Dynamics of the Employment Assimilation of First-Generation Immigrant Men in Sweden

-Comparing Dynamic and Static Assimilation Models with Longitudinal Data

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Abstract

We analyze the dynamics of the employment assimilation of first-generation immigrant man in Sweden using a high quality panel data set. If there are significant differences between employment-status persistence (structural and spurious state dependence) of immigrants and natives, then the standard static assimilation model produces biased predictions for the labour market outcome of immigrants. We find significant persistence of the employment-status which differs between immigrants and natives, also across immigrant groups. The static assimilation model of employment-status overestimates (underestimates) the early (later) marginal assimilation rates and the assimilation process is 5-10 years shorter compared to the dynamic assimilation model. A similar analysis based on the degree of educational levels reveals that the persistence of employment-status is also differed among subgroups by education levels leading to different labour market outcomes.

Keywords: *Dynamic random-effects probit model, employment assimilation, initial values problem.*

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1. Introduction

Sweden is one of the highly immigrated countries among the Western countries with almost 14% of immigrants. One of the policy targets of many governments is to assimilate the immigrants into Swedish labour-market as quickly as possible. However, previous studies report that the growth of the employment levels of the immigrants is weak and their employment levels are quickly diverged away from that of native Swedes, but the labour market outcome also differs by region of birth, arrival-cohort and education (Ekberg, 1994, 1999; Edin et al, 2000; Scott, 1999; Hammarstedt, 2001, 2003; Bevalander, 1995, 2001, 2005; Aguliar and Gustafson, 1991, 1994; Zheng and Gustafson, 2006; Åslund and Rooth Dan, 2007; Bevalander and Lundh, 2007). Up to the early 1970's the Swedish economy is highly dependent on foreign labour but later immigration is shifted to refugees and family reunification (Bevalander, 1995, 2005). Immigrant employment levels have also been declined after this period in comparison with the natives (Edin et al, 2000).[1] The most important reasons of the deterioration of the immigrants' relative employment levels are the structural change in the industrial sectors and changing composition of immigrants to Sweden (Ekberg, 1994, 1999; Bevalander, 2005). The deterioration is continued despite the boom in the Swedish economy during 1980s, and then gets worse during the slump in the early 1990s. A structural shift in the Swedish economy from industrial to service-oriented is increased the demand for employees with language and interpersonal skills, including the Swedish labour-market specific human capital and ability which can be gained with labour market experience (Ekberg, 1994, 1999; Edin et al., 2000). In this paper, we analyze

[1] It is happened not only in Sweden but also in many Scandinavian countries in the same period (see Hyfron, 1998; Husted et al, 2001; Longva and Raaum, 2003; Barth et al, 2004).

employment assimilation of the first-generation male immigrants in Sweden by considering the effect of past employment experience and time-persistent unobserved individual characteristics on the current and future employment levels of immigrants. We also deal with many sources of bias which can affect predictions about the employment assimilation of immigrants into Swedish labour-market.

The assimilation of immigrants is typically analyzed in previous studies by using either a *cross-section* of individuals or *synthetic* or *genuine panel data sets* in a *static framework* (e.g. Chiswick1978, Borjas, 1985, 1987, 1995; LaLonde and Topel, 1991, 1992; Baker and Benjamin, 1994; Duleep and Regets, 1999; Aguliar and Gustafson, 1991; Bauer and Zimmerman, 1997; Ekberg, 1994; Longva and Raaum, 2003; Barth et al, 2004; Bevalander, 2005). These studies provide results from a static assimilation model aiming to identify the effect of the duration of stay (year-since-migration, "assimilation-effect") in the host country, the arrival cohort-fixed-effects ("immigrant-quality") and the period-fixed-effects ("effect of overall macroeconomic conditions"). However, the static framework (with or without panel data sets) cannot account for the *structural* and *spurious* factors leading *persistence* of the employment-status. A structural state dependence of the labour-market behavior can be caused by the past employment experiences and a spurious state dependence due to time-persistent unobserved individual characteristics (motivation or ability) which can alter employment propensities independently from actual employment experiences. Controlling for different sources for persistence can also be rationalized by past experiences as well as the structure of the labour market *per se*. In the labour-market, unemployment can be perceived by employers as a signal for low productivity or time out

for skills, also potential labour market discrimination may affect the employment possibilities of immigrants, or search cost may differ across different participation states.

Ignoring these dynamic aspects of country-specific human-capital accumulation which directly affect the employment outcome can bias the predictions of employment assimilation of immigrants. The static assimilation model is silent about these issues since it cannot take the human capital acquired at the past into account. The static model *is a special case* of the dynamic assimilation model with an assumption that *the persistence of the employment-status is the same for the immigrants and natives*. Thus, relative employment-probabilities absorb the effect of the persistence in the case of the static assimilation model. If the past labour market experience of immigrants and natives have different impacts on their current employment possibilities, the relative employment-probabilities and resulting marginal assimilation rates obtained by the standard static assimilation model will be biased. The size and the direction of the bias depend on the difference between the degree of persistence in the employment-status of immigrants and natives.

Thus, we relax the assumption here and test whether the effect of the past employment experiences are the same for the immigrants and native Swedes. A structural state dependence of natives which is positive and larger than immigrants implies that the static assimilation model overestimates (underestimates) the short-run (long-run) marginal assimilation rates. Persistently employed native Swedes can accumulate increasingly higher degree of labour-market-specific human-capital and the existing employment-probability

gap between immigrants is increased. In other words, immigrants may be predicted to be closing the employment-probability gap with a higher speed than they actually do with the static assimilation model. Once human capital is achieved, it can also be transferred to later ages with a particular depreciation rate. The static assimilation model is expected to overestimate the human capital depreciation rates as well since it cannot account for how the past labour market experience and resulting human capital are transferred over time. Thus, the static assimilation model may highly cause the employment-probability gap in the long-run is to be overestimated as well. What about the total years of assimilation needed to minimize or to catch-up with the employment-probability level of comparable native Swedes? Failure to control for the structural and spurious state dependence may also affects the predictions about the assimilation outcome of immigrants. The dynamic assimilation model is expected to produce slower but stabile assimilation which is lasting longer years after migration. Thus this can also lead to longer years to assimilation compared to the ones produced by the static assimilation model.

To our knowledge this paper is the first study which explicitly aims to analyze the dynamics of employment assimilation of immigrant men in Sweden by using a high-quality panel data by accounting for structural and spurious factors on employment assimilation process. Particularly, our research questions are whether the structural and spurious factors differ between native Swedes and immigrants, and how the degree of persistence on the employment-status of immigrant men affects the process of employment assimilation as time spent in host country is increased. In order to address these issues a dynamic random-

effects panel data probit model with many observed and unobserved individual-characteristics and endogenous initial values is used.

By categorizing immigrants into seven regions of origin and estimating the models separately, we find that there is a strong positive structural and spurious state dependence on the employment-status and the degree of persistence largely differ between immigrants and natives, and across immigrant groups. Native Swedes experience higher (lower) persistence due to structural reason (spurious reasons) than immigrants. We could not find any evidence that there is a full employment assimilation of immigrants into Swedish labour-market (except some cases with different education levels) for both dynamic and static assimilation models. In general, the results are inline with our expectations, the static assimilation model predicts very high marginal assimilation-rates during the first years after arrival, but in fact the rates are quickly turned to negative, as employment-probabilities and of immigrants are diverged widely (with some exceptions) from those of native Swedes. Controlling for the past employment status lowers both the speed of assimilation and depreciation rates of human capital at later stages and thus the immigrants are able to keep their marginal assimilation rates positive for a longer period. The dynamic model predicts a lower initial employment-probability advantage and longer total years to assimilation which is up to 5-10 years compared with the predictions of static assimilation model. The immigrants from Nordic and Western countries are relatively successful and they are even able to reduce the employment probability gap under 10% whereas the others are far from being assimilated into to employment-probability levels of natives Swedes.

The remaining part of the paper is organized as follows. Next section presents the data and Section 3 gives our dynamic assimilation model and discusses econometric issues which can create bias in the measures of assimilation. Section 4 then presents the empirical results split by region of origin and subgroups of immigrants with different degree of education to examine how persistence differ with degree of human-capital. Section 5 summarizes and draws conclusions.

2. Data

Our data set is the Swedish register-based Longitudinal Individual Data-set (LINDA) between 1990 and 2000. The data set includes a population and an immigrant sample: the population sample includes 3.35% of the entire population each year and the immigrant sample includes almost 20% of immigrants to Sweden. In Sweden, immigrants enter to 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. 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 (for more details on LINDA, see Edin and Frederiksson, 2001).

In order to avoid selection-problems due to retirement at age 65, the 33,504 immigrant men 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 of residence. 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. We exclude self-employed since their employment- and earnings-conditions are considerably different from wage-earners.

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.

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.

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

	Native Swedes	Nordic Countries	Western Countries	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)
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 Cohort :								
<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)

The key variable for this study is the employment status and calculation of such a variable is related with the labour income of the individuals. We use gross labour income which is 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. This criterion, also adopted in LINDA is the *basic amount* that qualifies one for the earnings-related part of the public pension-system. Based on this criteria the employment-indicator (d_{it}) was defined as 1 if the individual *i* was employed and 0 otherwise at time period *t*.

In this paper we categorize the immigrants by region of origin as being from other Nordic countries; other Western Countries (including the USA, Canada, Australia, and New Zealand), Eastern Europe, the Middle East, Asia, Africa, or Latin America. We also control for many socio-demographic and economic characteristics of the individuals. The variables are age and age-squared; years-since-migration and -squared; marital status (cohabiting was considered as married); number of children living at home; highest education level (Primary education (Grundskola degree), 9 years of education; secondary education (Gymnasium-high school-degree), more than 9 years but less than 12 years of education); and university education (more than Gymnasium); residence in Stockholm or elsewhere; capital non-labour income; arrival-cohort; local unemployment-rates and arrival-year national unemployment-rates.[2]

[2] Local unemployment rates were calculated as follows: we first collected data from registers on the total number of individuals living in a municipality split by gender, age, unemployed and employed in a year. We first calculate the unemployment rate by dividing the number of unemployed by the population in the municipality of residence conditioned on age and gender every year. This data is merged with the main data set using gender, age, municipality of residence and year.

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

3. Econometric Specifications

3.1. The dynamic assimilation model

We specify a dynamic random-effects probit model for both immigrants and natives by controlling for structural and spurious state dependence together with many other observed individual characteristics and endogenous initial values. The dynamic employment-generating-process of immigrants (I) is specified as follows:

$$d_{it}^{\mathrm{I}*} = \mathbf{1}\left\{\left(x_{it}^{\mathrm{I}}\beta^{\mathrm{I}} + \lambda d_{i,t-1}^{\mathrm{I}} + \varphi^{\mathrm{I}} age_{it}^{\mathrm{I}} + \delta ysm_{it} + \sum\nolimits_j \psi_j C_j + \sum\nolimits_k \theta_k^{\mathrm{I}}\Pi_k^{\mathrm{I}} + u_{it}^{\mathrm{I}}\right) > 0\right\}, \quad (1)$$

$$u_{it}^{\mathrm{I}} = \eta_i^{\mathrm{I}} + \varepsilon_{it}^{\mathrm{I}}, \quad (2)$$

$$d_{i1}^{\mathrm{I}*} = \mathbf{1}\left\{\left(z_{i1}^{\mathrm{I}}\beta_1^{\mathrm{I}} + u_{i1}^{\mathrm{I}}\right) > 0\right\}, \quad (3)$$

where, $d_{it}^{\mathrm{I}*}$ is a binary latent (unobserved) variable indicating whether an immigrant is employed during the current period *t* (*i* is the individual and $i = 1,...,I$ and t is the index for the periods in the panel data set $i = 1,...,T_i$). x_{it} is a vector of current socio-demographic and economic characteristics (such as educational attainment, marital status and non-labour income and arrival-year national unemployment rates) and β is the corresponding vector of parameters to be estimated; $d_{i,t-i}$ is a (observed) binary variable indicating that whether the immigrant *i* is employed at the previous period $t-1$, and we will interpret the parameter λ as *structural state dependence* following Heckman (1981);[3] Note that the model (1-2) is a static assimilation model if λ is zero. *age* and year-since-migration *ysm* are the key variables for an

[3] Note that the lagged dependent variable is assumed as observed (not latent). The other alternative is to consider that the lagged employment status is also unobserved. Considering the lagged dependent variable as observed or latent leads to different implications in both economic and estimation terms (Hsiao, 2003)

assimilation model and their higher order terms are used in the actual specification but they are not presented here to simplify the notation. Immigrants arrive in different cohorts (C_j) and unobserved cohort specific characteristics (cohort fixed-effects) are controlled for using a series of indicator variables indexed by $j = 1,...,J$; the transitory overall macroeconomic economic fluctuations in the economy (such as upward or downward trend in unemployment rates) may have different impacts on the employment abilities of immigrants. In order to control for these characteristics, the period-effects, Π_k^{Im} are included for *k* periods in which an immigrant and native is observed.

The error term in the model is composed as in (2). The first part is, η_i, the time-invariant unobserved individual-effects and controlling for these characteristic is very crucial to be able to identify structural state dependence on the employment-probabilities. The second term is the usual error terms, ε_{it}, which are assumed as following a normal distribution with zero mean and unit variance due to identification of the binary dependent variable model (1). Actual disturbance process is assumed as serially uncorrelated. However, in this model controlling for unobserved individual-effect automatically induce a serial correlation. The correlation between two sequential error terms is, $Corr(\varepsilon_{it}, \varepsilon_{is}) = \sigma_\eta^2 / \sigma_\eta^2 + 1,$ $(t, s = 1,...,T_i; t \neq s)$, where σ_η^2 is the variance of unobserved individual-effects.

The assumption on the relation between observed and unobserved characteristics is that they are orthogonal to each other following the random-effects specification. However, the standard random-effects approach can be relaxed in practice (for instance unobserved test for

work for an immigrant can be correlated with experience and education). This correlation may be controlled for by using quasi-fixed-effects (the correlated random-effects model of Chamberlain (1984) or Mundlak's (1978) formulation). The general way to do this is to use an auxiliary distribution for the unobserved individual-effects as a function of time-variant observed characteristics. However, in our case this model is very close to how we deal with the initial values problem and it will be explained below.

In order to calculate the relative employment outcomes of the immigrant and native, the dynamic generating process for the employment outcomes of the native Swedes (N) is defined as follows:

$$d_{it}^{\mathrm{N}*} = \mathbf{1}\left\{\left(x_{it}^{\mathrm{N}}\beta^{\mathrm{N}} + \lambda^{\mathrm{N}} d_{i,t-1}^{\mathrm{N}} + \varphi^{\mathrm{N}} age_{it}^{\mathrm{N}} + \sum\nolimits_k \theta_k^{\mathrm{N}} \Pi_k^{\mathrm{N}} + u_{it}^{\mathrm{N}}\right) > 0\right\}, \tag{5}$$

$$u_{it}^{\mathrm{N}} = \eta_i^{\mathrm{N}} + \varepsilon_{it}^{\mathrm{N}}, \tag{6}$$

$$d_{i1}^{\mathrm{N}*} = \mathbf{1}\left\{\left(z_{i1}^{\mathrm{N}}\beta_1^{\mathrm{N}} + u_{i1}^{\mathrm{N}}\right) > 0\right\}, \tag{7}$$

where the variables year-since-migration and arrival-cohorts, which are not relevant for the data generating process of the natives, are excluded. The definition of the other terms is the same as in the case of immigrants (i.e. model (1)).

The model given in (1-3) involves one very important identification problem. The period-effects, Π_k, 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). 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 assumption used here is that the period-effects of immigrants and natives are the same (i.e. $\Pi_k^I = \Pi_k^N$). 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 Barth et al., (2004). The 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.

3.2. Estimation of the model and the initial values problem

We follow a fully parameterized random-effects approach with maximum likelihood-estimator. Such an approach requires correct specification of the distribution of initial values, conditioned on observed and unobserved individual-effects. The log likelihood function would be as follows:

$$\log L = \sum_{i=1}^{I} \ln \left[\int_{-\infty}^{\infty} \left\{ f_1(d_{i1} \mid \{\mathbf{x}_{it}\}_{t=1}^{T}, \eta_i) \prod_{t=2}^{T} f_{it}(d_{it} \mid d_{i.t-1}, \mathbf{x}_{it}, \eta_i; \beta^*) \right\} f(\eta_i) d\eta_i \right], \quad (8)$$

$$f_{it}(d_{it} \mid d_{i,t-1}, \mathbf{x}_{it}, \eta_i; \beta^*) = \Phi\left[(2d_{it} - 1)(\mathbf{x}'_{it}\beta^* + \lambda d_{i,t-1} + \sigma_\eta \eta_i) \right], \quad (9)$$

where $\mathbf{x}_{it}$ is the all right hand side observed variables (except lagged dependent variable) of an individual *i* at time *t* and β^* is a vector of corresponding parameters. Φ is the distribution function of the standard normal random variable.

The likelihood function in (8) can be easily maximized using Gaussian-Hermite-Quadrature when the conditional distribution of the initial values $f_1(d_{i1} \mid \{\mathbf{x}_{it}\}_{t=1}^{T}, \eta_i)$ is known. In order to identify the magnitude of the structural state dependence and disentangle it from spurious state dependence, the initial values can play an important role (Heckman, 1981; Wooldridge, 2005). Many immigrants (and of course native Swedes) entered to the Swedish labour-market much before the study period 1990-2000. Thus, assuming exogenous initial values would be too strong, causing biased and inconsistent estimators (Heckman, 1981). The sample initial employment-states must instead be considered endogenous, with a probability distribution conditioned on observed and unobserved individual characteristics.

There are two main methods for doing this: Heckman's (1981) reduced-form approximation and the simple method of Wooldridge (2005). Heckman's method is based on available pre-sample information with which the conditional distribution of the initial values to be approximated via a reduced form. This approximation allows a flexible specification of the relationships between initial values, observed and unobserved individual characteristics. Wooldridge (2005) introduced a simple alternative to Heckman's reduced-form approximation. He suggests that the unobserved individual-effects can be considered conditional on the initial values and the time-varying exogenous variables in a similar way to the correlated random-effects model of Chamberlain (1984) using an auxiliary distribution. In this paper we use the Wooldridge method which is simple by considering that difference between this method and the other is minimal for longer panels as we employ here in this paper (Arulampalam and Steward, 2009; Akay, 2009). The auxiliary distribution of the unobserved individual-effects is given as follows for the immigrant women.

$$\eta_i^{\mathrm{I}} = \pi_0^{\mathrm{I}} + \pi_1^{\mathrm{I}} d_{i1}^{\mathrm{I}} + \pi_2^{\mathrm{I}} \bar{\mathbf{x}}_i^{\mathrm{I}} + \alpha_i^{\mathrm{I}} \tag{10}$$

$$\eta_i^{N} = \pi_0^{N} + \pi_1^{N} d_{i1}^{N} + \pi_2^{N} \bar{\mathbf{x}}_i^{N} + \alpha_i^{N} \tag{11}$$

where, d_{i1} is the first period employment status; α_i is another individual-effect which is assumed as distributed normal with zero mean and variance. The time-variant variables used in (10) and (11) are age, non-labour income (capital income) and number of children at home.

3.3. The estimators of the employment assimilation

We would like to calculate two measures: *marginal assimilation rates* (*MRA*) as a function of year-since-migration and *total years to assimilation* (*TYA*). The approach to measure these quantities is adopted here based an idea of assimilation to have occurred when immigrant employment probabilities catch-up over time with the employment probability levels of natives (following Borjas, 1985, 1987 and 1995). An estimator of the marginal assimilation rate was defined simply,

$$MRA_i(t) = \frac{\partial E^{\mathrm{Im}}(t)}{\partial t} - \frac{\partial E^{\mathrm{N}}(t)}{\partial t} \tag{12}$$

where E is the expected probability of employment conditional on observed and unobserved individual characteristics. The conditional expectations can be written for the immigrants and natives as follows:

$$E^{\mathrm{Im}}\left[d_{it}=1 \mid \mathbf{x}_{it}, age_{it}, ysm_{it}, \alpha_i\right] = \Phi\left[\mathbf{x}_{it}\hat{\beta}^{\mathrm{Im}*} + \hat{\varphi}^{\mathrm{Im}} age_{it}(t_0+t) + \hat{\delta} ysm_{it}(t)\right] \tag{13}$$

$$E^{\mathrm{N}}\left[d_{it}=1 \mid \mathbf{x}_{it}, age_{it}, \alpha_i\right] = \Phi\left[\mathbf{x}_{it}\hat{\beta}^{\mathrm{N}*} + \hat{\varphi}^{\mathrm{N}} age_{it}(t_0+t)\right] \tag{14}$$

In expression (13) and (14), year-since-migration is reparameterized with t, and t_0 is the *entry age* to the labour market. In the paper the entry age is assumed as 20 for every individual. Using (12), an estimator for MRA is obtained as,

$$\widehat{MRA_i(t)} = (\hat{\varphi}^{\mathrm{Im}} + \hat{\delta})\phi\left[\mathbf{x}_{it}\hat{\beta}^{\mathrm{Im}*} + \hat{\varphi}^{\mathrm{Im}} age_i\,(t_0 + t) + \hat{\delta}\, ysm_i(t)\right]$$

$$-\hat{\varphi}^{\mathrm{N}}\phi\left[\mathbf{x}_{it}\hat{\beta}^{\mathrm{N}*} + \hat{\varphi}^{\mathrm{N}} age_{it}(t_0 + t)\right] \qquad (15)$$

where ϕ indicates the density function of the standard normal random variable. Thus, the estimator of the marginal rate of assimilation in (15) shows the employment-probability difference between an immigrant and a comparable native after *t* years spent in Sweden. For instance when $t = 0$, we obtain the *initial employment-probability differential* upon arrival ($ysm_i(0) = 0$).

The other target measure that we derive from (15) is the total years of assimilation (the time needed to fully achieve equal employment-probability with otherwise identical native Swedes). This occurs when the conditional expectations of the immigrants and the natives are equal. In other words, the time required in the host country before the age-employment probability or age-earnings curves of immigrants and native Swedes intersect. Thus, it can be formulated in *MRA* terms as,

$$(\hat{\varphi}^{\mathrm{I}} + \hat{\delta})\phi\left[\mathbf{x}_{it}\hat{\beta}^{\mathrm{I}*} + \hat{\varphi}^{\mathrm{I}} age_i\,(t_0 + \tilde{t}) + \hat{\delta}\, ysm_i(\tilde{t})\right] = \hat{\varphi}^{\mathrm{N}}\phi\left[\mathbf{x}_{it}\hat{\beta}^{\mathrm{N}*} + \hat{\varphi}^{\mathrm{N}} age_{it}(t_0 + \tilde{t})\right] \qquad (16)$$

where the estimator of the total years of assimilation is $\widehat{TYA_i} = \tilde{t}$.[4]

[4] Note that all estimators are given with individual indices. They can also be calculated for a group of individuals by using mean values of a group of individuals. For instance, an average African immigrant may be compared with and the average native and so on.

4. Estimation results

The main interest here is to determine the magnitude of the structural and spurious state dependence which are experienced by the immigrants and natives. We later predict relative employment-probabilities of different immigrant groups as a function of year-since-migration and compare these results with the static assimilation models. We also show the persistence differences between the immigrants and natives and predict the relative employment-probabilities by educational attainment levels.

4.1. Identifying structural and spurious state dependence on employment probabilities

The models given in (1-3) and (3-6) are estimated for seven region of origin. We only report marginal effects of structural state dependence and the variance of unobserved individual-effects which is as a proxy for the spurious state dependence on the employment-probabilities. The results for the other parameters are in line with the literature. For instance, the employment-probabilities increasing with age in a decreasing rate; educational attainment level is increased the probability of employment.[5]

Having controlled for endogenous initial values, unobserved and observed individual characteristics, the coefficient of lagged employment status provides and estimates of the structural state dependence. Table 4a suggests that there is substantial and significant structural state dependence on the employment-status of all immigrants groups and natives.

[5] Estimation results are not reported here due to space reasons. However, they can be provided upon request from the author.

The lagged employment status i.e. past labour market experience is associated with a higher probability to be employed in current period. Natives experience higher structural state dependence than immigrants. Being employed in the previous period increases the probability of being employed in the current period 81% for the native Swedish men. The probability changes between 45-60% for the immigrants. The highest state dependence following natives is experienced by the immigrants from Eastern Europe, Western countries and Latin America. The structural state dependence or persistence is lower for Nordics that can be expected to be closer to native Swedes due to cultural, geographic and human capital similarities. However, Nordic immigrants experience multiple immigrations or discontinuity in their working experience more often than other immigrants do.

Table 4a. Structural and spurious state dependence on the employment-probabilities of immigrants and natives (by region of origin)

	Regions							
	Nordic Countries	Western Countries	Eastern Europe	Middle East	Asia	Africa	Latin America	Native Swedes
Males								
λ	0.509***	0.574***	0.586***	0.470***	0.527***	0.526***	0.553***	0.805***
	(0.010)	(0.009)	(0.010)	(0.011)	(0.011)	(0.010)	(0.010)	(0.007)
σ_α	0.885	0.879	0.578	0.542	0.619	0.504	0.573	0.500
	[1.921]	[1.971]	[1.507]	[1.194]	[1.383]	[1.163]	[1.281]	[1.611]

Note: Marginal effects of structural state dependence (λ) and the standard deviation of the random-effects (σ_α). The standard errors of the marginal effects are reported in parentheses. The model also controls for age and -squared; year since migration and -squared; marital-status; three indicator variables to control for education (primary = 1 (Grundskola degree, 9 years of education), secondary = 1 (Gymnasium (high school) degree, more than 9 years but less than 12 years of education), university = 1 (education more than Gymnasium); big city dummy; number of children; log local unemployment rates; arrival year national unemployment rates; 7 cohort fixed-effects (pre-1970, 1970-1974, 1975-1979, 1980-1984, 1985-1989, 1990-1994, 1995-2000) pre-1970 is the base category; full set of time fixed-effects; 25 regional fixed-effects; first period employment status as a part of Wooldridge initial values; mean age, mean number of children, mean capital non-labour income. Additionally, the models for females include husbands' employment status; husbands earnings and within means of husbands' earnings. *, **, *** indicate significance levels at 1%, 5% and 10% respectively. Standard errors are reported in parentheses. The figures reported in [brackets] are the variance of unobserved individual-effects which are produced by the static assimilation model.

Table 4a also reports the variance of the unobserved individual-effects which can be considered as a proxy for the spurious state dependence. In order to show the effect of the dynamic model on the distribution of the unobserved individual effects we also report the variance obtained from the static models [in brackets]. Conditional on the structural state dependence (and all other control variables), immigrants are more heterogeneous than native Swedes (the static assimilation models suggest that only Nordic and Western immigrants are more heterogeneous (1.921 and 1.971 vs. 1.611)). The dynamic model identifies the different sources of state dependence. The size of the variance obtained from the static model shrinks in the dynamic model by being identified as structural state dependence. We also test for the superiority of dynamic specification using likelihood ratio test. The p-values are very close to zero in each case (and not reported here). The difference between the state dependence parameter of the natives and the immigrants is statistically significant for every immigrant region and country of origin.

4.2. Employment-assimilation by region of origin and comparing the dynamic and static assimilation models

We predict the relative employment-probabilities of immigrants as a function of years-since migration and report the results in Table 4b. The numbers are calculated by using the formulations given in Section 2.3. $t_0 = 20$ (*ysm* = 0) is used as labour market entry age and we increase the years-since-migration from 0 to 45 (from age=20 until *age* = 65), and predict employment-probabilities for natives and immigrants using their conditional expectations. The point estimate of the employment-probability for a particular year-since-migration is obtained

for every immigrant and the standard errors of every individual prediction are obtained to calculate individual 95% confidence intervals. We then take the average of every individual prediction and 95% confidence intervals to produce the average employment probability level and confidence interval for a year-since-migration. In order to calculate relative employment probabilities we predict the employment-probabilities of the native Swedes as a function of age starting from age=20 until age=65 with the similar strategy as the above.

When year-since-migration is 0 and age is 20 (that is only the age=20 for the natives), the relative employment-probability is the initial employment-probability differential upon arrival and it is given in the first column of the Table 4b. For instance, according to the static model, the Nordic immigrants experience 10% employment-probability disadvantage compared to the native Swedes. The same is 70% for the Middle Eastern immigrants. In other words, this numbers says that, in average, the probability of being employed is 10% for Nordic immigrants and 70% less for a Middle Eastern immigrant upon arrival compared to similar aged average native (the initial employment-probability of the other immigrant groups can be interpreted in a same way). It changes in Sweden between 50-75% (except Nordic immigrants) according to the static assimilation model. The table presents the results from the dynamic model in the second rows. In general, the dynamic assimilation model predicts lower initial employment-probability disadvantage (except Nordic immigrants, 20%). For instance, initial employment probability disadvantage of the Middle Eastern immigrants is predicted as almost 62% which is 8% lower compared to the static assimilation model. In general, the dynamic model predicts that the initial employment-probability differential changes between 35-65% (10-15% lower than the static assimilation model).

In the subsequent columns in Table 4b, we report relative employment-probabilities as year-since-migration is increased. For instance, year-since-migration (1-5) stands for the average employment probability gap experinced in 1 to 5 years after arrival.[6] Using the same strategy, we calculate the employment probability gap five years apart until the end of an immigrants working life. We observe some assimilation: almost all immigrant groups are able to reduce the initial employment probability disadvantage at the first years after arrival. The Middle Eastern immigrants, for instance, close the initial employment-probability gap 7% and the gap reduces to 63% in 1 to 5 years after arrival.

The last column in Table 4b presents the total years to assimilation i.e. the year-since-migration interval in which the employment-probability gap is minimized. *P* stands for the *partial* meaning that the gap is not fully closed at all. The static model suggest for instance that the Eastern European immigrants minimize the employment probability gap in 15-20 years after arrival but the gap then diverges away later on. The employment-probability gap experienced by the Eastern European immigrants is reduced to almost 9%. The same is 25-30 years which is 10 years longer with the dynamic model and it is predicted that the minimum employment-probability gap is almost 14%. We observe the same pattern in every case. The static assimilation model predicts shorter total years to assimilation with a lower employment-probability differential but it is diverged away with higher speed.

[6] We predict the employment probability for every individual from ysm=1 to ysm=5 and take the average to represent the employment probability gap in 1 to 5 years after arrival.

In general, both models suggest that there *is no* immigrant group which is able to attain employment-probability level of native Swedes. However, the immigrants from Nordic and Western countries are very successful relative to the others. They are followed by Eastern European and Latin Americans. Other three immigrant groups are doing the worse with very large employment-probability gap and long years to assimilation.

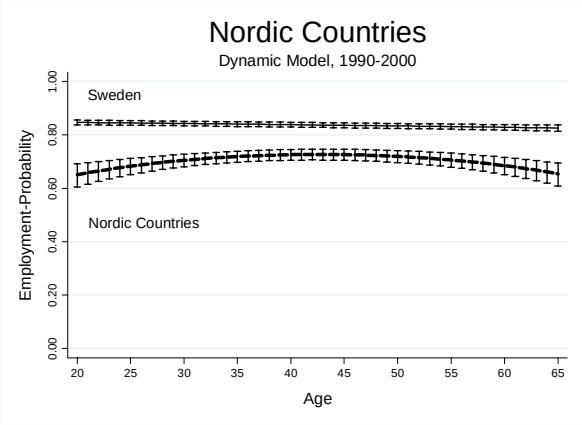
Table 4c. Relative employment-probabilities and years-to-assimilation of male immigrants, by region and country of origin, 1990-2000

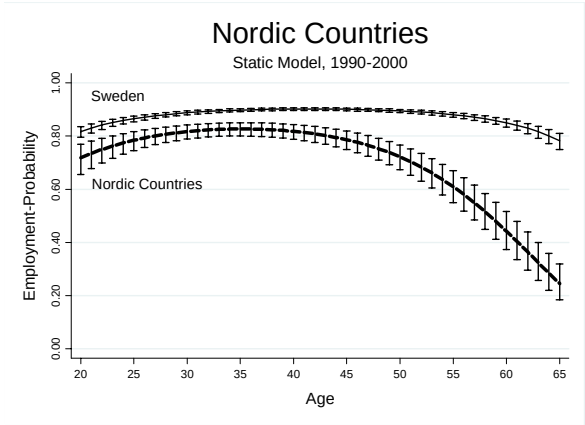
	Years since migration									
	Upon Arrival	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	*TYA*
Nordic Countries										
Static	–0.098	–0.088	–0.074	–0.069	–0.077	–0.100	–0.146	–0.120	–0.228	11-15 (P)
Dynamic	–0.196	–0.175	–0.147	–0.128	–0.115	–0.110	–0.111	–0.120	–0.135	21-25 (P)
Western Countries										
Static	–0.567	–0.463	–0.299	–0.190	–0.136	–0.123	–0.141	–0.202	–0.319	21-25 (P)
Dynamic	–0.366	–0.322	–0.261	–0.216	–0.185	–0.167	–0.159	–0.162	–0.177	26-30 (P)
Eastern Europe										
Static	–0.732	–0.591	–0.301	–0.133	–0.088	–0.121	–0.267	–0.562	–0.801	16-20 (P)
Dynamic	–0.545	–0.447	–0.309	–0.213	–0.158	–0.151	–0.138	–0.151	–0.198	26-30 (P)
Middle East										
Static	–0.700	–0.632	–0.510	–0.448	–0.476	–0.592	–0.750	–0.852	–0.861	11-15 (P)
Dynamic	–0.623	–0.570	–0.466	–0.399	–0.364	–0.365	–0.400	–0.468	–0.561	16-20 (P)
Asia										
Static	–0.492	–0.415	–0.311	–0.259	–0.260	–0.313	–0.428	–0.599	–0.756	11-15 (P)
Dynamic	–0.425	–0.389	–0.332	–0.282	–0.239	–0.202	–0.171	–0.146	–0.126	40+ (P)
Africa										
Static	–0.747	–0.673	–0.488	–0.344	–0.298	–0.354	–0.511	–0.716	–0.380	16-20 (P)
Dynamic	–0.640	–0.557	–0.428	–0.327	–0.263	–0.239	–0.253	–0.307	–0.398	21-25 (P)
Latin America										
Static	–0.558	–0.448	–0.285	–0.193	–0.166	–0.199	–0.300	–0.482	–0.687	16-20 (P)
Dynamic	–0.420	–0.366	–0.288	–0.226	–0.178	–0.145	–0.124	–0.113	–0.114	31-35 (P)

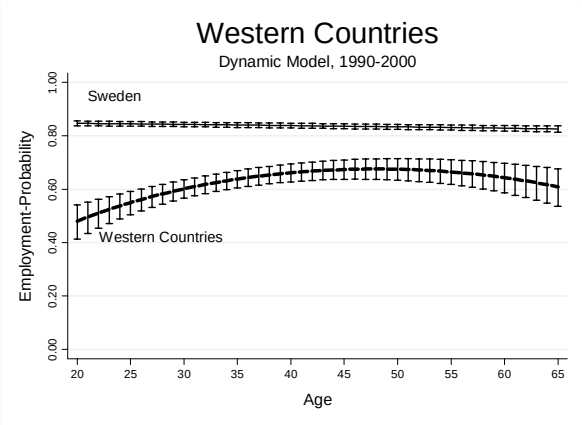
Notes: Average of 5 years in each case except upon arrival. All numbers reported in the table are significant different than zero at 1% significance level. (P) is partial total years to assimilation i.e. the year interval in which the employment-probability gap between natives is minimized.

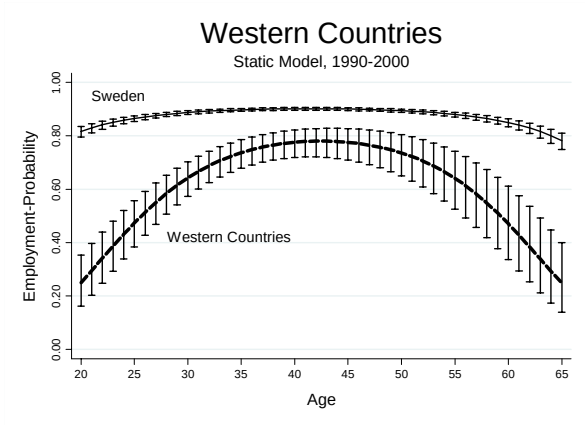
We would like to analyze and show the difference between the static and dynamic assimilation models further by simulating the age-employment-probability-profiles of the immigrants and natives. Figure 1 presents these profiles by region of origin for both the dynamic and static assimilation models. The vertical axes in Figure 1 are the average

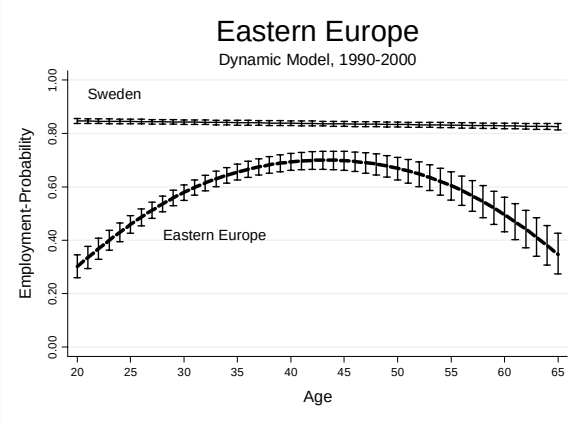
probability of being employed for the immigrant after arrival. For instance when age is 30, all immigrants are in Sweden 10 years and all natives are 30 years old. The market entry age is 20 (or arrival-age) and thus simulations are performed for 45 years after arrival. The vertical lines around the age-employment-probability profile are the average 95% confidence intervals of individual predictions.










Eastern Europe
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Eastern Europe
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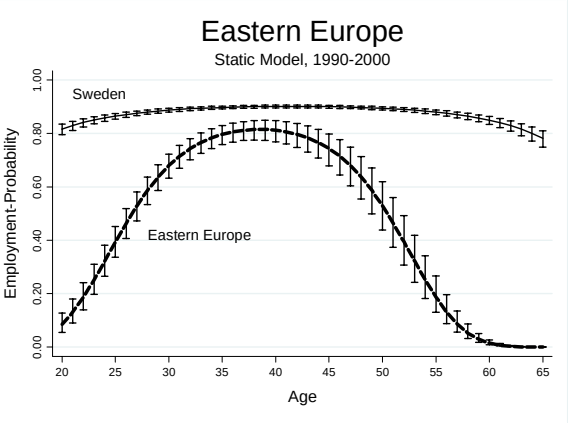
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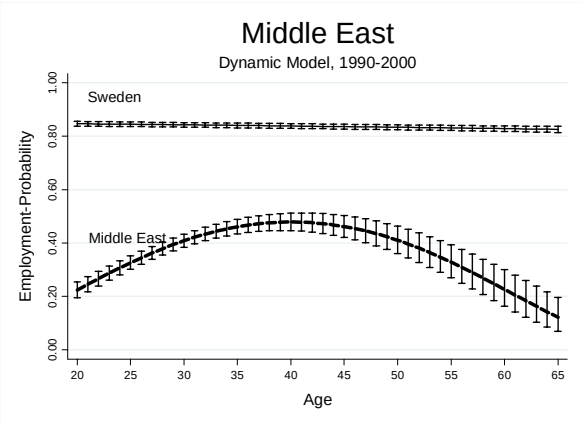
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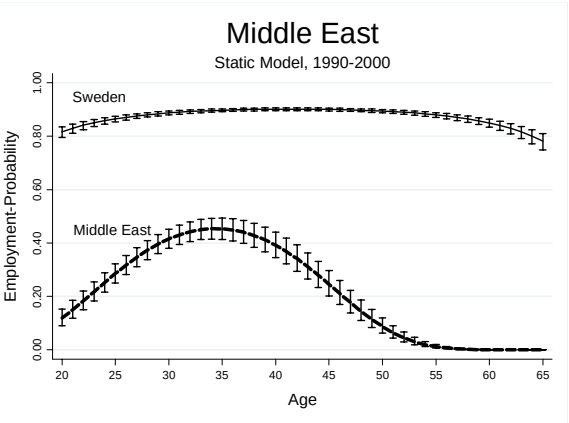
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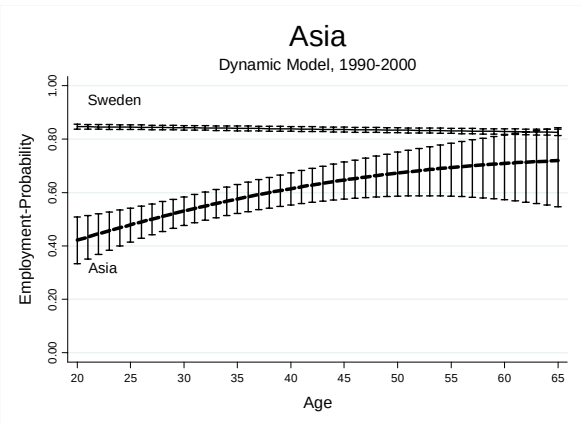
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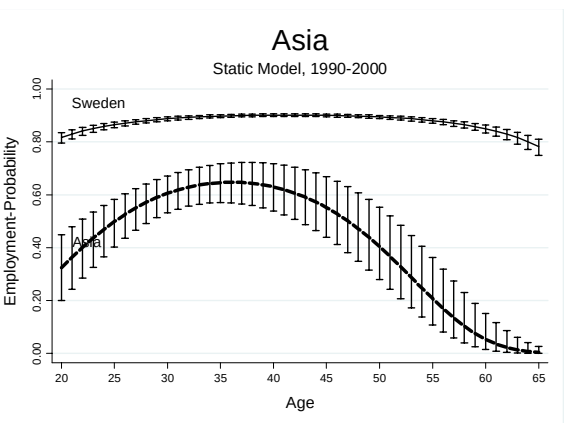
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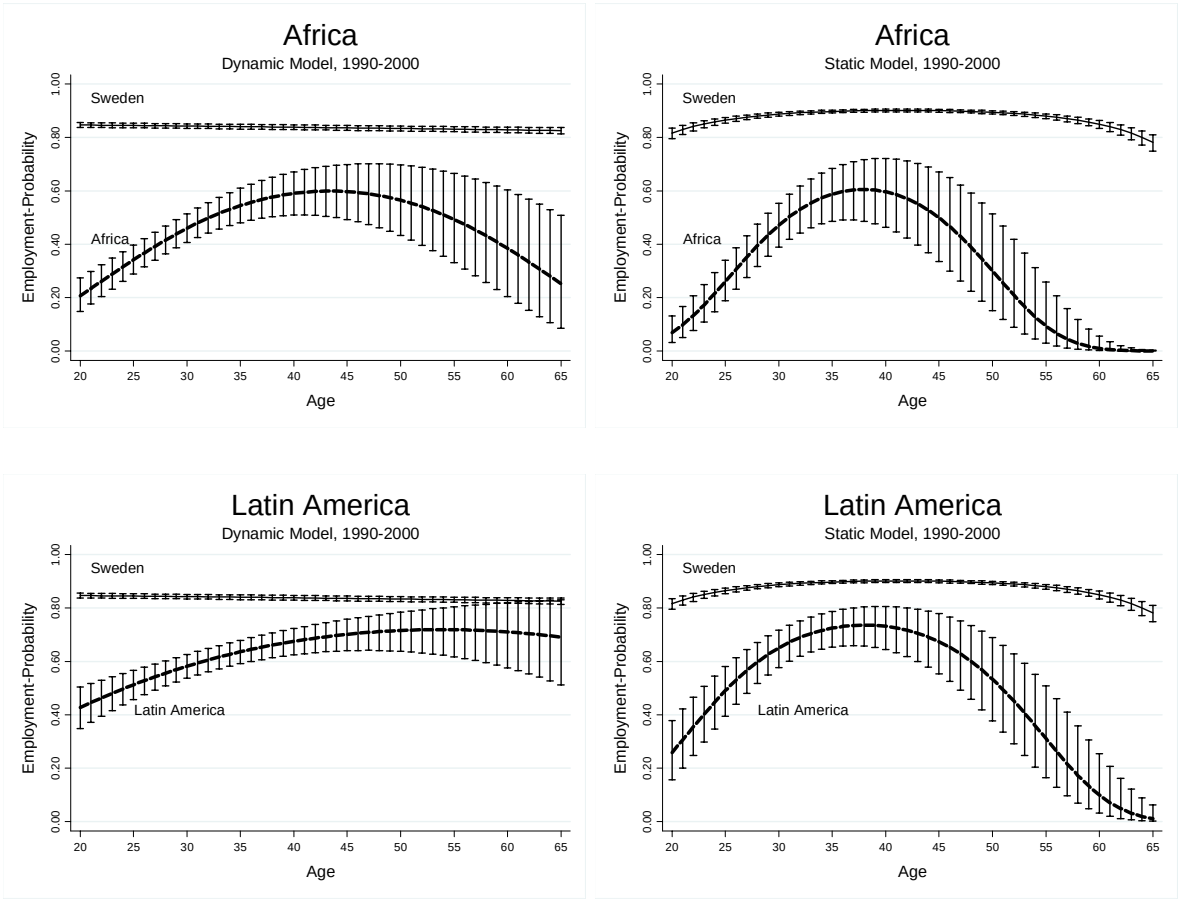


Figure 1. Age-employment-probability profiles by region of origin and models. The immigrants are presented using dashed curves. The vertical lines are the %95 confidence intervals obtained by averaging the individual confidence intervals around the point estimates of employment-probabilities.

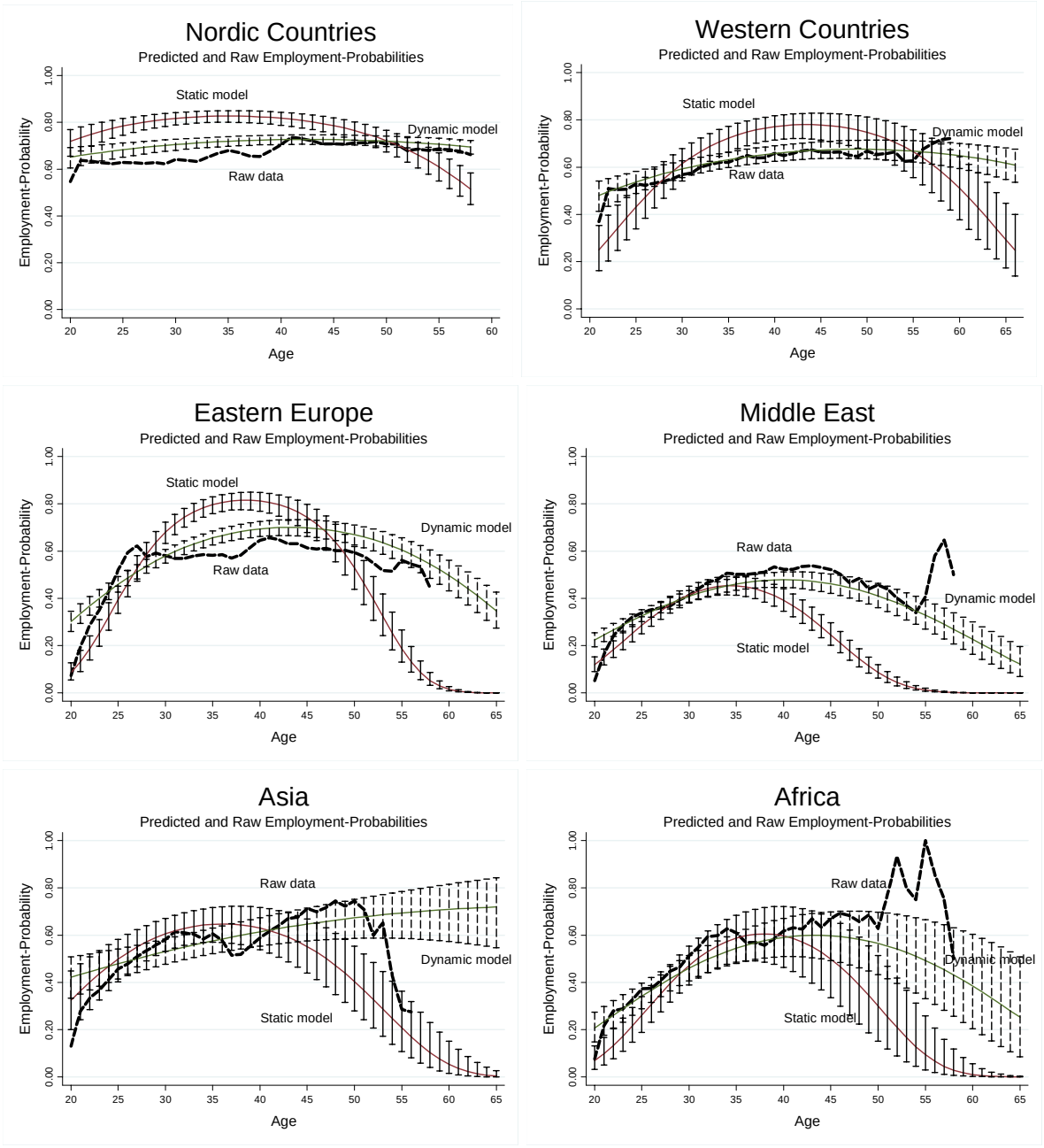
The difference between dynamic and static assimilation models are striking. The static assimilation model is biased and the bias changes with the degree of structural state dependence and year-since-migration. The static assimilation model overestimates the initial employment probability levels as presented in Table 4a. Consistent with our expectations that the static assimilation model overstates the short-run marginal assimilation rates whereas understates the long-run ones compared to the dynamic assimilation model. It predicts very

fast employment-probability growth at the first years after arrival and very fast human capital depreciation rate at the later stages. The size of the structural state dependence parameter is an indicator of the degree of difference between the profiles obtained by dynamic and static model. The higher the structural state dependence the flatter is the profile. Thus, the penalty of age is the lower the higher is the parameter and the longer is the assimilation process with a stabile employment-probability level once is achieved.

In order to portray the differences between static and dynamic models of assimilation, the predicted probabilities from the models are also compared with the observed unconditional density points of employment incidence as a function year-since-migration. Figure 2 present predicted and the actual employment probabilities. The dynamic assimilation model fits the actual data more adequately than the static assimilation model. Except Eastern Europeans and Asians, the static model fails to predict early employment-probabilities (0-10 years after arrival). However, it fails to predict the behavior of the later employment-probabilities for all regions of origins. Briefly, the static model, which is not taking into account the structural factors, predicts fast employment probability growth and very fast depreciation of human capital in the long-run which is not truly portraying the actual employment behavior in the practice.

We also note that 95% confidence intervals indicate interesting differences between models. The static assimilation models predict that the variation in the probability of being employed among immigrants in the early and later ages is getting lower compared to middle aged immigrants. This means for instance that among young and very old immigrants the

probability of being employed show lower variation than an immigrant who is in his or her middle ages (conditional on being arrived at 20). The same is reversed in the dynamic model consistent with the actual employment incidences observed in the practice.



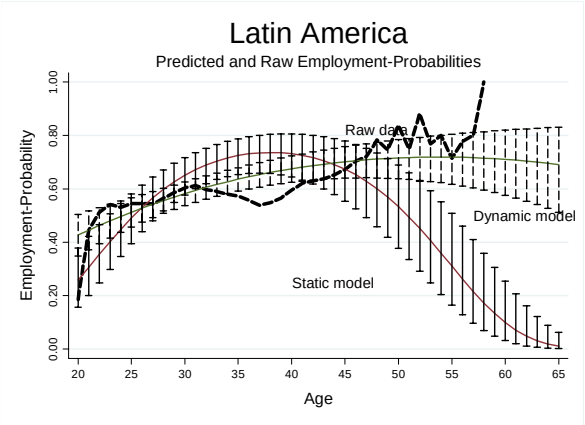


Figure 2. Age-employment-probability profiles by region of origin, models and raw employment-probabilities. The raw employment-probabilities are presented with bold and dashed curves. Dashed vertical lines are the %95 confidence intervals of the predictions obtained by the dynamic assimilation model. See also Figure 1.

4.3. Education, persistence of employment and employment assimilation by education

In this section we focus on the persistence of employment-status and resulting assimilation by educational attainment levels to understand how structural state dependence behaves as degree of human capital is changed. Models are estimated by splitting the data into three educational categories. They are *primary education* (Grundskola degree, 9 years of education), *secondary education* (Gymnasium (high school) degree, more than 9 years but less than 12 years of education) and *university degree or more* (education more than Gymnasium). We report structural state dependence which is experienced by the immigrants with different educational attainment levels in Table 5a.

Table 5a. Structural state dependence on the employment probabilities of immigrants and natives (by education status and region of origin)

	Regions							
	Nordic Countries	Western Countries	Eastern Europe	Middle East	Asia	Africa	Latin America	Native Swedes
Males								
University	0.481***	0.570***	0.607***	0.505***	0.426***	0.496 *	0.591***	0.504***
	(0.019)	(0.014)	(0.009)	(0.012)	(0.039)	(0.268)	(0.032)	(0.015)
Secondary	0.501 ***	0.550***	0.600***	0.457***	0.545***	0.535***	0.535***	0.810***
	(0.010)	(0.011)	(0.007)	(0.007)	(0.014)	(0.014)	(0.016)	(0.004)
Primary	0.503 ***	0.485***	0.478***	0.439***	0.551***	0.538***	0.533***	0.829***
	(0.012)	(0.018)	(0.017)	(0.010)	(0.019)	(0.020)	(0.019)	(0.005)

Note: See Table 4a

The results reveal that the magnitude and behavior of structural state dependence experienced by natives differ compared to immigrants. A higher level of education implies a lower degree of structural state dependence for the natives. The same is not true for many immigrant groups (except Nordic, Asian and African immigrants). For immigrants, the size of the structural state dependence is the higher the lower is the level of the education. University educated natives and the university educated immigrants from Nordic Countries, Middle East, Asia and Africa experience almost the same degree of persistence but the university educated immigrants from Western Countries, Eastern Europe and Latin America experience a higher structural state dependence. The situation is completely different for the other education categories: native Swedes with secondary and elementary school education experience higher structural state dependence than all immigrant groups.

Table 5b reports relative employment-probabilities by years-since-migration, region of origin and model. The calculated quantities compares, for instance, the university educated immigrants with university educated natives. There is full assimilation for some of the immigrant groups by different educational attainments but only with the static assimilation model. University educated Nordics (in 11-15 years) and Westerners (in 21-25 years),

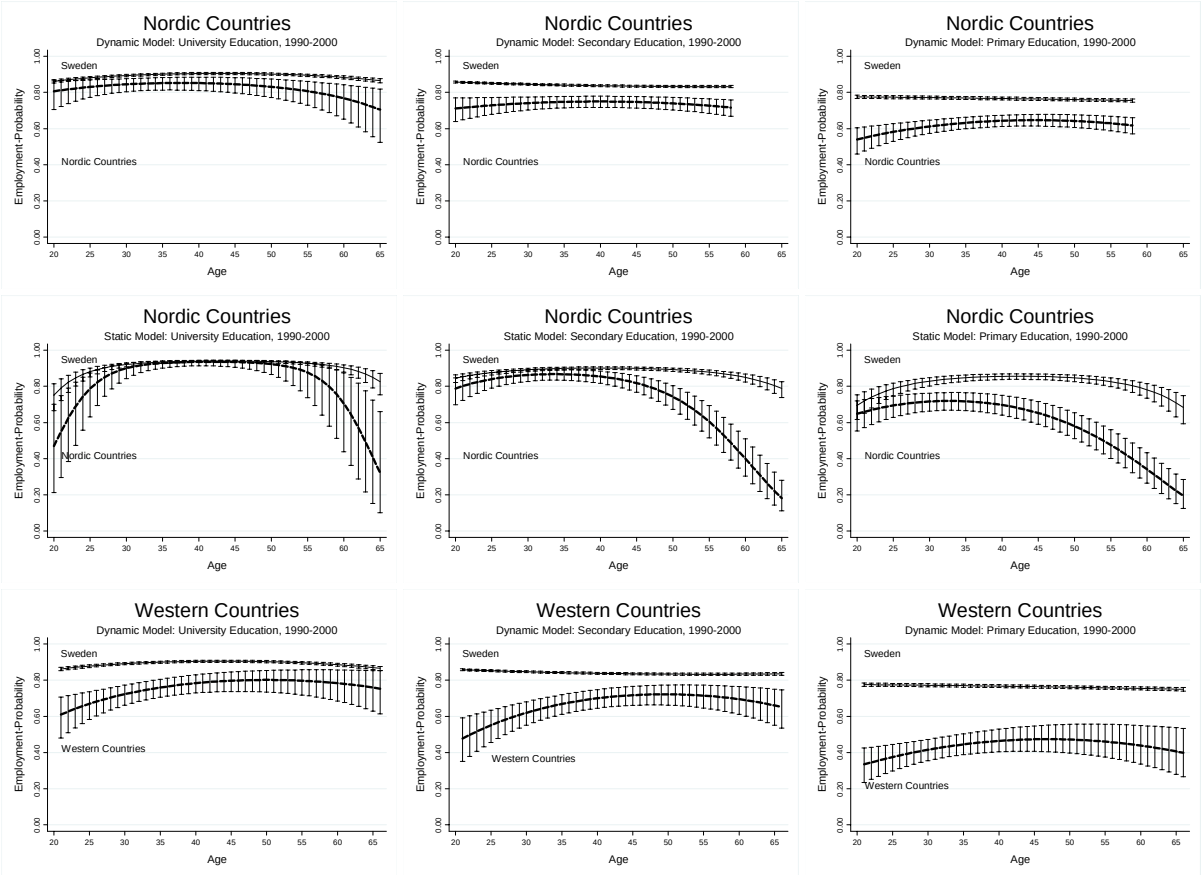
secondary educated Eastern Europeans (in 16-20 years) are predicted to be fully assimilated according to the static model. Only low-skilled Latin Americans are able to reach to full assimilation according to the dynamic model (in 36-40 years). The age-employment-probability profiles of the natives and immigrants by education are presented in Figure 2.

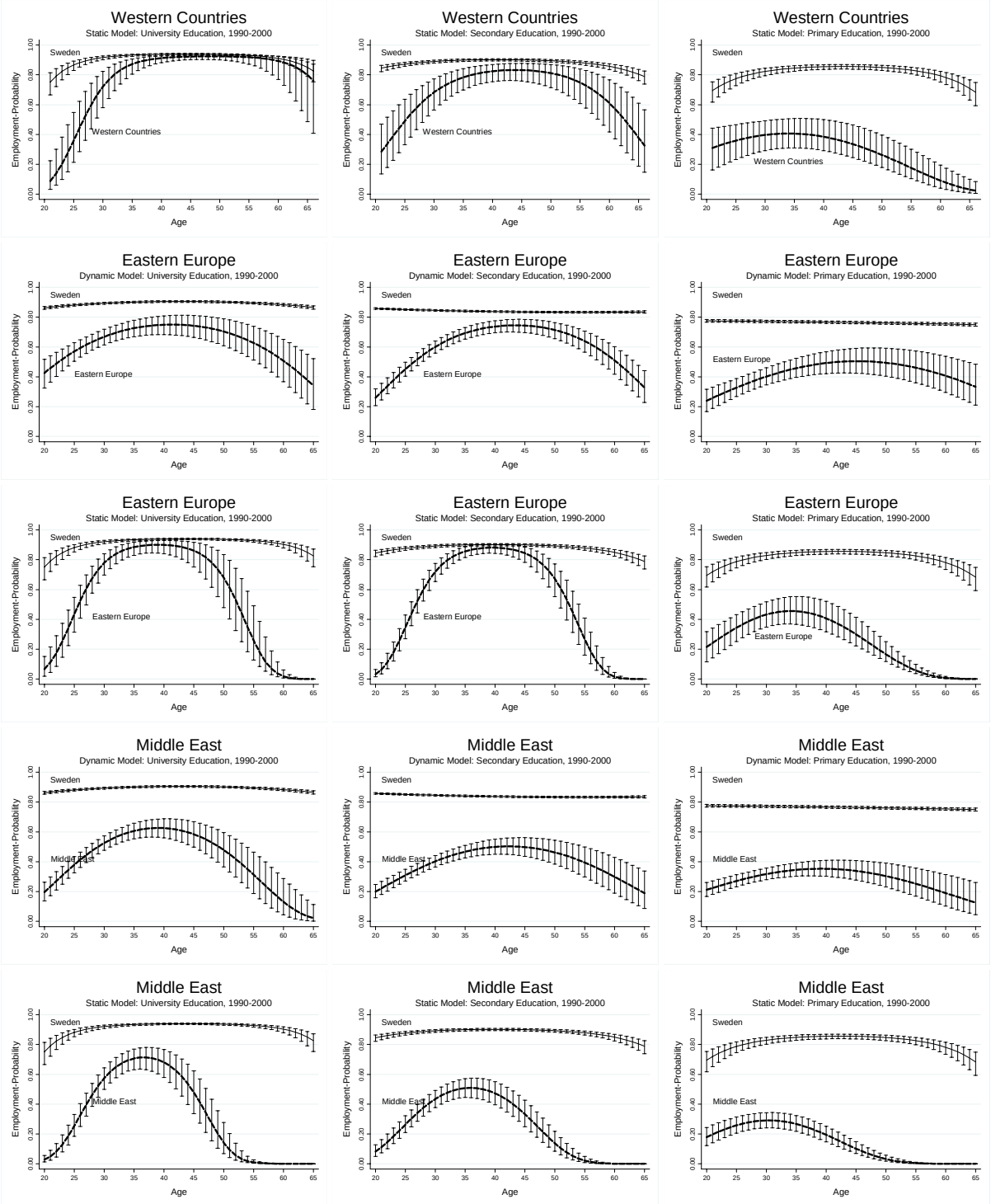
Table 5b. Relative employment-probabilities and years-to-assimilation of immigrants, (by education and region of origin)

	Upon Arrival	Years-since-migration						
		1-5	6-10	11-15	16-20	21-25	26-30	*TYA*
Nordic Countries								
dynamic								
University	-0.06	-0.05	-0.04	-0.04	-0.05	-0.06	-0.07	11-15(P)
Secondary	-0.15	-0.13	-0.11	-0.10	-0.09	-0.09	-0.09	16-20(P)
Primary	-0.24	-0.21	-0.17	-0.15	-0.13	-0.12	-0.12	21-25(P)
static								
University	-0.28	-0.16	-0.04	**-0.01**	**-0.00**	**-0.00**	**-0.01**	**11-15(F)**
Secondary	-0.06	-0.04	-0.03	-0.03	-0.04	-0.07	-0.11	11-15(P)
Primary	-0.04	-0.07	-0.10	-0.12	-0.15	-0.18	-0.24	NA
Western Europe								
dynamic								
University	-0.25	-0.21	-0.18	-0.15	-0.12	-0.11	-0.10	31-35(P)
Secondary	-0.38	-0.32	-0.24	-0.18	-0.15	-0.12	-0.12	26-30(P)
Primary	-0.44	-0.40	-0.36	-0.33	-0.30	-0.29	-0.28	26-30(P)
static								
University	-0.66	-0.56	-0.25	-0.08	-0.03	**-0.01**	**-0.00**	**21-25(F)**
Secondary	-0.56	-0.43	-0.24	-0.13	-0.08	-0.07	-0.08	21-25(P)
Primary	-0.39	-0.41	-0.42	-0.44	-0.46	-0.51	-0.57	NA
Eastern Europe								
dynamic								
University	-0.44	-0.36	-0.26	-0.19	-0.16	-0.16	-0.18	21-25(P)
Secondary	-0.60	-0.48	-0.30	-0.18	-0.12	-0.09	-0.10	21-25(P)
Primary	-0.54	-0.49	-0.40	-0.33	-0.29	-0.26	-0.26	26-30(P)
static								
University	-0.69	-0.58	-0.24	-0.07	-0.04	-0.06	-0.17	16-20(P)
Secondary	-0.81	-0.68	-0.30	-0.08	**-0.01**	-0.03	-0.14	**16-20(F)**
Primary	-0.48	-0.46	-0.41	-0.39	-0.42	-0.51	-0.63	11-15(P)
Middle East								
dynamic								
University	-0.67	-0.57	-0.42	-0.32	-0.28	-0.30	-0.37	16-20(P)
Secondary	-0.66	-0.58	-0.48	-0.40	-0.35	-0.33	-0.35	21-25(P)
Primary	-0.56	-0.52	-0.47	-0.43	-0.30	-0.29	-0.28	26-30(P)
static								
University	-0.72	-0.70	-0.45	-0.26	-0.24	-0.36	-0.66	16-20(P)
Secondary	-0.76	-0.68	-0.51	-0.41	-0.41	-0.51	-0.68	11-15(P)
Primary	-0.52	-0.53	-0.53	-0.56	-0.63	-0.71	-0.79	NA
Asia								
dynamic								
University	-0.50	-0.43	-0.34	-0.26	-0.21	-0.17	-0.14	40+(P)
Secondary	-0.42	-0.38	-0.32	-0.27	-0.23	-0.18	-0.16	40+(P)
Primary	-0.41	-0.38	-0.33	-0.29	-0.25	-0.21	-0.17	40+(P)
static								
University	-0.75	-0.75	-0.46	-0.19	-0.10	-0.09	-0.09	26-30(P)

Secondary	-0.56	-0.42	-0.24	-0.16	-0.15	-0.20	-0.33	16-20(P)
Primary	-0.28	-0.31	-0.35	-0.41	-0.51	-0.63	-0.76	NA
Africa								
dynamic								
University	-0.50	-0.45	-0.38	-0.32	-0.29	-0.28	-0.29	21-25(P)
Secondary	-0.70	-0.59	-0.41	-0.27	-0.18	-0.15	-0.17	21-25(P)
Primary	-0.61	-0.54	-0.45	-0.38	-0.33	-0.36	-0.41	16-20(P)
static								
University	-0.61	-0.57	-0.42	-0.31	-0.28	-0.34	-0.49	16-20(P)
Secondary	-0.83	-0.76	-0.45	-0.18	-0.09	-0.11	-0.26	16-20(P)
Primary	-0.55	-0.55	-0.55	-0.56	-0.62	-0.71	-0.78	NA
Latin America								
dynamic								
University	-0.25	-0.23	-0.22	-0.21	-0.22	-0.23	-0.26	11-15(P)
Secondary	-0.47	-0.40	-0.30	-0.21	-0.15	-0.11	-0.09	36-40(P)
Primary	-0.46	-0.41	-0.32	-0.25	-0.18	-0.12	-0.07	**36-40(F)**
static								
University	-0.67	-0.57	-0.28	-0.12	-0.08	-0.11	-0.23	16-20(P)
Secondary	-0.69	-0.54	-0.30	-0.13	-0.07	-0.06	-0.10	21-25(P)
Primary	-0.40	-0.37	-0.34	-0.32	-0.36	-0.45	-0.59	11-15(P)

Notes: Bold indicates that the employment-probabilities of an immigrant group exceed those of native Swedes. *F* indicates full assimilation, *P* partial assimilation. *NA* is "not applicable".




Western Countries
Static Model: University Education, 1990-2000
Sweden
Western Countries
Western Countries
Static Model: Secondary Education, 1990-2000
Sweden
Western Countries
Western Countries
Static Model: Primary Education, 1990-2000
Sweden
Western Countries
Eastern Europe
Dynamic Model: University Education, 1990-2000
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Dynamic Model: Secondary Education, 1990-2000
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Eastern Europe
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Dynamic Model: Primary Education, 1990-2000
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Static Model: University Education, 1990-2000
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Eastern Europe
Static Model: Secondary Education, 1990-2000
Sweden
Eastern Europe
Eastern Europe
Static Model: Primary Education, 1990-2000
Sweden
Eastern Europe
Middle East
Dynamic Model: University Education, 1990-2000
Sweden
Middle East
Middle East
Dynamic Model: Secondary Education, 1990-2000
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Middle East
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Dynamic Model: Primary Education, 1990-2000
Sweden
Middle East
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Static Model: University Education, 1990-2000
Sweden
Middle East
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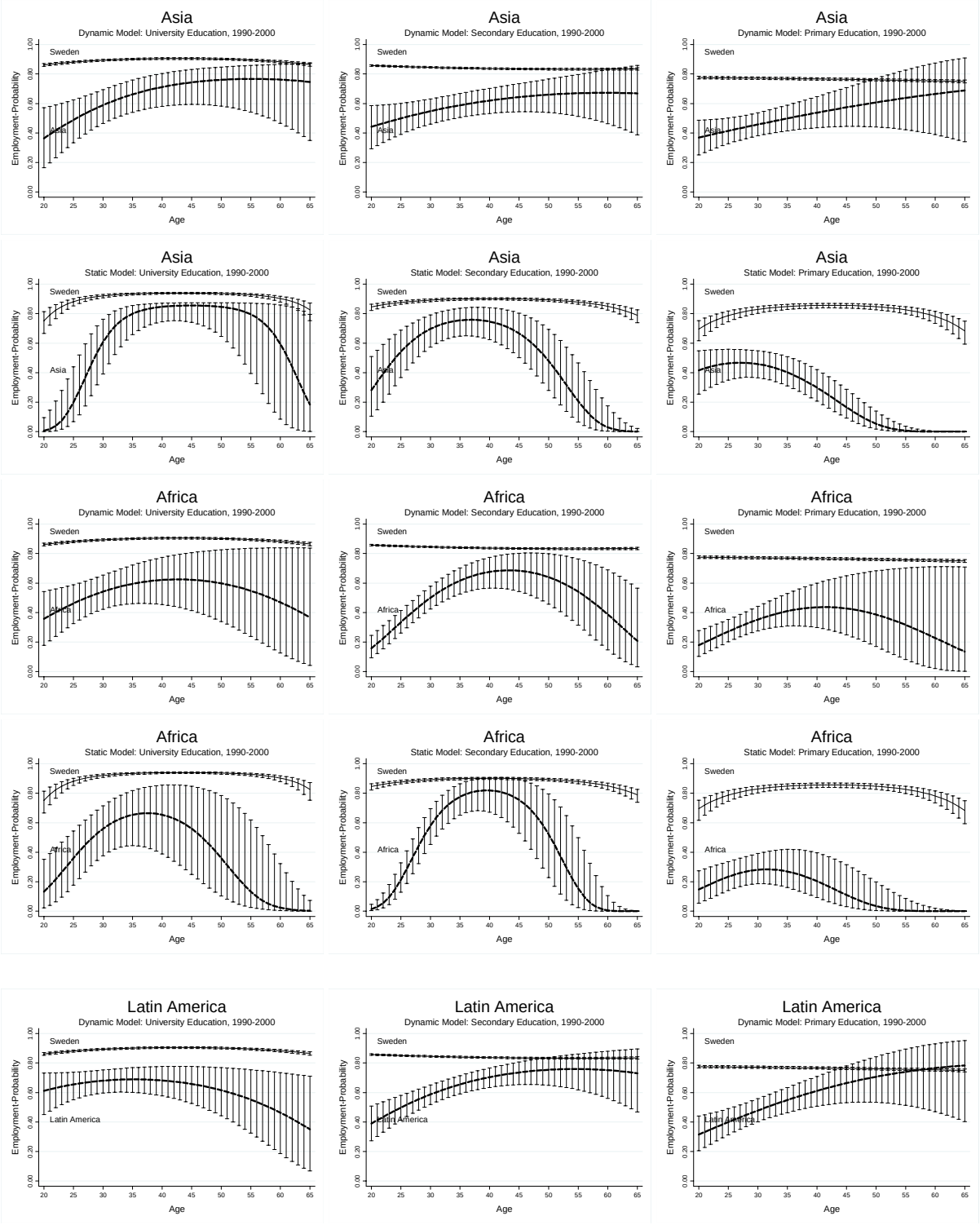
Static Model: Secondary Education, 1990-2000
Sweden
Middle East
Middle East
Static Model: Primary Education, 1990-2000
Sweden
Middle East
Employment-Probability
Age


Asia
Dynamic Model: University Education, 1990-2000
Asia
Dynamic Model: Secondary Education, 1990-2000
Asia
Dynamic Model: Primary Education, 1990-2000
Asia
Static Model: University Education, 1990-2000
Asia
Static Model: Secondary Education, 1990-2000
Asia
Static Model: Primary Education, 1990-2000
Africa
Dynamic Model: University Education, 1990-2000
Africa
Dynamic Model: Secondary Education, 1990-2000
Africa
Dynamic Model: Primary Education, 1990-2000
Africa
Static Model: University Education, 1990-2000
Africa
Static Model: Secondary Education, 1990-2000
Africa
Static Model: Primary Education, 1990-2000
Latin America
Dynamic Model: University Education, 1990-2000
Latin America
Dynamic Model: Secondary Education, 1990-2000
Latin America
Dynamic Model: Primary Education, 1990-2000
Sweden
Asia
Africa
Latin America
Employment-Probability
Age

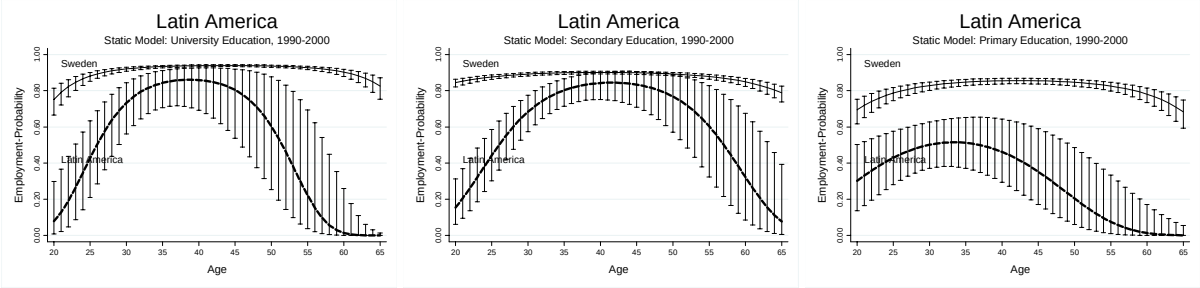


Figure 3. Age-employment-probability profiles by education, region of origin and models. The immigrants are presented using dashed curves. The vertical lines are the %95 confidence intervals obtained by averaging the individual confidence intervals around the point estimates of employment-probabilities. See also Figure 1 and 2.

5. Conclusions

One of the most important policy targets of every government in Sweden is to assimilate the immigrants into labour-market as quickly as possible. This implies that the governments want to know how the employment levels of the immigrants relative to natives develop as time spent in Sweden increased. The previous studies on this issue are suggested that the immigrant's employment-probabilities are incomparable with natives even after many years after arrival. Immigrant employment-probabilities show a substantial growth after arrival but they never catch-up with that of natives. These results are based on a static assimilation model predicted by using panel data sets and also confirmed here. In this paper, we expended this literature by studying the dynamics of employment assimilation of first-generation immigrant men in Sweden using a high-quality register-based panel data set covering periods between 1990 and 2000. We estimate an assimilation model using a genuine dynamic panel data model controlling for structural state dependence and time-persistent unobserved individual-effects

as well as many observed individual socio-economic and demographic characteristics. The results of the dynamic model are compared with the results from the standard static assimilation model which is standard in the literature. The models are controlled also for 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 together. Initial values problem is solved using Wooldridge (2005) method considering that initial employment status of each individual is endogenous variables correlated with observed and unobserved individual characteristics.

A substantial structural state dependence is found for the employment-probabilities of both immigrants and native Swedes. The structural state dependence is differed for native Swedes and immigrants, and also across immigrant groups. Native Swedes experience almost 1.5 times higher structural state dependence than some of the immigrant groups. Failure to control for structural state-dependence (i.e., using the static model instead of dynamic model) is found to cause serious overestimation of variance for the unobserved individual-effect.

The results suggest that the static assimilation model is not able to capture the actual behavior of employment experience and of human-capital accumulation with years spent in Sweden. It overstates the marginal assimilation rates in the first years after arrival, but fast and high depreciation later, thus predicting too early "penalty" for the age of the immigrants. On the other hand, the dynamic model predicts a lower initial-employment-probability disadvantage and a stabile and continuous human-capital accumulation in the first years after arrival once

achieved, thus less depreciation later. Total years to assimilation (whether partial or full) are thus longer in the dynamic model than the static model.

Overall, findings obtained in this present study are not particularly encouraging with respect to policy objectives of the governments. The employment assimilation of male immigrants in Swedish labour-market is very weak especially for the immigrants outside the West Europe and Nordic region. The other two immigrant groups which are relatively successful are the Eastern Europeans and Latin Americans, but Africans, Asians and especially Middle Easterners are doing worse in the Swedish labour market. Except some immigrants groups with high level of education, we do not find any evidence for the *full assimilation*. Our results also suggest that the employment assimilation of immigrants much weaker than that is predicted before. There is very weak employment assimilation in a way that immigrants are not able to close the initial employment-probability gap with year spent in the host country. The dynamic model estimated here suggested that, once immigrants achieve a level of country-specific human-capital, they are able to use it to keep their employment probability level at the same level over time although this level is far from the one experienced by native Swedes.

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