0.381	-0.115***	**0.040***** (0.015***)	0.228	-0.102*** [-0.011***]
ρ	-0.624			-0.455						
Yugoslavia										
	1.647	-0.071*	**0.671***** (0.285***)	0.524	-0.076* [-0.004]	0.369	-0.075***	**0.036***** (0.015***)	0.367	-0.099*** [-0.026*]
ρ	-0.581			-0.510						

Table 2. *Continued*

	Employment Probability					Earnings				
	S + CRE + WC		*SD*(1) + *WC + WIV*			*S + CRE + WC*		*SD*(1) + *WC + WIV*		
Region or country	$\hat{\sigma}_\eta$	$\hat{\xi}_{emp}$	$\hat{\lambda}$	$\hat{\sigma}_\eta$	$\hat{\xi}_{emp}$	$\hat{\sigma}_\alpha$	$\hat{\xi}_{inc}$	$\hat{\gamma}$	$\hat{\sigma}_\alpha$	$\hat{\xi}_{inc}$
Middle East										
	1.179	-0.056*	**0.447***** (0.132***)	0.517	-0.036 [-0.002*]	0.328	-0.234***	**0.024***** (0.009***)	0.344	-0.225*** [-0.054***]
ρ	-0.780			-0.647						
Iran										
	1.047	-0.049*	**0.418***** (0.081***)	0.494	-0.013 [-0.001]	0.325	-0.071***	**0.027***** (0.005***)	0.308	-0.084*** [-0.006]
ρ	-0.721			-0.670						
Iraq										
	1.080	-0.114**	**0.313***** (0.117***)	0.514	-0.036** [-0.010*]	0.284	-0.295***	**0.023***** (0.004***)	0.314	-0.343*** [-0.095***]
ρ	-0.799			-0.732						
Turkey										
	1.363	-0.046*	**0.450***** (0.240***)	0.565	-0.043* [-0.017**]	0.375	-0.187***	**0.023***** (0.004***)	0.164	-0.251*** [-0.072***]
ρ	-0.634			-0.619						
Asia										
	1.401	-0.091**	**0.587***** (0.169***)	0.074	-0.056* [-0.004]	0.380	-0.168***	**0.032***** (0.010***)	0.218	-0.089*** [-0.054***]
ρ	-0.522			-0.566						
Africa										
	1.175	-0.089***	**0.611***** (0.097)	0.907	-0.109*** [-0.006]	0.293	-0.141***	**0.024***** (0.007***)	0.262	-0.170*** [-0.029*]
ρ	-0.782			-0.688						

Table 2. *Continued*

	Employment Probability					Earnings				
	S + *CRE* + *WC*		*SD*(1) + *WC* + *WIV*			*S* + *CRE* + *WC*		*SD*(1) + *WC* + *WIV*		
Region or country	$\hat{\sigma}_\eta$	$\hat{\xi}_{emp}$	$\hat{\lambda}$	$\hat{\sigma}_\eta$	$\hat{\xi}_{emp}$	$\hat{\sigma}_\alpha$	$\hat{\xi}_{inc}$	$\hat{\gamma}$	$\hat{\sigma}_\alpha$	$\hat{\xi}_{inc}$
Latin America										
	1.221	-0.057*	**0.638***** (0.142)	0.153	-0.045* [-0.009]	0.336	-0.145***	**0.033***** (0.011***)	0.162	-0.131*** [-0.028***]
ρ	-0.728			-0.669						
Chile										
	1.197	-0.054*	**0.617***** (0.135)***	0.387	-0.044* [-0.011]	0.292	-0.166***	**0.032***** (0.005***)	0.080	-0.183*** [-0.028***]
ρ	-0.640			-0.662						

Notes: All results reported in this table are marginal effects on employment-probabilities and earnings. *S* is static; *CRE* is correlated random effects; *WC* is wage-curve model including interactions with year since migration and year since migration squared; *SD* (1) is first order state dependence; *WIV* is simple method of Wooldridge; $\hat{\lambda}$ and $\hat{\gamma}$ are estimated marginal effects of structural state-dependence on both employment-probabilities and earnings; $\hat{\sigma}_\eta$ and $\hat{\sigma}_\alpha$ are variance of unobserved individual-effects in both equations; $\hat{\xi}_{emp}$ and $\hat{\xi}_{inc}$ are local unemployment elasticities on employment-probabilities and earnings, respectively; The marginal effects of initial sample-period dependent variable (in parentheses); the figures in brackets are the marginal effects of arrival-year national unemployment elasticities. ρ is correlation between participation and earnings-equations. *, **, *** represent significance at 0.01, 0.05 and 0.10, respectively.

Table 3a. *Relative employment-probabilities and years-to-assimilation of immigrants, by region and country of origin, 1990-2000 (percentage-points)*

	Years since migration									
	Initial	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	TYA
Nordic Countries										
Static	**0.072**	**0.028**	**0.002**	– 0.011	– 0.017	– 0.018	– 0.019	– 0.022	– 0.033	NA
Dynamic	– 0.051	– 0.023	– 0.023	– 0.021	– 0.018	– 0.014	– 0.008	**0.002**	**0.011**	**31.3** (FA)
Norway										
Static	**0.075**	**0.048**	**0.029**	**0.017**	**0.008**	–0.001	–0.014	–0.027	–0.038	NA
Dynamic	– 0.059	– 0.051	– 0.039	– 0.023	– 0.012	– 0.003	**0.002**	**0.006**	**0.008**	**29.0** (FA)
Finland										
Static	**0.066**	**0.029**	**0.004**	– 0.012	– 0.017	– 0.025	– 0.034	– 0.075	– 0.179	NA
Dynamic	– 0.058	– 0.051	– 0.042	– 0.033	– 0.024	– 0.017	– 0.009	**0.003**	**0.008**	**32.0** (FA)
Western Europe										
Static	– 0.194	– 0.078	– 0.033	– 0.019	– 0.013	– 0.006	**0.004**	**0.014**	– 0.001	**28.8** (FA)
Dynamic	– 0.127	– 0.065	– 0.037	– 0.027	– 0.017	– 0.008	– 0.002	**0.004**	**0.012**	**31.1** (FA)
Eastern Europe										
Static	– 0.792	– 0.695	– 0.342	– 0.155	– 0.137	– 0.255	– 0.582	– 0.617	– 0.628	17.2 (PA)
Dynamic	– 0.761	– 0.581	– 0.407	– 0.290	– 0.237	– 0.241	– 0.304	– 0.431	– 0.470	20.2 (PA)
Yugoslavia										
Static	–0.771	–0.644	–0.315	–0.121	–0.117	–0.220	–0.473	–0.557	–0.593	15.1 (PA)
Dynamic	–0.782	–0.639	–0.490	–0.377	–0.316	–0.304	–0.343	–0.432	–0.497	23.5 (PA)
Middle East										
Static	– 0.712	– 0.682	– 0.613	– 0.546	– 0.603	– 0.720	– 0.786	– 0.746	– 0.628	12.1 (PA)
Dynamic	– 0.783	– 0.703	– 0.629	– 0.579	– 0.560	– 0.575	– 0.622	– 0.693	– 0.771	20.2 (PA)
Iraq										
Static	– 0.791	– 0.772	– 0.636	– 0.686	– 0.882	– 0.936	– 0.908	– 0.847	– 0.728	9.27 (PA)
Dynamic	– 0.875	– 0.778	– 0.649	– 0.580	– 0.609	– 0.723	– 0.844	– 0.893	– 0.896	16.0 (PA)
Iran										
Static	– 0.712	– 0.665	– 0.512	– 0.407	– 0.509	– 0.529	– 0.627	– 0.732	– 0.783	13.6 (PA)
Dynamic	– 0.823	– 0.741	– 0.652	– 0.583	– 0.549	– 0.557	– 0.304	– 0.681	– 0.769	21.5 (PA)
Turkey										
Static	– 0.686	– 0.621	– 0.544	– 0.429	– 0.594	– 0.621	– 0.734	– 0.738	– 0.792	12.9 (PA)
Dynamic	– 0.706	– 0.643	– 0.595	– 0.569	– 0.566	– 0.588	– 0.631	– 0.691	– 0.757	17.8 (PA)
Asia										
Static	– 0.778	– 0.741	– 0.574	– 0.441	– 0.411	– 0.487	– 0.647	– 0.647	– 0.774	18.7 (PA)
Dynamic	– 0.714	– 0.648	– 0.585	– 0.526	– 0.468	– 0.415	– 0.367	– 0.405	– 0.460	29.1 (PA)
Africa										
Static	– 0.773	– 0.719	– 0.551	– 0.469	– 0.449	– 0.471	– 0.558	– 0.740	– 0.821	18.4 (PA)
Dynamic	– 0.752	– 0.643	– 0.537	– 0.454	– 0.406	– 0.393	– 0.416	– 0.474	– 0.563	24.2 (PA)
Latin America										
Static	– 0.666	– 0.561	– 0.427	– 0.346	– 0.333	– 0.388	– 0.506	– 0.643	– 0.674	17.3 (PA)
Dynamic	– 0.561	– 0.452	– 0.364	– 0.300	– 0.262	– 0.248	– 0.235	– 0.317	– 0.369	28.6 (PA)
Chile										
Static	– 0.482	– 0.301	– 0.303	– 0.257	– 0.301	– 0.385	– 0.525	– 0.664	– 0.683	14.8 (PA)
Dynamic	– 0.445	– 0.370	– 0.317	– 0.286	– 0.273	– 0.265	– 0.307	– 0.353	– 0.421	24.5 (PA)

Notes: The values were obtained by setting the years since migration to zero then adding five years at a time until 40; other variables are set to their mean values, except local market unemployment-rates (median was used). For each region of origin, the first row presents the static correlated random effects model with augmented wage-curve method (*S+CRE+WC*). The second row presents the results from dynamic model with augmented wage curve methodology and Wooldridge initial values (*SD(1)+WC + WIV*). Bold indicates that the employment-probabilities of an immigrant group exceed those of native Swedes. *FA* indicates full assimilation, *PA* partial assimilation. *NA* "not applicable".

Figure 1a. Comparison of predicted age-employment probability-profiles of native Swedes and immigrants by region of origin, 1990-2000, obtained from classic static assimilation model (*dashed curves*, $S + CRE + WC$) and dynamic assimilation model (*solid curves*, $SD(1) + WC + WIV$), using median local unemployment rates: for Nordics= 2.89%; Western Europeans= 2.88%; Eastern Europeans= 2.81%; Middle Easterners= 3.17%; Asians= 3.02%; Africans= 2.99%; Latin Americans= 3.07% and for native Swedes= 2.88%; see also the note on Table 3a

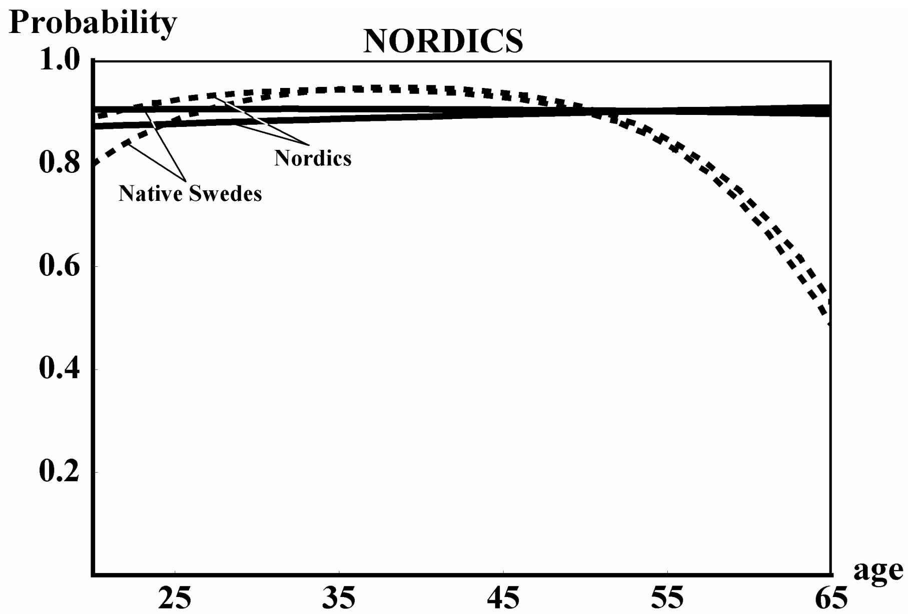
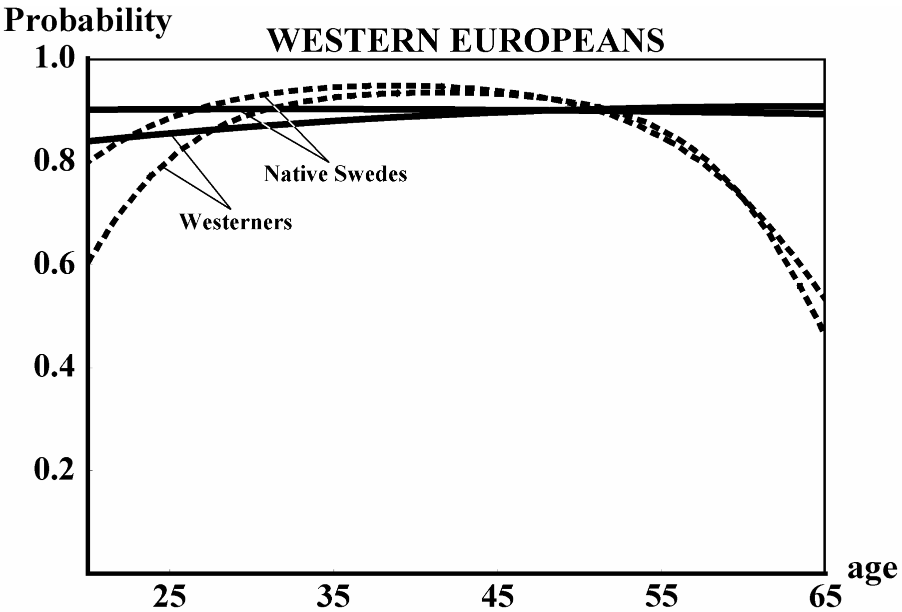


Figure 1a. *Continued*



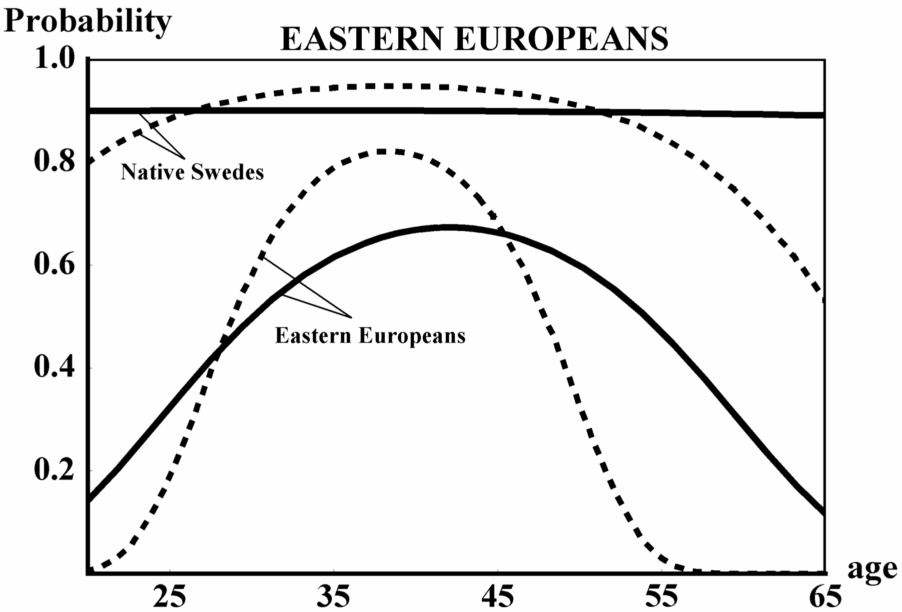
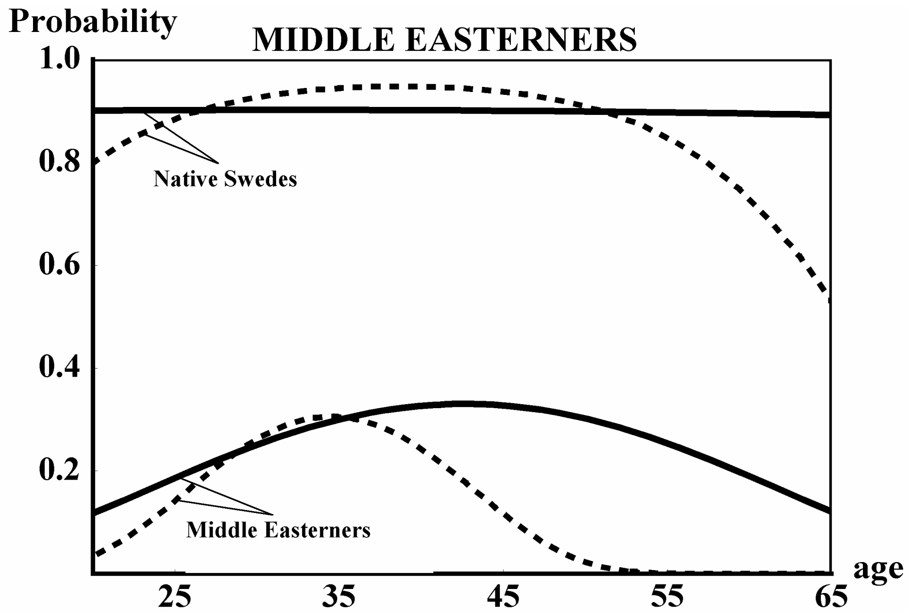


Figure 1a. *Continued*



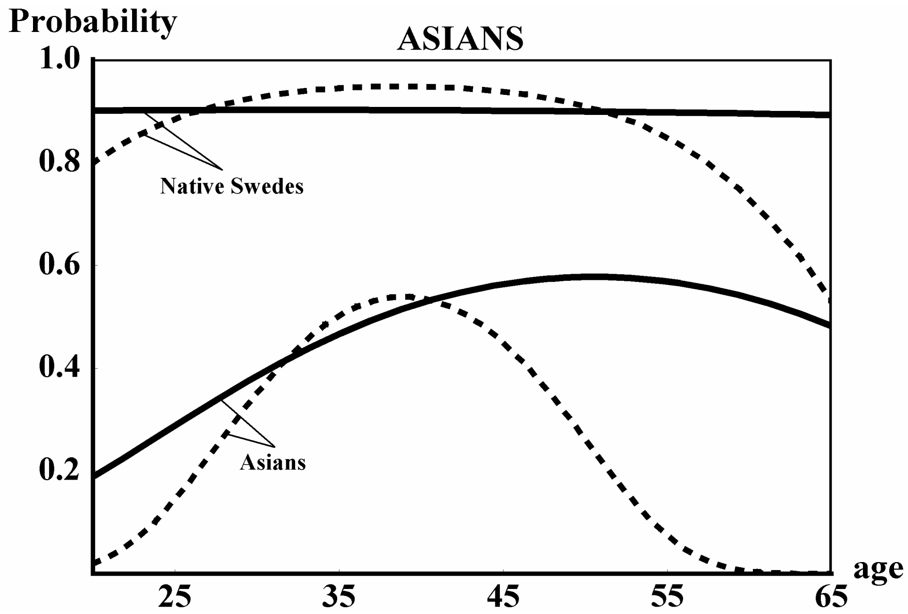
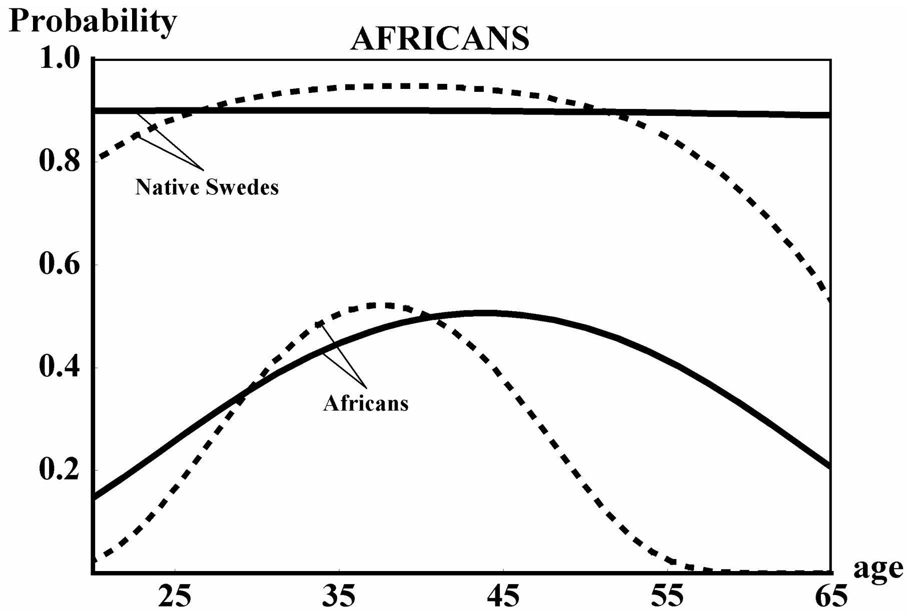


Figure 1a. *Continued*



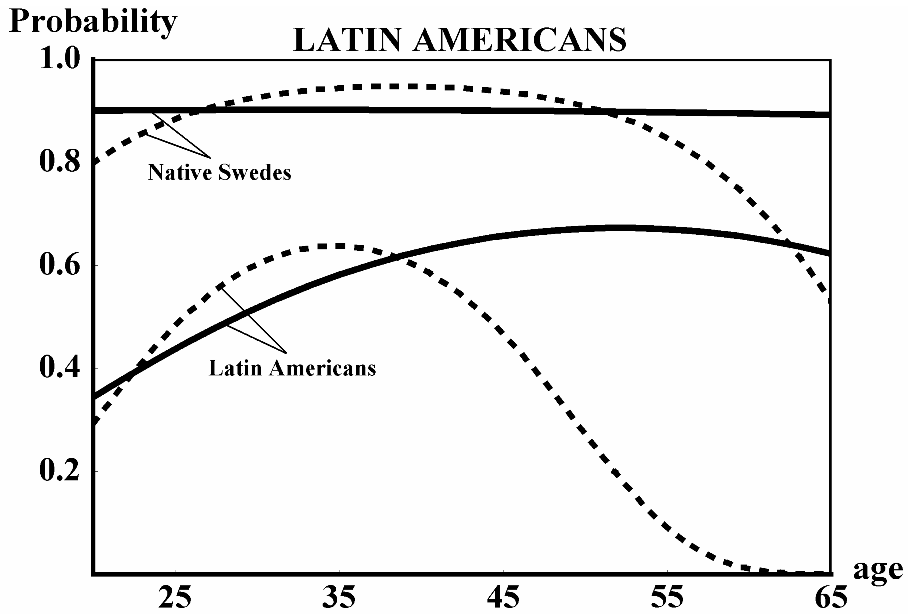


Table 3b. *Relative earnings and years-to-assimilation of immigrants, by region and country of origin, 1990-2000 (Log-points)*

	Year since migration									
	Initial	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	TYA
Nordic Countries										
Static	– 0.136	– 0.158	– 0.154	– 0.131	– 0.069	**0.042**	**0.094**	**0.189**	**0.311**	**22.5** (FA)
Dynamic	– 0.058	– 0.099	– 0.104	– 0.096	– 0.076	– 0.045	– 0.005	**0.043**	**0.100**	**30.6** (FA)
Norway										
Static	**0.005**	– 0.039	– 0.060	– 0.062	– 0.048	– 0.020	**0.026**	**0.092**	**0.188**	NA
Dynamic	– 0.049	– 0.048	– 0.044	– 0.036	– 0.023	– 0.007	**0.013**	**0.038**	**0.047**	**26.5** (FA)
Finland										
Static	– 0.034	– 0.055	– 0.043	**0.003**	**0.061**	**0.144**	**0.240**	**0.348**	**0.470**	**14.8** (FA)
Dynamic	– 0.031	– 0.043	– 0.049	– 0.037	**0.008**	0.038	0.101	0.179	0.275	**18.3** (FA)
Western Europe										
Static	– 0.179	– 0.102	– 0.027	**0.045**	**0.110**	**0.169**	**0.218**	**0.259**	**0.295**	**11.8** (FA)
Dynamic	– 0.160	– 0.090	– 0.026	**0.032**	**0.055**	**0.079**	**0.082**	**0.078**	**0.051**	**12.1** (FA)
Eastern Europe										
Static	– 0.875	– 0.473	– 0.215	– 0.070	**0.009**	**0.031**	– 0.043	– 0.256	– 0.612	**18.4** (FA)
Dynamic	– 0.532	– 0.427	– 0.339	– 0.263	– 0.194	– 0.130	– 0.071	– 0.020	**0.016**	**37.5** (FA)
Yugoslavia										
Static	– 0.795	– 0.517	– 0.317	– 0.125	**0.042**	**0.026**	– 0.031	– 0.158	– 0.356	**17.1** (FA)
Dynamic	– 0.544	– 0.473	– 0.407	– 0.344	– 0.279	– 0.212	– 0.141	– 0.076	**0.007**	**39.4** (FA)
Middle East										
Static	– 0.812	– 0.639	– 0.518	– 0.441	– 0.404	– 0.417	– 0.494	– 0.642	– 0.858	21.4 (PA)
Dynamic	– 0.746	– 0.682	– 0.618	– 0.554	– 0.486	– 0.416	– 0.242	– 0.268	– 0.195	**55.3** (FA)
Iran										
Static	– 0.702	– 0.472	– 0.294	– 0.160	– 0.063	**0.006**	**0.032**	– 0.044	– 0.148	**24.3** (FA)
Dynamic	– 0.581	– 0.484	– 0.351	– 0.238	– 0.143	– 0.043	**0.001**	**0.009**	**0.017**	**30.7** (FA)
Iraq										
Static	– 1.023	– 0.664	– 0.532	– 0.573	– 0.803	– 1.286	– 2.031	– 2.571	– 2.896	8.38 (PA)
Dynamic	– 0.833	– 0.675	– 0.572	– 0.508	– 0.479	– 0.487	– 0.544	– 0.661	– 0.846	17.4 (PA)
Turkey										
Static	– 0.591	– 0.510	– 0.429	– 0.345	– 0.213	– 0.100	– 0.041	**0.024**	**0.055**	**33.5** (FA)
Dynamic	– 0.586	– 0.607	– 0.681	– 0.680	– 0.650	– 0.549	– 0.421	– 0.262	– 0.151	**40.1** (FA)
Asia										
Static	– 0.845	– 0.627	– 0.461	– 0.342	– 0.261	– 0.217	– 0.213	– 0.259	– 0.356	31.8 (PA)
Dynamic	– 0.695	– 0.631	– 0.565	– 0.497	– 0.424	– 0.348	– 0.268	– 0.184	– 0.097	**45.2** (FA)
Africa										
Static	– 0.871	– 0.611	– 0.451	– 0.371	– 0.352	– 0.395	– 0.520	– 0.748	– 1.082	19.2 (PA)
Dynamic	– 0.642	– 0.559	– 0.494	– 0.444	– 0.404	– 0.344	– 0.292	– 0.229	– 0.160	**52.9** (FA)
Latin America										
Static	– 0.600	– 0.442	– 0.313	– 0.209	– 0.120	– 0.046	**0.008**	**0.033**	**0.027**	**29.1** (FA)
Dynamic	– 0.525	– 0.500	– 0.466	– 0.422	– 0.368	– 0.304	– 0.229	– 0.143	– 0.045	**42.2** (FA)
Chile										
Static	– 0.374	– 0.311	– 0.250	– 0.188	– 0.123	– 0.057	**0.002**	**0.049**	**0.083**	**26.6** (FA)
Dynamic	– 0.389	– 0.326	– 0.266	– 0.206	– 0.146	– 0.085	– 0.025	**0.028**	**0.043**	**31.7** (FA)

Notes: See Table 3a.

Figure 1b. Comparison of predicted age-earnings-profiles of native Swedes and immigrants by region of origin, 1990-2000, obtained from classic static assimilation model (*dashed curves*, $S + CRE + WC$) and dynamic assimilation model (*solid curves*, $SD(1) + WC + WIV$), using median local unemployment rates: for Nordics= 2.89%; Western Europeans= 2.88%; Eastern Europeans= 2.81%; Middle Easterners= 3.17%; Asians= 3.02%; Africans= 2.99%; Latin Americans= 3.07% and for native Swedes= 2.88%; see also the note on Figure1a

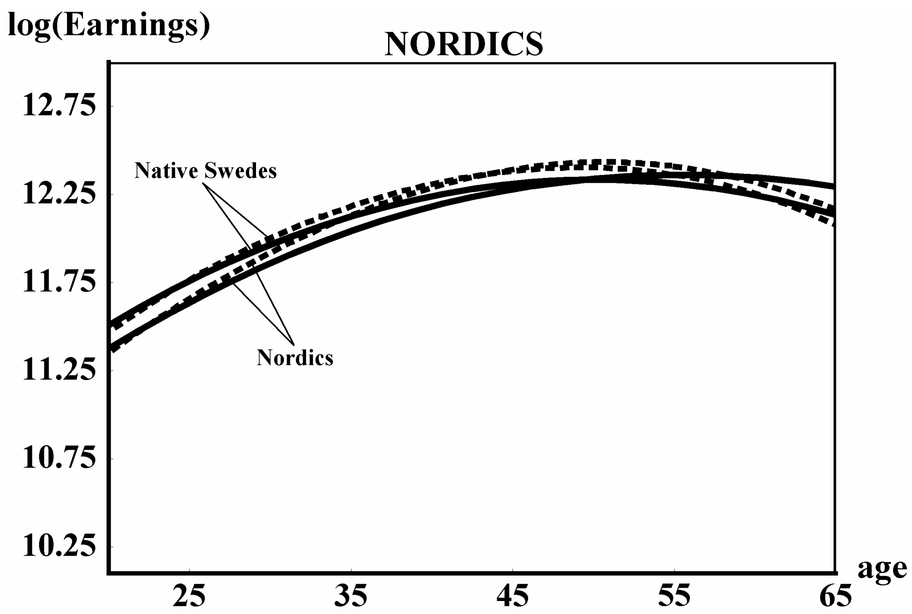
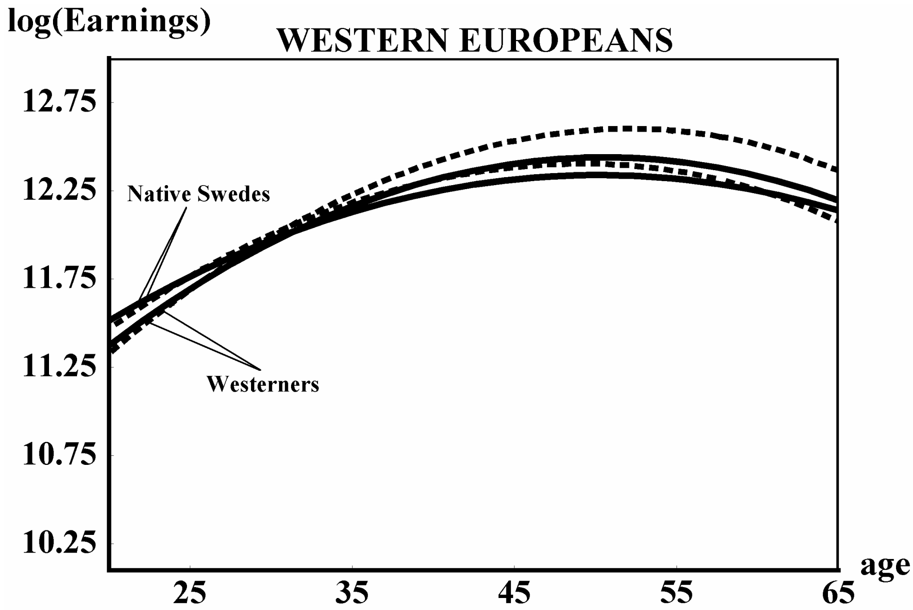


Figure 1b. *Continued*



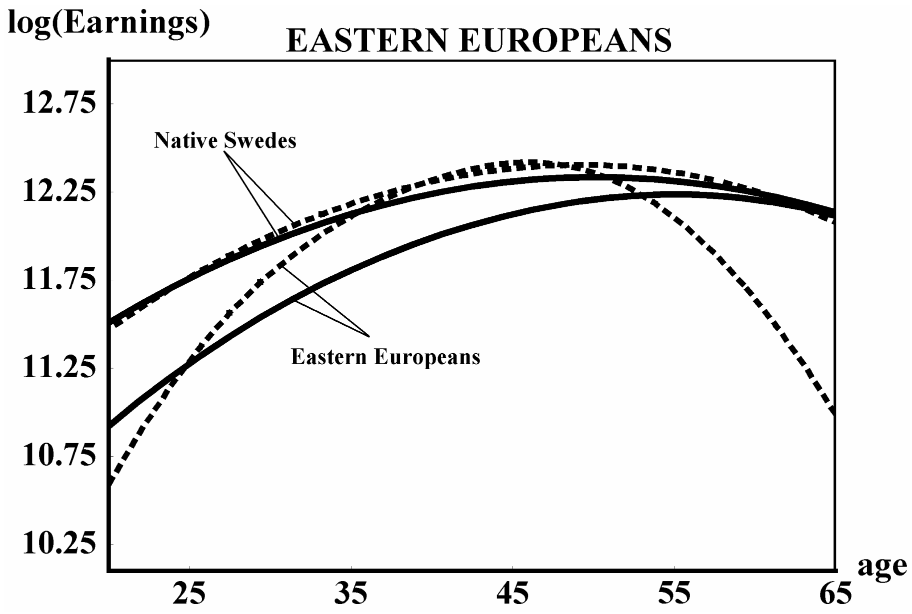
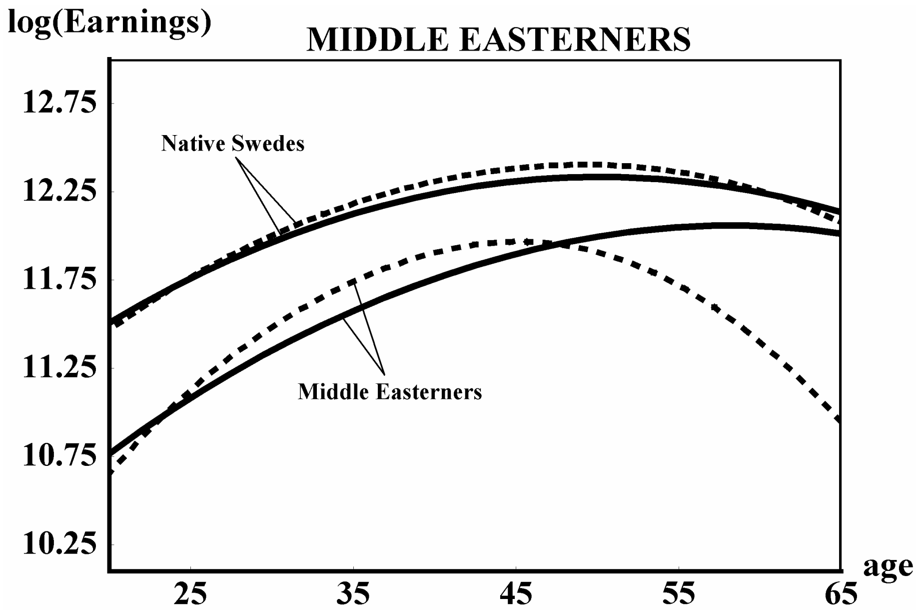


Figure 1b. *Continued*



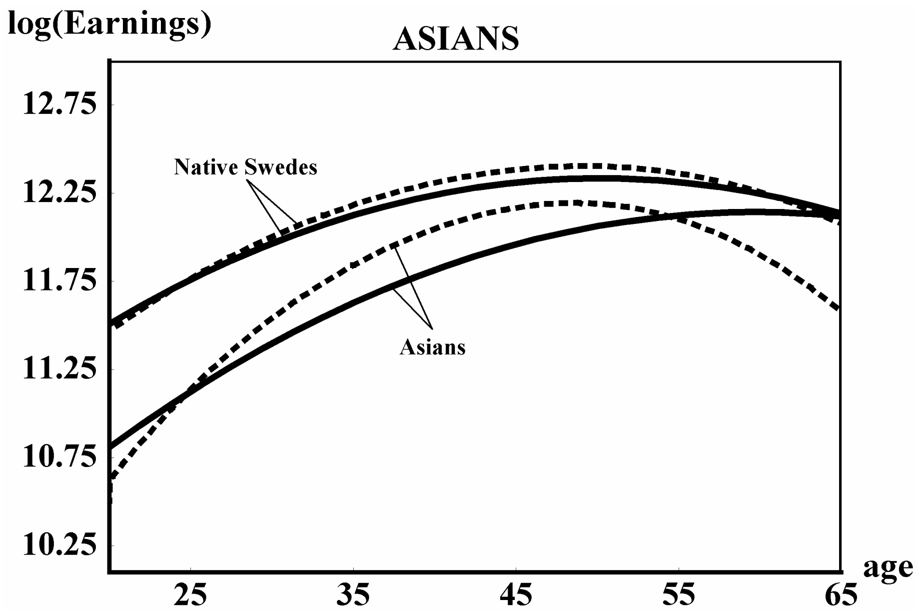


Figure 1b. *Continued*

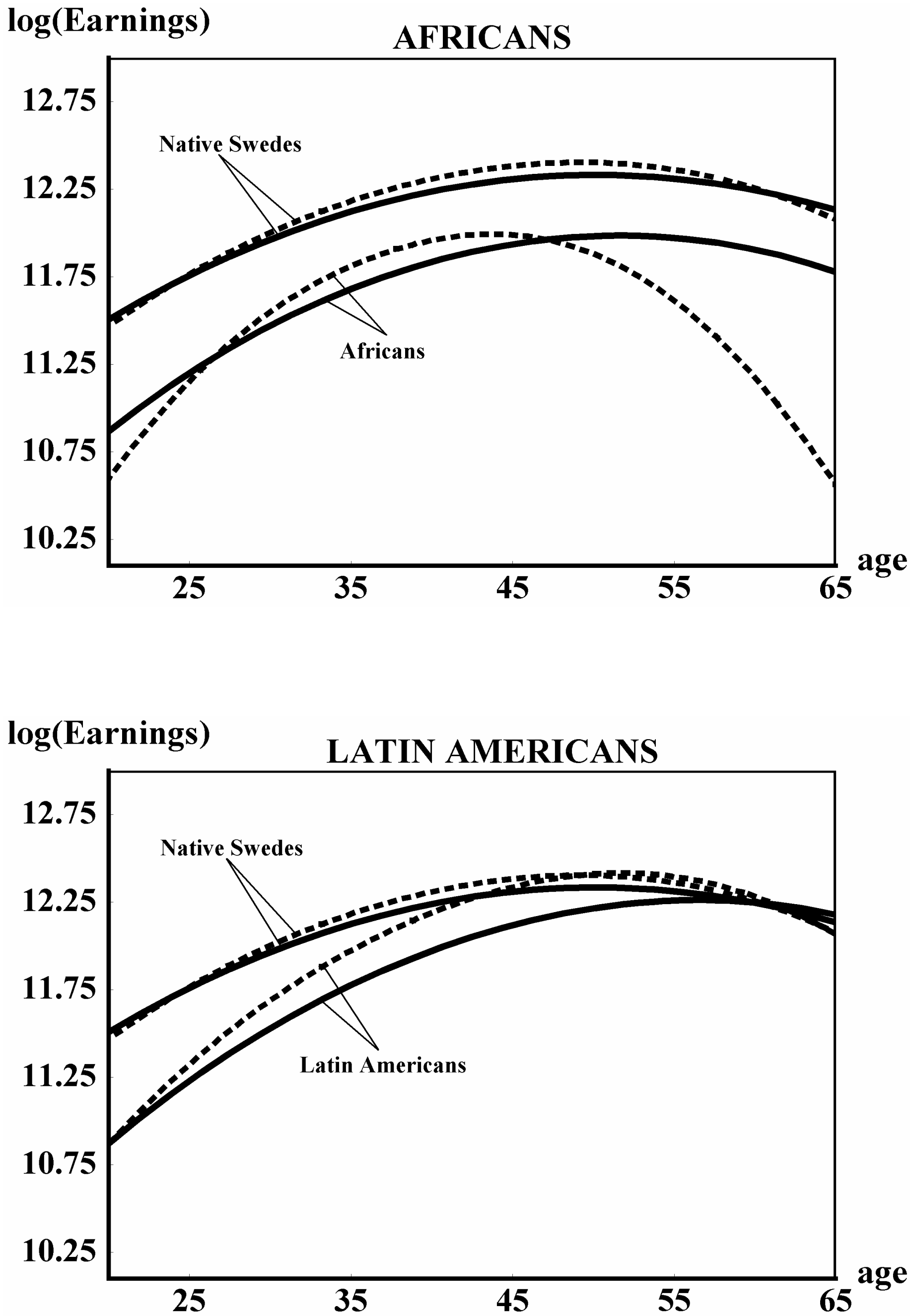


Table 4. *Estimated cohort-effects on employment-probabilities and earnings from static and dynamic models, by region of origin*

	Employment Probabilities		Earnings	
Arrival Cohort	*S+ CRE + WC*	*SD*(1) + WC+WIV	*S+ CRE + WC*	*SD*(1) + WC+ WIV
Nordic Countries				
1970-74	– 0.233 (0.018)	– 0.014 (0.016)	0.015 (0.003)	0.082 (0.003)
1975-79	– 0.403 (0.022)	– 0.014 (0.021)	0.039 (0.004)	0.164 (0.004)
1980-84	– 0.545 (0.027)	– 0.039 (0.027)	0.167 (0.005)	0.223 (0.005)
1985-89	– 0.647 (0.029)	– 0.070 (0.032)	0.284 (0.006)	0.398 (0.006)
1990-94	– 0.817 (0.099)	– 0.055 (0.037)	0.380 (0.007)	0.521 (0.007)
1995-2000	– 0.937 (0.042)	– 0.070 (0.049)	0.525 (0.009)	0.680 (0.009)
Western Countries				
1970-74	– 0.171 (0.036)	– 0.035 (0.027)	– 0.042 (0.009)	0.001 (0.006)
1975-79	– 0.406 (0.042)	– 0.037 (0.033)	– 0.056 (0.010)	0.163 (0.007)
1980-84	– 0.463 (0.046)	– 0.044 (0.038)	– 0.010 (0.011)	0.186 (0.008)
1985-89	– 0.718 (0.050)	– 0.094 (0.042)	0.117 (0.012)	0.356 (0.009)
1990-94	– 0.983 (0.055)	– 0.057 (0.045)	0.282 (0.013)	0.497 (0.010)
1995-2000	– 0.849 (0.058)	– 0.018 (0.051)	0.477 (0.015)	0.655 (0.011)
Eastern Europe				
1970-74	– 0.410 (0.036)	– 0.074 (0.018)	– 0.230 (0.011)	– 0.001 (0.005)
1975-79	– 0.617 (0.045)	– 0.068 (0.022)	– 0.246 (0.015)	0.126 (0.006)
1980-84	– 0.558 (0.047)	– 0.013 (0.030)	– 0.049 (0.017)	0.249 (0.008)
1985-89	– 0.423 (0.048)	– 0.145 (0.032)	0.163 (0.019)	0.435 (0.009)
1990-94	– 0.602 (0.049)	– 0.108 (0.033)	0.114 (0.020)	0.647 (0.009)
1995-2000	– 0.500 (0.055)	– 0.112 (0.034)	0.274 (0.022)	0.776 (0.012)
Middle East				
1970-74	– 0.305 (0.064)	– 0.037 (0.042)	– 0.211 (0.028)	– 0.014 (0.014)
1975-79	– 0.395 (0.065)	– 0.015 (0.045)	– 0.295 (0.029)	– 0.156 (0.015)
1980-84	– 0.482 (0.070)	– 0.010 (0.048)	– 0.278 (0.031)	– 0.212 (0.015)
1985-89	– 0.541 (0.071)	– 0.009 (0.047)	– 0.258 (0.032)	– 0.375 (0.016)
1990-94	– 0.718 (0.071)	– 0.036 (0.048)	– 0.425 (0.032)	– 0.538 (0.017)
1995-2000	– 0.719 (0.073)	– 0.067 (0.049)	– 0.305 (0.033)	– 0.704 (0.017)
Asia				
1970-74	– 0.205 (0.085)	– 0.046 (0.072)	– 0.184 (0.033)	– 0.304 (0.020)
1975-79	– 0.285 (0.086)	– 0.103 (0.075)	– 0.155 (0.034)	– 0.432 (0.020)
1980-84	– 0.296 (0.090)	– 0.191 (0.079)	– 0.248 (0.037)	– 0.508 (0.021)
1985-89	– 0.396 (0.092)	– 0.227 (0.085)	– 0.337 (0.039)	– 0.667 (0.023)
1990-94	– 0.618 (0.092)	– 0.238 (0.086)	– 0.211 (0.040)	– 0.750 (0.024)
1995-2000	– 0.690 (0.096)	– 0.252 (0.092)	– 0.347 (0.043)	– 0.803 (0.027)
Africa				
1970-74	– 0.503 (0.072)	– 0.109 (0.081)	– 0.435 (0.026)	– 0.054 (0.022)
1975-79	– 0.627 (0.071)	– 0.089 (0.086)	– 0.515 (0.028)	– 0.007 (0.025)
1980-84	– 0.697 (0.075)	– 0.052 (0.091)	– 0.440 (0.028)	– 0.082 (0.027)
1985-89	– 0.759 (0.075)	– 0.014 (0.096)	– 0.401 (0.030)	– 0.190 (0.029)
1990-94	– 1.034 (0.075)	– 0.015 (0.095)	– 0.616 (0.030)	– 0.281 (0.029)
1995-2000	– 0.962 (0.078)	– 0.088 (0.101)	– 0.428 (0.031)	– 0.409 (0.031)
Latin America				
1970-74	0.008 (0.072)	– 0.029 (0.072)	– 0.064 (0.023)	– 0.018 (0.019)
1975-79	– 0.116 (0.069)	– 0.041 (0.073)	– 0.062 (0.023)	0.035 (0.020)
1980-84	– 0.276 (0.072)	– 0.064 (0.076)	– 0.107 (0.024)	0.116 (0.020)
1985-89	– 0.277 (0.073)	– 0.108 (0.079)	0.050 (0.025)	0.271 (0.021)
1990-94	– 0.573 (0.074)	– 0.142 (0.079)	0.067 (0.025)	0.367 (0.022)
1995-2000	– 0.487 (0.076)	– 0.214 (0.085)	0.121 (0.025)	0.411 (0.024)

Notes: The reported cohort-effects are the marginal effects of estimated parameters for cohorts in participation and earnings-equations, See also the note in Tables 2 and 3a,b (standard errors in parentheses)