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Alpaslan Akay

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Forschungsinstitut
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Institute for the Study
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IZA

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

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ABSTRACT

Dynamics of the Employment Assimilation of First-Generation Immigrant Men in Sweden: Comparing Dynamic and Static Assimilation Models with Longitudinal Data*

We analyse the dynamics of employment assimilation of first-generation immigrant men in Sweden using a high-quality, register-based panel data set. It is discussed that when there are significant differences between employment status persistence of immigrants and natives, the standard static assimilation model produces biased predictions for the relative labour market outcomes for immigrants. We find significant persistence of employment status which differs between immigrants and natives, and also across immigrant groups. The static assimilation model overestimates (underestimates) the short-run (long-run) marginal assimilation rates. We find 10-15 percentage points lower initial employment probability disadvantage but the years to assimilation are 5-10 years longer compared to the standard static assimilation model.

JEL Classification: C33, J15, J61

Keywords: dynamic random-effects probit model, employment assimilation, initial values problem

Corresponding author:

Alpaslan Akay
IZA
P.O. Box 7240
D-53072 Bonn
Germany
E-mail: akay@iza.org

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1. Introduction

Sweden has proportionally one of the largest immigrant populations among Western countries, accounting for almost 14% of the population. One of the policy targets of recent governments is to assimilate immigrants into the Swedish labour market as quickly as possible. However, previous studies report that not only was the growth of immigrant employment levels in Sweden weak and their employment levels quickly diverged away from that of native Swedes, but the labour market outcome also differed by region of birth, arrival-cohort and education (Ekberg, 1994, 1999; Edin et al., 2000; Scott, 1999; Hammarstedt, 2001, 2003; Bevelander, 1995, 2005; Bevelander and Nielsen, 2001; Aguilar and Gustafsson, 1991, 1994; Gustafsson and Zheng, 2006; Åslund and Rooth, 2007; Bevelander and Lundh, 2007). Both the demand and supply side factors played important roles on the appearance of this result. Up until the early 1970's the Swedish economy was highly dependent on foreign labour. Foreign-born individuals in Sweden had even higher employment rates than natives in the early 1970s; however, later immigration shifted to refugees and family reunification, and immigrant employment levels declined after this period (Bevelander, 1995, 2005; Edin et al., 2000). The deterioration of the immigrants' relative employment levels was also caused by the structural change in the Swedish economy from industrial to service-oriented sectors (Ekberg, 1994, 1999; Bevelander, 2005). The structural shift increased the demand for employees with language and interpersonal skills, and Swedish labour market-specific human capital in general. Obtaining labour market-specific skills to compete in the labour market with natives requires a continual accumulation of labour market experience after

arrival. Immigrants, however, may be confronted with difficulties in obtaining it because, first of all, upon arrival the human capital which is acquired in the home country may not be perfectly transferable; and many other factors such as labour market discrimination and segmentation may also lead to different patterns (interruptions and continuities) on the employment status of immigrants and natives over time. The primary aim of the paper is to examine the dynamics of employment assimilation of first-generation (foreign-born) male immigrants in Sweden. We extend the standard static assimilation models by taking the effect of past labour market experience into account together with time-persistent, unobserved characteristics and analyse their effects on the current employment levels and assimilation outcome of immigrants. By estimating the employment probability outcome of the immigrants and natives in a standard assimilation model, our study also focuses on comparing the conventional assimilation models and the dynamic one suggested in this paper.

The assimilation of immigrants is typically analysed in previous studies by using either a *cross-section* of individuals or *synthetic* or *genuine panel data sets* with static modeling framework (e.g. Chiswick, 1978; Borjas, 1985, 1987, 1995; LaLonde and Topel, 1991, 1992; Baker and Benjamin, 1994; Duleep and Regets, 1999; Aguilar and Gustafsson, 1991; Bauer et al., 2000; Ekberg, 1994; Husted et al., 2001; Longva and Raaum, 2002, 2003; Barth et al, 2004; Bevelander, 2005). However, the static framework (with or without panel data sets) cannot account for the structural and spurious factors leading to the persistence of employment status over time. A *structural state dependence* on employment status can be caused by past employment experiences; and a *spurious state*

dependence is due to time-persistent, unobserved, individual characteristics (motivation or ability), which can alter employment propensities independently from actual employment experience.[1] In this paper we argue that the labour market conditions faced by immigrants and natives may be substantially different. Thus, the effect of any employment (or unemployment) experience may lead to different consequences for the future employment experience of immigrants and natives. When the effect of any past employment experience (the structural state dependence) of immigrants and natives is significantly different, the assimilation results produced by the standard static model may be biased. The static model assumes that the relative employment probabilities of immigrants absorb the effect of past labour market experience (conditioned on time-persistent, unobserved and observed, individual characteristics). In this paper we relax this assumption and control for both structural and spurious state dependence in a dynamic panel data random-effects probit model with endogenous initial conditions to analyse the dynamics of employment assimilation of immigrant men in Sweden for the years between 1990 and 2000.

Immigrants are heterogeneous, i.e. their human capital and degree of unobserved characteristics differ. By separating the immigrants into seven regions of origin and analysing them in different models, we find very strong, positive structural state dependence on the employment status of native Swedes and also of immigrants. It largely differs between native Swedes and immigrants and also across immigrant groups. Native Swedes experience higher (lower) persistence due to structural reason (spurious reasons)

[1] See Heckman (1981) for the terminology of "structural and spurious state dependence".

than immigrants. The static assimilation model predicts very large marginal assimilation rates during the initial years after arrival, but in fact the rates are quickly turned to negative, as employment probabilities of immigrants widely diverge (with some exceptions) from those of native Swedes. Controlling for past labour market experience lowers both the speed of assimilation and depreciation rates of human capital at later stages; and thus, immigrants are able to keep their marginal assimilation rates positive for a longer period. The dynamic model predicts a lower initial employment probability advantage (10-15 percentage points) and longer total years to assimilation, which is up to 5-10 years longer compared with the predictions of the static assimilation model. We could not find any evidence that there is a full employment assimilation of immigrants into the Swedish labour market for either dynamic or static assimilation models (except in some cases with different education levels). Immigrants from Nordic and Western countries (and secondarily Eastern Europe and Latin America) are relatively successful, and they are even able to reduce the employment probability gap to under 5-10 percentage points; whereas the others are far from being assimilated into the employment probability levels of native Swedes.

The remaining part of the paper is organised as follows. The following section discusses the hypotheses tested in the paper and potential reasons leading to structural and spurious state dependence in larger detail. 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 data, and Section 5 gives the empirical results by region of

origin and by education to examine how persistence differs with degree of human capital. Section 6 summarises and draws conclusions.

2. Hypotheses, structural vs. spurious state dependence and assimilation

The main aim of this paper is to test the so-called "assimilation hypothesis" under different assumptions (Chiswick, 1978; Chiswick et al., 1997; Borjas, 1985, 1987, 1995; LaLonde and Topel, 1991, 1992; Baker and Benjamin, 1994; Hayfron, 1998; Edin and Frederiksson, 2000). The hypothesis suggests that immigrants arrive at the host country without the human capital specific to the host country and they experience lower levels of employment probabilities relative to natives upon arrival.[2] However, they develop the necessary capital over time and they reduce the initial disadvantage and eventually "catch-up" with (assimilate into) the employment probability levels of natives as years since migration increases (Borjas, 1999; Edin et al., 2000; LaLonde and Topel, 1992). The literature testing this hypothesis is generally based on a static human capital model. In this paper we extend this approach to a dynamic framework to capture the persistence of the employment outcome for immigrants and native Swedes.

There may be many sources leading to persistence and we have also many reasons to believe that the effect of some of these reasons may differ for immigrants and natives, even though we cannot empirically identify them separately. For instance, an unemployment experience in the past may be perceived by employers as a *signal* for low

[2] In this paper we focus on employment assimilation; however, the literature predominantly focuses on earnings assimilation (Chiswick, 1978, Borjas, 1985, 1999; and many others)

productivity or time out for skills (Hyslop, 1999). Failure to find a job upon arrival may *scar* future job possibilities and this could reduce the bargaining power of the workers. Wage offers may also be lowered, which may in turn affect the labour supply decisions of workers.[3] Employers (or other employees in the firm) may have preferences towards working together with natives rather than immigrants (*preference discrimination*). It is also possible that employers may judge immigrants and natives differently, even though they have the same labour market experience (*labour market discrimination*). Job search costs may also differ across different participation states between natives and immigrants. On the other hand, as Chiswick (1978) explains, immigrants are a positively selected group of individuals. Their time-persistent unobserved motivation to work, abilities or skills may be different than natives, and these factors may also lead to different patterns on the employment status over time (*unobserved preferences*).

Ignoring these dynamic aspects of labour market experience might bias the predictions for the employment assimilation of immigrants. The static assimilation model is silent about these issues because it cannot take past labour market experience into account. It is a special case of the dynamic assimilation model which is suggested in this paper. A static assimilation model controlling for the unobserved individual-effects assumes that "*the persistence effect of past employment experience on current employment status is the same for immigrants and natives"*. That is, the persistence difference between

[3] In another strand of literature aiming to examine welfare take-up differences of immigrants and natives in Sweden, Hansen and Lofstrom (2009) find that refugee immigrants display a greater degree of structural state dependence than natives and non-refugee immigrants in terms of welfare participation. They conclude that high welfare take-up rates among refugee immigrants may be due to the existence of a "welfare trap".

immigrants and natives is only due to different time-persistent, unobserved characteristics (conditional on the observed characteristics). Thus, relative employment-probabilities of immigrants absorb the effect of the persistence which is due to actual employment experience, i.e. structural. When the past labour market experience (or unobserved characteristics of immigrants and natives conditional on past labour market experience) has a different impact on the current employment possibilities, the relative employment probabilities and resulting marginal assimilation rates obtained by the standard static assimilation model may be biased. The size and direction of the bias would depend on the difference between the degree of state dependence on the employment status of immigrants and natives.

We control for the structural and spurious state dependence and relax the assumption that structural state dependence is equal for immigrants and native Swedes. Thus, we examine whether or not the effect of past employment experience of immigrants and native Swedes is the same for their current employment status. We argue for instance that when native Swedes experience a positive and larger structural state dependence compared to immigrants, the static assimilation model is expected to overestimate (underestimate) the short-run (long-run) marginal assimilation rates. In the case of higher persistence of employment, the frequency of labour market transitions (from work or to work) of natives is lower than that of immigrants. Once they are employed, they stay in this state persistently. Thus, continually employed natives accumulate a higher degree of labour market-specific human capital than immigrants; and the existing employment probability differential (that is expected due to a lack of country-specific human capital of the

immigrants) between immigrants increases over time. In the short-run the static assimilation model (which ignores the factors leading to persistence) may predict that the immigrants are closing the employment probability differential with greater speed than is actually true.

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 too (given a positive structural state dependence), since it cannot truly account for the human capital transfers over time. Without the effect of the past as a link between past employment experience and current employment experience, the static model may produce a very large *penalty* of age in the employment probability levels as years since migration increase. Overall, failure to control for past employment experience may also affect the predictions about the assimilation outcome of immigrants in terms of years to assimilation. The dynamic assimilation model is expected to produce a slower but stabile assimilation, which lasts longer years after migration, leading to longer years to assimilation compared to the ones produced by the static assimilation model.

3. Econometric specifications

3.1. The dynamic assimilation model

We specify a dynamic random-effects probit model for both immigrants and native Swedes by controlling for previous period employment status, observed and unobserved

individual characteristics, and endogenous initial values. The dynamic employment generating process of immigrants (I) is specified as follows:[4]

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

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

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

where $d_{it}^{\mathrm{I}*}$ is a binary latent (unobserved) dependent variable indicating whether an immigrant is employed during the current period *t* (*i* is the individual and $i = 1,...,I$ and *t* is the period in the panel data set $t = 1,...,T_i$ (unbalanced panel)); x_{it} is a vector of current socio-demographic and economic characteristics (such as educational attainment, marital status and non-labour income); β is the corresponding vector of parameters to be estimated; $d_{i,t-i}$ is a (observed) binary variable indicating whether an immigrant *i* was employed in the previous period ($t-1$); and we will interpret the parameter λ as *structural state dependence* following the discourse of Heckman (1981).[5] *Age* and *ysm* (years since migration) are two key variables for an 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

[4] The model given in (1) is a static assimilation model with unobserved individual effects when λ is zero. The static model estimated here in this paper uses a similar auxiliary distribution for the unobserved individual effects using the Chamberlain (1984) approach. The auxiliary distribution of the unobserved individual effects does not include the first period employment status in the case of the static model.

[5] 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).

specific characteristics (cohort fixed-effects) are controlled for using a series of indicator variables indexed by $j = 1,...,J$; the transitory macroeconomic fluctuations in the economy (such as upward or downward trend in unemployment rates during observation periods) may have different impacts on the employment abilities of immigrants and natives. In order to control for these characteristics, the period-effects, Π_k^{I}, are included for *k* periods.

Clearly, the model given in (1) is not identified.[6] An additional restriction must be imposed: either that the period-effect 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. $\Pi_k^{\mathrm{I}} = \Pi_k^{\mathrm{N}}, \forall k$). This assumption would be credible if there were no change in macroeconomic conditions or even if it did change, the responsiveness of immigrants and natives to these changes should be the same. The important point for the current study is that changing macroeconomic conditions may influence the price paid for skills of immigrants and natives differently. Thus, if the sensitivities of immigrants and native Swedes are in fact different and if they are not equally affected by changing macroeconomic conditions, this restriction can lead to a severe bias in estimates of the effects of the arrival cohort and years since migration (Barth et al., 2004). Sweden (and the other Nordic countries) experienced a sharp economic downturn coinciding with the sample period, 1990-2000. Thus, the model, which assumes equal period-effects, could

[6] The period-effects, Π_k, is a linear combination of the effects of the 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).

be biased. To attempt to control for this bias, at least partially, local market unemployment rates are used by following the wage-curve model suggested in Barth et al., (2004). The wage-curve model is also restricted by the assumption of equal period-effects. However, it is assumed that the period-effects can be identified by controlling for local unemployment rates (Akay and Tezic, 2007).

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

$$d_{it}^{\mathrm{N}*} = \mathbf{1}\left\{\left(x_{it}^{\mathrm{N}}\beta^{\mathrm{N}} + \lambda^{\mathrm{N}} d_{i,t-1}^{\mathrm{N}} + \varphi^{\mathrm{N}} age_{it}^{\mathrm{N}} + \sum\nolimits_k \theta_k^{\mathrm{N}} \Pi_k^{\mathrm{N}} + u_{it}^{\mathrm{N}}\right) > 0\right\}, \tag{4}$$

$$u_{it}^{\mathrm{N}} = \eta_i^{\mathrm{N}} + \varepsilon_{it}^{\mathrm{N}}, \tag{5}$$

$$d_{i1}^{\mathrm{N}*} = \mathbf{1}\left\{\left(z_{i1}^{\mathrm{N}}\beta_1^{\mathrm{N}} + u_{i1}^{\mathrm{N}}\right) > 0\right\}, \tag{6}$$

where the variables years 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 (1-3)).

The error term in the model (1 and 4) is composed as in (2 and 5). The first part (η_i) is the time-invariant (persistent), unobserved individual-effects and controlling for these effects is crucial in order to be able to identify structural state dependence. The second term (ε_{it}) is the usual error term, which is assumed to have a normal distribution with

zero mean and unit variance due to the 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 induces 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.

3.2. Estimation of the model and the initial values problem

We follow a fully parameterised 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:

$$\log L = \sum_{i=1}^{I} \ln \left[\int_{-\infty}^{\infty} \left\{ f_1(d_{i1} \mid \{\mathbf{x}_{it}\}_{t=1}^{T}, \eta_i) \prod_{t=2}^{T} f_{it}(d_{it} \mid d_{i.t-1}, \mathbf{x}_{it}, \eta_i; \beta^*) \right\} f(\eta_i) d\eta_i \right], \quad (7)$$

$$f_{it}(d_{it} \mid d_{i,t-1}, \mathbf{x}_{it}, \eta_i; \beta^*) = \Phi\left[(2d_{it} - 1)(\mathbf{x}'_{it}\beta^* + \lambda d_{i,t-1} + \sigma_\eta \eta_i) \right], \quad (8)$$

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

The likelihood function in (7) can be easily maximised 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 the Swedish labour market much earlier than the study period 1990-2000. Thus, it is assumed 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, and observed and unobserved individual characteristics. Wooldridge (2005) introduces 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 by considering that any difference between this method and the others is very small for longer panels than we employ here in this paper (Arulampalam and Stewart, 2009; Akay, 2009). The auxiliary distribution of the unobserved individual-effects for immigrants and natives is given as follows:

$$\eta_i^{\mathrm{I}} = \pi_0^{\mathrm{I}} + \pi_1^{\mathrm{I}} d_{i1}^{\mathrm{I}} + \pi_2^{\mathrm{I}} \bar{\mathbf{x}}_i^{\mathrm{I}} + \alpha_i^{\mathrm{I}}, \tag{9}$$

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

where d_{i1} is the first period employment status; and α_i is the new unobserved individual-effect, which is assumed to be normally distributed with zero mean and unit variance and uncorrelated with the observed individual characteristics. The time-variant variables used in (9) and (10) are age, capital non-labour income and the number of children at home.

3.3. The estimators of employment assimilation

We would like to calculate two measures: *marginal assimilation rates* (*MRA*) as a function of years since migration and *total years to assimilation* (*TYA*). The approach adopted here to measure these quantities is based on the idea of assimilation having occurred when immigrant employment probabilities catch-up over time with the employment probability levels of natives (following Borjas, 1985, 1987 and 1999). An estimator of the marginal assimilation rate is defined simply as:

$$\widehat{MRA}_i(t) = \frac{\partial E^{\mathrm{I}}(t)}{\partial t} - \frac{\partial E^{\mathrm{N}}(t)}{\partial t}, \qquad (11)$$

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:

$$E^{\mathrm{I}}\left[d_{it} = 1 \mid \mathbf{x}_{it}, age_{it}, ysm_{it}, \alpha_i\right] = \Phi\left[\mathbf{x}_{it}\hat{\beta}^{\mathrm{I}*} + \hat{\varphi}^{\mathrm{I}} age_{it}(t_0 + t) + \hat{\delta} ysm_{it}(t)\right], \qquad (12)$$

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

In expression (12) and (13), years since migration is reparameterised with t, and t_0 is the *entry age* to the labour market. In the paper the entry age is assumed to be 20 for each individual. Using (11) an estimator for *MRA* is obtained as:

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

$$-\hat{\varphi}^{\mathrm{N}}\phi\left[\mathbf{x}_{it}\hat{\beta}^{\mathrm{N}*} + \hat{\varphi}^{\mathrm{N}} age_{it}(t_0 + t)\right] \qquad (14)$$

where ϕ indicates the density function of the standard normal random variable. Thus, the estimator of the marginal rate of assimilation in (14) 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 we derive from (14) is the total years of assimilation (the time needed to achieve equal employment probability with otherwise identical native Swedes). This occurs when the conditional expectations of the immigrants and the natives are equal. Thus, it can be formulated in *MRA* terms as:

$$(\hat{\varphi}^{\mathrm{I}} + \hat{\delta})\phi\left[\mathbf{x}_{it}\hat{\beta}^{\mathrm{I}*} + \hat{\varphi}^{\mathrm{I}} age_i\,(t_0 + \tilde{t}) + \hat{\delta}\, ysm_i(\tilde{t})\right] = \hat{\varphi}^{\mathrm{N}}\phi\left[\mathbf{x}_{it}\hat{\beta}^{\mathrm{N}*} + \hat{\varphi}^{\mathrm{N}} age_{it}(t_0 + \tilde{t})\right], \quad (15)$$

where the estimator of the total years of assimilation is $\widehat{TYA}_i = \tilde{t}$.[7]

[7] Note that all estimators are given with individual indices. They can also be calculated for a group of individuals by using mean values of the group of individuals. For instance, an average African immigrant may be compared with the average native and so on. In this paper we calculate all quantities for each individual and period separately and then take the mean values to report.

4. 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:[8] the population sample includes 3.35% of the entire population each year and the immigrant sample includes almost 20% of immigrants arriving in Sweden. In Sweden immigrants are entered into the national register (and thus the sampling frame) when they receive a residence permit. In general immigrants may become a Swedish citizen after a sufficient number of years. The sampling frame consists of everyone who was living in Sweden during a particular year, including those who were born or died and those who immigrated or emigrated. It 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, 2000).

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 equally large control group of randomly selected native Swedish men, matched for age and county of residence. The 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 around 65,000 immigrant men (generating 521,686

[8] We define immigrants as those who are foreign-born (first-generation immigrants).

individual year observations for immigrants and 540,651 for natives). We exclude the self-employed, since their employment-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. In this respect the immigrant sample might not be a random sample of the population of immigrants. Klinthäll (2003) finds that 40% of immigrants arriving from Germany, Greece, Italy and the U.S. leave Sweden within five years. His main hypothesis, borrowed from the U.S. Emigration Studies, is that the least successful immigrants leave. However, as pointed out by Arai et al. (2000), even low-earning immigrants might have a strong incentive to stay because of the relatively high living standards compared to other countries, even in the lower range of the earnings distribution. In our sample 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.

The key variable for this study is employment status. There are many different ways to define an indicator for employment. Whether an individual is employed or not is obtained from the income registers by using the gross labour income of the individuals. First we measure the annual gross labour income in Swedish Krona (SEK) using the income registers (we also inflate by the consumer price index to 2000 prices). It is easier to select the individuals as not working if the gross labour income is zero. We also follow Antelius

and Björklund (2000), who consider an individual as employed if annual earnings are at least 36,400 SEK. In our case it eliminates those with short employment periods or part-time jobs with low pay.[9] Thus, based on this criterion the employment indicator (d_{it}) is defined as 1 if the individual *i* at time period *t* is employed, and 0 otherwise.

In this paper we categorise the immigrants by region of origin from: the other Nordic countries; other Western Countries (including the U.S., Canada, Australia and New Zealand); Eastern Europe; the Middle East; Asia; Africa, and 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 this also squared); marital status (cohabiting is considered as being married); number of children living at home; highest education level (primary education (*Grundskola* degree), 9 years of education; and secondary education (high school diploma), more than 9 but fewer than 12 years of education); and university education; residence in Stockholm or elsewhere; capital non-labour income; arrival cohort; local unemployment rates; and national unemployment rates for the arrival year.[10]

Table 1a about here

[9] This criterion is also adopted in LINDA as the *basic amount* which entitles someone to the earnings related part of the public pension system.

[10] Local unemployment rates are calculated as follows: we first collect 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 for each 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. The employment rate figures are very much inline with previous studies (Bevelander and Nielsen, 2001; Bevelander, 2005). The employment rates (83% vs. 37-68%) are considerably higher for native Swedes. On the other hand more immigrants are married or cohabit (40% vs. 38-59%). Native Swedes are generally better educated: About 77% have at least upper-secondary education, compared to 61-77% for immigrants. The earlier immigrant arrival cohorts account for 9-12% of the total, whereas 1985-89 have 18%, and 1990-94 had almost 25%. The Iran-Iraq war and various conflicts in the former Yugoslavia occurred during these 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 is clearly not homogenous: employment rates are much higher for those from Nordic or Western countries (68% and 59%). Middle Eastern and African immigrants are far less likely to be employed (37% and 40%). Immigrants from non-Nordic Western countries probably have more education than all other groups (nearly 32% have a university degree), followed by Eastern Europeans. Despite the fact that Nordic immigrants, most of them from Finland, have less education, they have a higher employment rate and earn more than all other groups. All this is generally in accordance with previous studies on immigrants in Sweden.

Table 1b about here

Table 1b reports raw transition patterns of employment status of native Swedes and immigrant groups for different degrees of transitions to work or from work. The second column presents the proportion of individuals who were employed for 11 years without any change in their employment status; and the third column gives the proportion of those employed for 0 years without any transition. Being employed in every period implies a binary sequence of employment status {1,1,...,1} for every period (where employed = 1 and it is 0 otherwise). 61% of native Swedes were employed in all periods and a small fraction of Swedes were not employed (the sequence is {0,0,…,0} for each period) in each period (7.5%). Native Swedes are followed by Nordic and Western Countries, with a relatively high percentage of employment (44% and 34%) and relatively low percentage of unemployment in all periods (16% and 24%). The employment status of the other immigrant regions has many interruptions, and they experience very frequent transitions from work and to work. For instance, only 10-11% of immigrants from the Middle East and Africa were continuously employed in all periods and some 25-30% were not employed at all.

The fourth column presents the proportion of individuals who experienced a single transition from employment to unemployment. For instance, a single transition from work implies a sequence of employment status {1,…,1,0,0,…,0}. These are the individuals who are unemployed once and stay in unemployment until the end of the sample period in the data. The frequency of the single transition from work is the lowest for native Swedes with 6.5%; and it is the highest among Nordic and Western immigrants at 12% and 11% respectively. A single transition to work (from unemployment to

employment, fifth column) implies for instance the employment status sequence {0,…,0,1,1,…,1}. During the sample period immigrant groups (except Nordics) experienced a very high degree of single transition to work. The highest is experienced by Eastern Europeans (28%) followed by Asians and Africans (25% and 21%).

The last column gives multiple transitions of any kind. A multiple transition implies many combinations of the binary employment status sequences such as {0,…,1,0,1,…,1} and {1,…,0,1,0,…,0}. We calculate the figures in the last column by considering transitions which occur at least twice. Native Swedes, Nordics, Westerners and Easterners do not experience a high degree of multiple transitions compared to other immigrant groups (17%, 22% and 20%). Almost 30-35% of other immigrant groups experience transitions more than twice. It is very clear from unconditional data that the patterns of persistence and transition between immigrants and natives are substantially different.

5. Estimation results

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

immigrants and natives and predict the relative employment probabilities by educational attainment levels.

5.1. Identifying structural and spurious state dependence on employment probabilities

The models given in (1-3) and (4-6) are estimated for seven regions of immigrant groups. The models estimated here have non-linear expected values and thus we report (Table 2a) the marginal effects of past employment experience on the current employment probabilities. The variance of unobserved individual-effects is also presented in the table as a proxy for the extent of the spurious state dependence on the employment probabilities. The results for the other parameters are in line with the literature: the employment probabilities increase with age at a decreasing rate; and educational attainment level increases the probability of employment.[11]

Having controlled for endogenous initial values, unobserved and observed individual characteristics, the coefficient of lagged employment status provides an estimate of the structural state dependence.[12] Table 2a suggests that there is substantial and significant structural state dependence on the employment status of natives and immigrants. The lagged employment status (i.e. being employed in previous period) is associated with a higher probability of being employed in the current period. Table 2a shows that natives

[11] Estimation results are not reported here due to restrictions of space. However, they can be provided upon request.

[12] In order to check the sensitivity of the results we estimated some of the models with exogenous initial values and Heckman's reduced form approximation. We could not find any large difference between Heckman's methods and the method applied here, i.e. the Wooldridge (2005) method. This may be due to the long duration of the panel data set which is used (see Akay, 2009).

experience higher structural state dependence than immigrants. Being employed in the previous period increases the probability of being employed in the current period by 81% for the average, native, Swedish man. We observe that the state dependence experienced by immigrants is almost the same across groups, varying between 45% and 60%. The highest state dependence after natives is experienced by immigrants from Eastern Europe, Western countries and Latin America. It is surprising that the persistence of employment status is low for Nordic immigrant men, although these immigrants have very similar characteristics to Swedish natives, such as language, culture or geographic proximity. One might expect to obtain very similar persistence outcomes to Swedish natives. However, it is perhaps due to geographical proximity which leads Nordic immigrants to experience multiple immigrations or discontinuity in their working experience more often than any other group of immigrants.

Table 2a about here

Table 2a also reports the variance of the unobserved individual effects, which can be considered as a proxy for the extent of the spurious state dependence. In order to show the effect of the dynamic assimilation model on the distribution of unobserved individual effects, we also report the variance obtained from the static assimilation models [in brackets]. Conditional on the lagged employment status (and all other control variables), immigrants are found to be more heterogeneous in their unobserved characteristics compared to 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 size of the

variance obtained from the static model shrinks when the model is controlled for the lagged employment status.

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

We predict relative employment probabilities of immigrants as a function of years since migration and report the results in Table 2b. The figures in the table are calculated by using the equations given in Section 3.3. $t_0 = 20$ (*ysm* = 0) is used as labour market entry age, and we increase the years since migration from 0 to 45 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 each immigrant, and the standard errors of each individual prediction are obtained to calculate individual 95% confidence intervals. We then take the average of each individual prediction and also 95% confidence intervals to produce the average employment probability level and average confidence interval for a year since migration. In order to calculate relative employment probabilities we predict the employment probabilities of 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 (i.e. only the age = 20 for natives), the relative employment probability is the initial employment probability differential upon arrival and is given in the first column of Table 2b. According to the static model for

instance, immigrants from Nordic countries experience 10 percentage points initial employment probability disadvantage. In other words, the average probability of being employed upon arrival for a Nordic immigrant is 10 percentage points less than comparable native Swedes. In general, there are large differences in the initial employment probability gap which change between 50 and 75 percentage points for the other immigrant groups. The table also presents the results from the dynamic model. In general the dynamic assimilation model predicts a lower initial employment probability disadvantage (except Nordic immigrants, 20 percentage points). For instance, the initial employment probability disadvantage of immigrants from the Middle East is predicted at almost 62 percentage points which is 8 percentage points lower compared to the static assimilation model. The dynamic model predicts that the initial employment probability differential changes between 35 and 65 percentage points which are 10-15 percentage points lower than the static assimilation model.

In Table 2b we report relative employment probabilities as a function of years since migration. For instance, years since migration (1-5) stands for the average employment probability gap experienced in one to five years after arrival.[13] Using the same strategy we calculate the employment probability gap five years apart until the end of an immigrant's working life (age = 65). We observe some assimilation but it is very weak with both static and dynamic assimilation models. Almost all immigrant groups are somehow able to reduce the initial employment probability disadvantage in the initial years after arrival, at least partially. For instance, according to the static model, Middle

[13] For instance 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 one to five years after arrival.

East immigrants close the initial employment probability differential by almost 7 percentage points (0.700-0.632) in 1 to 5 years, 19 percentage points (0.700-0.510) in 6 to10 years, 25 percentage points (0.700-0.448) in 11 to15 years after arrival and so on. The same is also true for the dynamic model but reduction in the initial employment probability differential is much less over time.

The last column in Table 2b presents the total years to assimilation, i.e. the years since migration interval in which the employment probability gap is minimised. *P* stands for *partial*, meaning that the gap is not fully closed. The static model suggests that the Eastern European immigrants minimise the employment probability differential in 15-20 years after arrival; but the gap diverges later. The employment probability gap experienced by Eastern European immigrants is reduced to almost 9 percentage points. The same is 25-30 years and 10 years longer for the dynamic model, with 14 percentage points minimum employment probability difference.

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 diverges with greater speed. Both models suggest that there is *no* immigrant group which is able to attain employment probability level of native Swedes. The immigrants from Nordic and Western countries are relatively successful compared to others. They are followed by those from Eastern Europe and Latin America. The other three immigrant groups fare worst and have very large employment probability gaps and longer years to assimilation.

Table 2b about here

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

Figure 1 about here

Note that the only difference between static and dynamic assimilation models is that the dynamic model includes two more explanatory variables: the *lagged dependent variable* and the *first period employment state* as a part of the solution for the initial values problem. However, the difference between dynamic and static assimilation models is striking. The static assimilation model is biased and the bias changes with the degree of employment status persistence. The size of the structural state dependence parameter is an indicator of the degree of difference between the profiles obtained from the dynamic and static models.

The static model overestimates the initial employment probability levels as presented in Table 2a. It is consistent with our expectations that the static assimilation model overstates the short-run marginal assimilation rates and understates the long-run ones. It predicts very fast employment probability growth in the initial years after arrival and very fast human capital depreciation rates in the long-run. We also observe that when the structural state dependence is larger, the penalty of age is lower and the assimilation process is longer, with a stabile employment probability level once it 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 of age plus years since migration as in the econometric model. Figure 2 presents predicted and actual employment probabilities. It suggests that the dynamic assimilation model fits the actual data more closely than the static assimilation model. Apart from Eastern Europeans and Asians, the static model fails to predict early employment probabilities (0-10 years after arrival). The static model also fails to predict the behaviour of the long-run employment probabilities for all regions of origins. Briefly, the static model predicts fast employment probability growth and very fast depreciation of human capital in the long-run, which does not truly portray the actual employment behaviour in practice.

Figure 2 about here

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

In this section we focus on the persistence of employment status and resulting assimilation outcome of immigrants by educational attainment levels to understand whether structural state dependence differs as degree of human capital changes. Models are estimated by splitting the data into three educational categories. They are *primary education* (Grundskola degree, 9 years of education), *secondary education* (high school diploma, more than 9 years but fewer than 12 years of education) and *university degree or more* (education more than high school).[14] We report structural state dependence experienced at different educational attainment levels in Table 3a.

Table 3a about here

The results reveal that educational attainment levels do not induce substantially different employment status persistence for immigrants. However, it largely differs for native Swedes. For instance, the structural state dependence is 0.481, 0.501 and 0.503 for the university, secondary and primary school-educated Nordic immigrants, respectively. The difference between lowest and the highest educational attainment level only induces an almost 2 percentage points increase in the probability of being employed in the current period. The highest difference by educational attainment level is experienced among Eastern European immigrants, after native Swedes, with 13 percentage points (0.607-

[14] One of the most significant weaknesses of the register data is that the country in which the education is acquired is not available. Therefore, the results do not account for the differences in educational quality for those immigrants who were educated partially or fully in their home country.

0.478). University-educated native Swedes experience almost the same structural state dependence with the university-educated immigrants (even lower in some cases, especially Western countries, Eastern Europe and Latin America). It means that persistence of employment status is almost the same for the university-educated immigrants and natives. This result also suggests that the persistence difference between immigrants and native Swedes found above is mainly driven by the primary and secondary school-educated native Swedes due to their highly persistent employment status.

Table 3b reports relative employment probabilities by years since migration, region of origin and models. These quantities compare university-educated immigrants with university-educated but otherwise comparable native Swedes. There is full assimilation for some of the immigrant groups by different educational attainment, mostly with the static assimilation model. University-educated Nordics (in 11-15 years) and Westerners (in 21-25 years), secondary school-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 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 3.

Table 3b about here

Figure 3 about here

6. Summary and conclusions

Immigrant economic integration has been predominantly studied in a static framework. It is found in the case of the Swedish labour market that immigrant employment probabilities show substantial growth just after arrival but quickly diverge and immigrants' employment probabilities never catch-up with those of natives, except for some particular groups of immigrants. We have confirmed these results in this paper using a similar static assimilation model estimated in the literature. However, these results are based on the assumption that immigrants and natives face similar labour market conditions leading exactly to the same pattern of employment status over time conditional on employment or unemployment experience in the past (structural). These models also assume that the employment status persistence is only due to temporarily correlated, time-persistent, unobserved characteristics (spurious).

The focus of this paper is to contribute to the 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 which uses a genuine dynamic panel data model controlling for both structural and spurious state dependence as well as many observed individual socio-economic and demographic characteristics. The results of the dynamic assimilation model are also compared with the results from a static assimilation model conventionally used in the literature. The models are also controlled for the local unemployment rate as a proxy for the changing economy-wide conditions to deal with a

possible bias due to identification restrictions on the period-effects. The initial values problem is solved using the 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. It differs for native Swedes and immigrants, and also across immigrant groups. Native Swedes experience a structural state dependence almost 1.5 times larger than most of the immigrant groups. Failure to control for structural state dependence (i.e. using the static instead of the dynamic model) is found to cause a serious overestimation of the variance for the unobserved individual-effect.

The results also suggest that the static assimilation model is not able to capture the actual behaviour of employment experience and resulting human capital accumulation with years spent in Sweden. The initial employment probability disadvantage of immigrants is 10-15% overestimated by the static model in the literature. The static model also overstates the marginal assimilation rates in the initial years after arrival, but fast and high depreciation later, thus predicting a too early and high “penalty” for the age of immigrants. The dynamic model predicts a slow but continuous growth of the employment probabilities. Total years to assimilation (whether partial or full) are thus 5 to 15 years longer with the dynamic model. The analysis based on educational attainment also suggests that university educated immigrants experience very similar structural state dependence as native Swedes. However, a primary and secondary school education is

associated with very low employment transitions leading to very high state dependence on the employment status for natives compared to immigrants.

Overall, the findings obtained in this study are not particularly encouraging with respect to government policy objectives. The employment assimilation of male immigrants into the Swedish labour market is even weaker than what has been found in the literature. There is a very weak assimilation process in the way immigrants are able to close the initial employment probability gap very little with time spent in Sweden. It is found that immigrants from Western and Nordic countries are relatively successful. Another two immigrant groups which do relatively well are immigrants from Eastern Europe and Latin America; but Africans, Asians and especially those from the Middle East fare worse in the Swedish labour market. With the exception of some immigrant groups (with high levels of education), we do not find any evidence of *full assimilation*. The main message given by the model which is estimated in this paper is that in contrast to the static model, 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 for longer periods, although this level is far from the one experienced by native Swedes.

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Table 1a. 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)
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-labour 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).

Table 1b. Employment status transitions by region of origin

Region of origin	# Individuals	Employed all periods	Employed 0 periods	Single transition *from work*	Single transition *to work*	Multiple transitions
Native Swedes	65842	0.613	0.075	0.065	0.081	0.165
		(0.487)	(0.263)	(0.245)	(0.273)	(0.371)
Nordic Countries	15578	0.443	0.162	0.116	0.063	0.215
		(0.497)	(0.369)	(0.320)	(0.243)	(0.410)
Western Countries	8541	0.338	0.238	0.113	0.110	0.201
		(0.473)	(0.425)	(0.316)	(0.312)	(0.401)
Eastern Europe	13628	0.187	0.258	0.072	0.275	0.212
		(0.390)	(0.434)	(0.259)	(0.446)	(0.408)
Middle East	14564	0.100	0.300	0.095	0.180	0.325
		(0.298)	(0.458)	(0.293)	(0.384)	(0.469)
Asia	3333	0.168	0.207	0.076	0.247	0.302
		(0.373)	(0.405)	(0.264)	(0.431)	(0.458)
Africa	3267	0.110	0.249	0.081	0.218	0.339
		(0.313)	(0.432)	(0.273)	(0.413)	(0.473)
Latin America	4057	0.202	0.148	0.093	0.207	0.349
		(0.401)	(0.355)	(0.290)	(0.405)	(0.476)

Notes: (Standard deviations in parentheses).

Table 2a. 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
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]

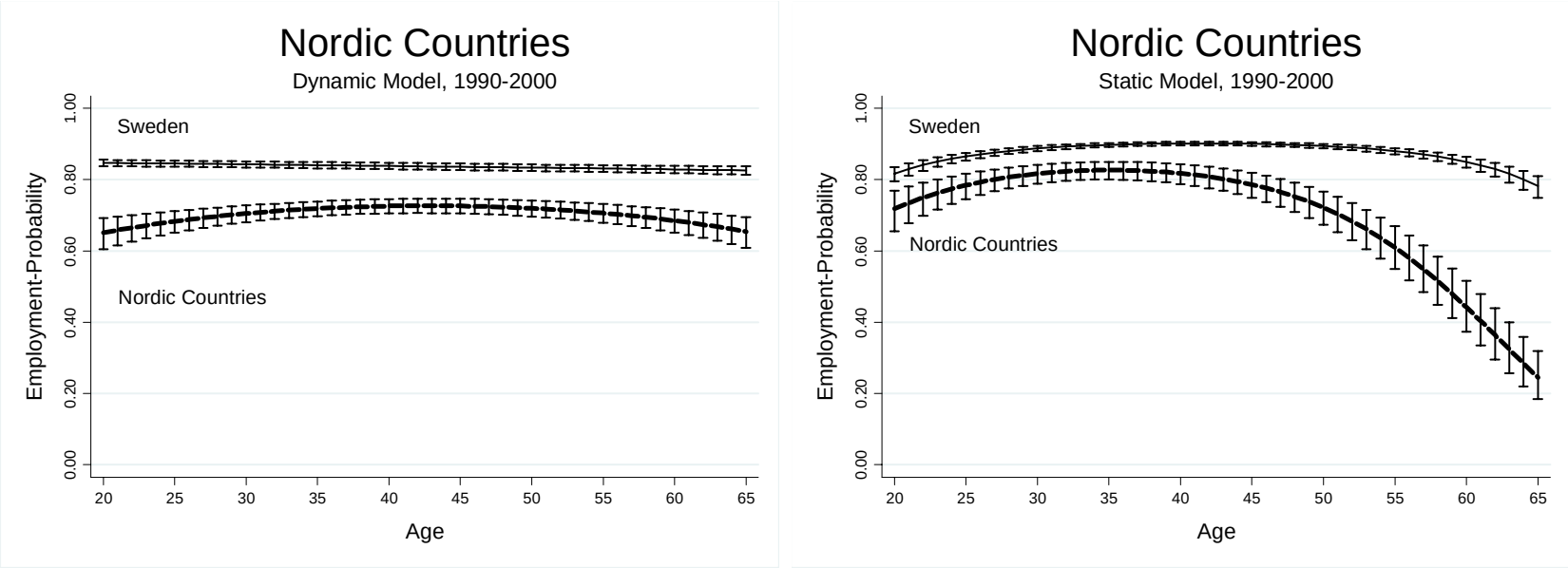
Note: Marginal effects of structural state dependence (λ) and the standard deviation of the random-effects (σ_α). The standard errors of the marginal effects are reported in parentheses. The model also controls for age and age squared; year since migration (and this also squared); marital-status; three indicator variables to control for education (primary = 1 (Grundskola degree, 9 years of education), secondary = 1 (high school diploma, more than 9 years but fewer than 12 years of education), university = 1 (education more than high school); large city dummy; number of children; log local unemployment rates; arrival year national unemployment rates; cohort fixed-effects as pre-1970, 1970-1974, 1975-1979, 1980-1984, 1985-1989, 1990-1994, 1995-2000 and 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 method; mean age, mean number of children, mean capital non-labour income. *, **, *** 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 produced by the static assimilation model.

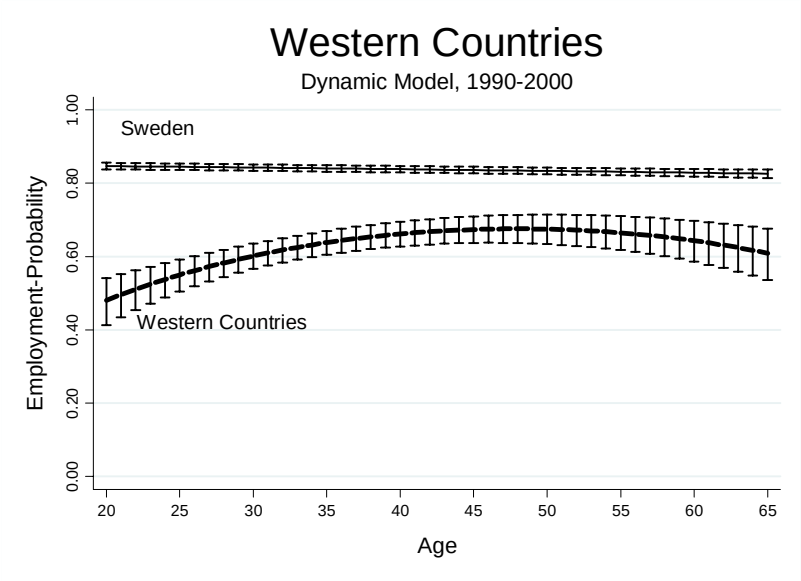
Table 2b. Relative employment probabilities and years to assimilation of male immigrants by region and country of origin, 1990-2000 (percentage points)

	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 employment probability differential between immigrants and natives five years apart in each case. All figures reported in the table are significantly different than zero at a 1% significance level. (P) is *partial* total years to assimilation, i.e. the year interval in which the employment probability differential is minimised.

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

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Dynamic Model, 1990-2000
Sweden
Western Countries
Employment-Probability
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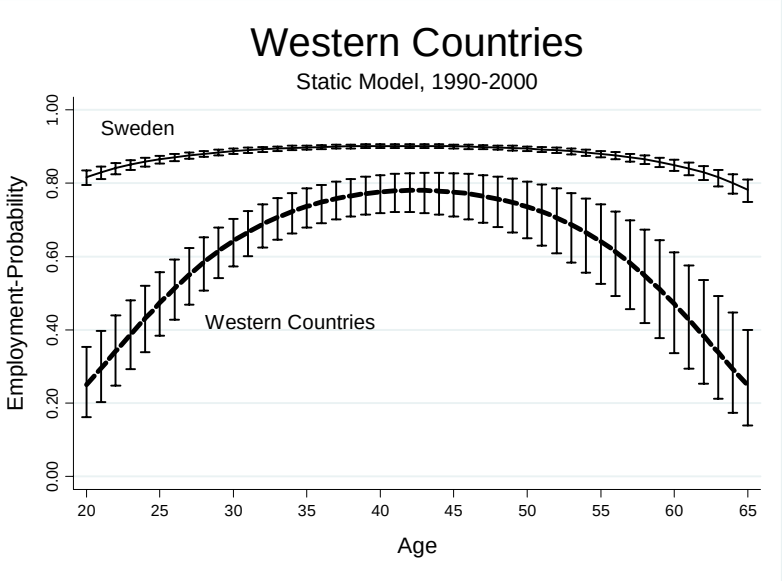
Age


Western Countries
Static Model, 1990-2000
Sweden
Western Countries
Employment-Probability
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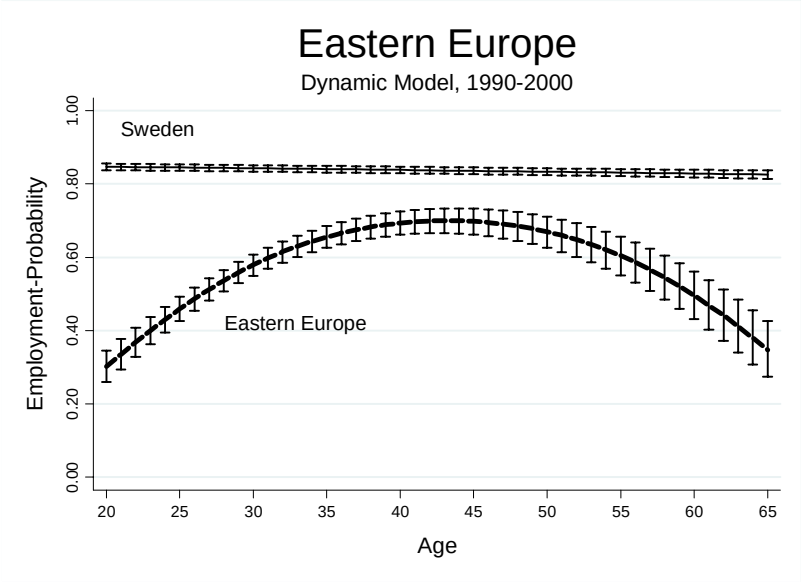
Age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Sweden
Eastern Europe
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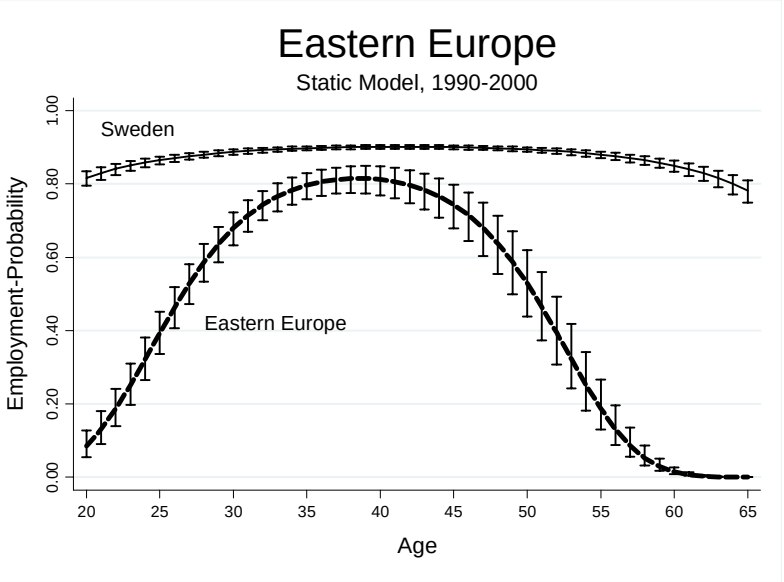
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Sweden
Eastern Europe
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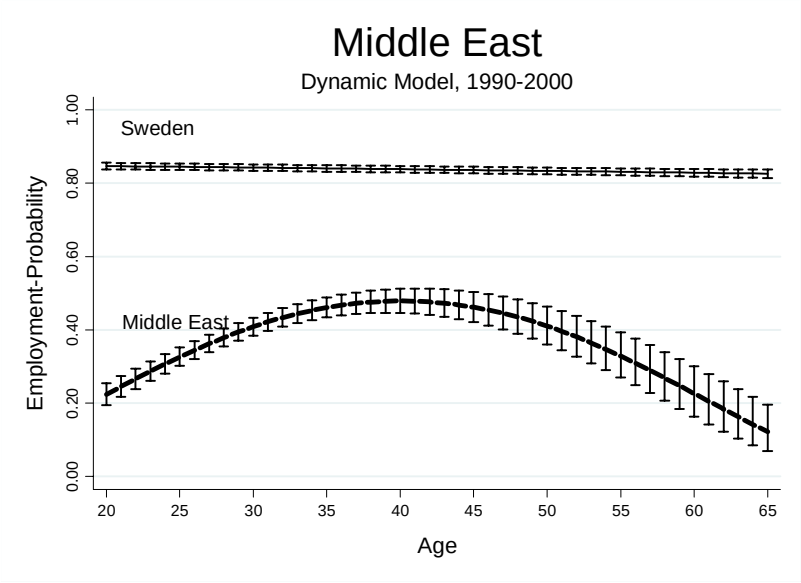
Age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Sweden
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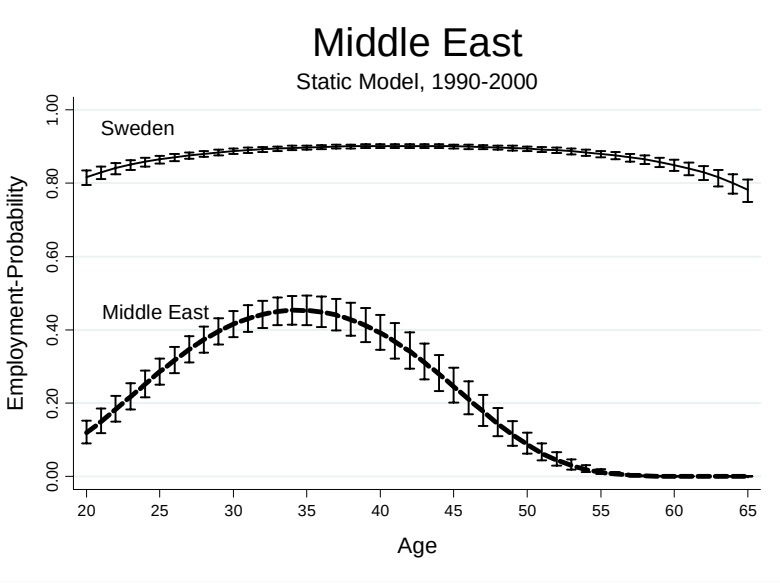
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Sweden
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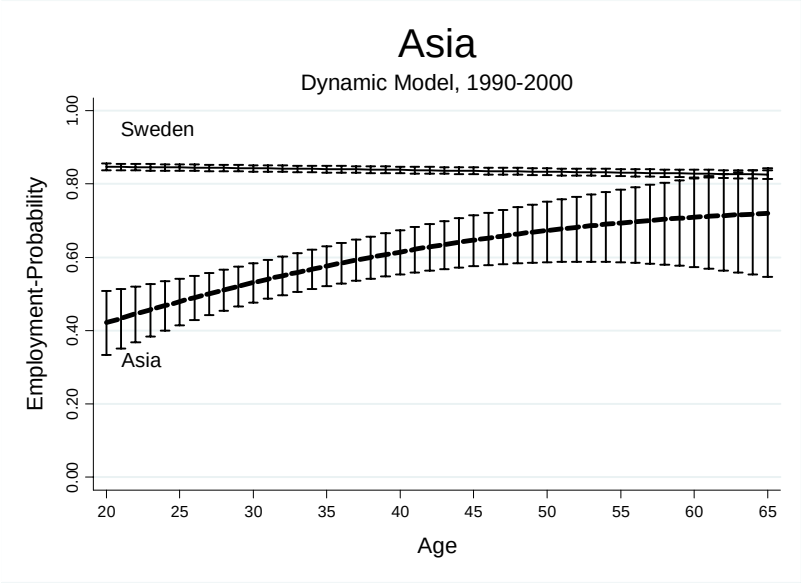
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Sweden
Asia
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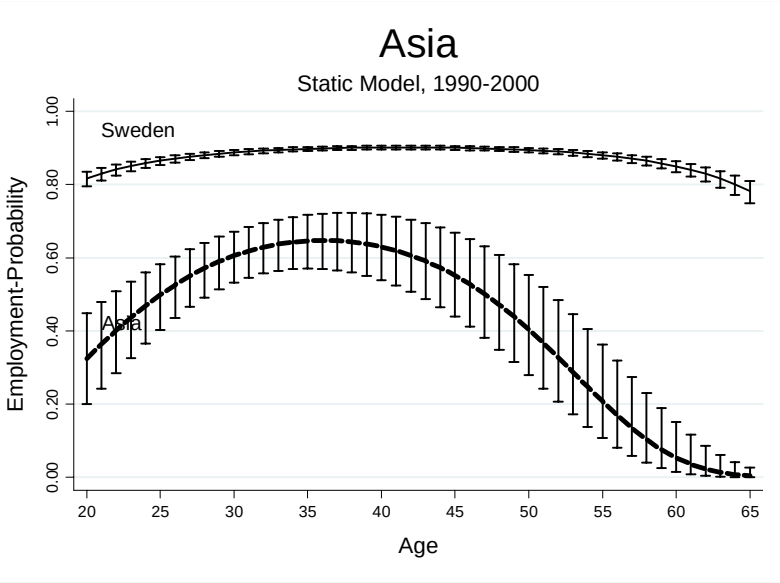
Age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Sweden
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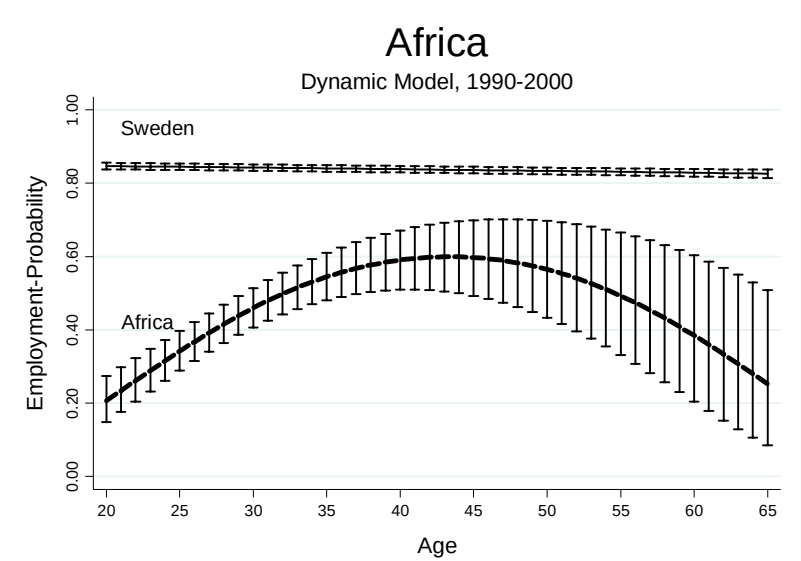
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Sweden
Africa
Employment-Probability
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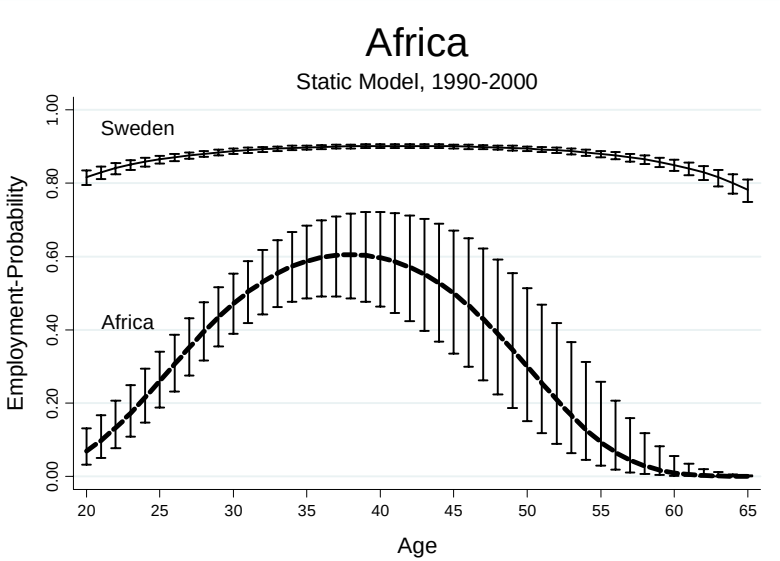
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Static Model, 1990-2000
Sweden
Africa
Employment-Probability
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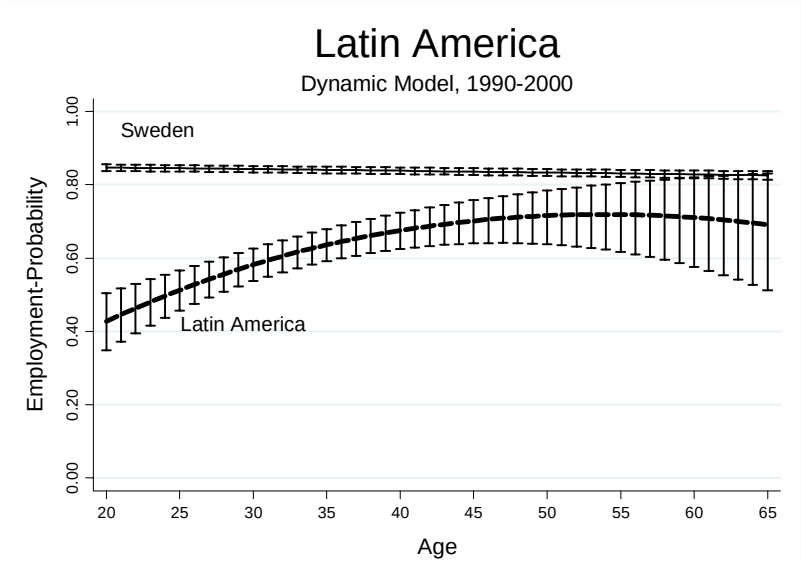
Age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Dynamic Model, 1990-2000
Sweden
Latin America
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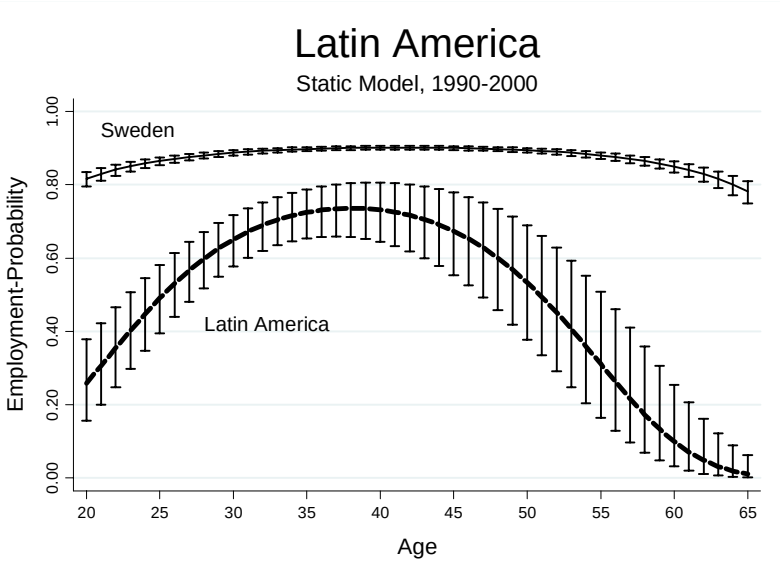
Age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Static Model, 1990-2000
Sweden
Latin America
Employment-Probability
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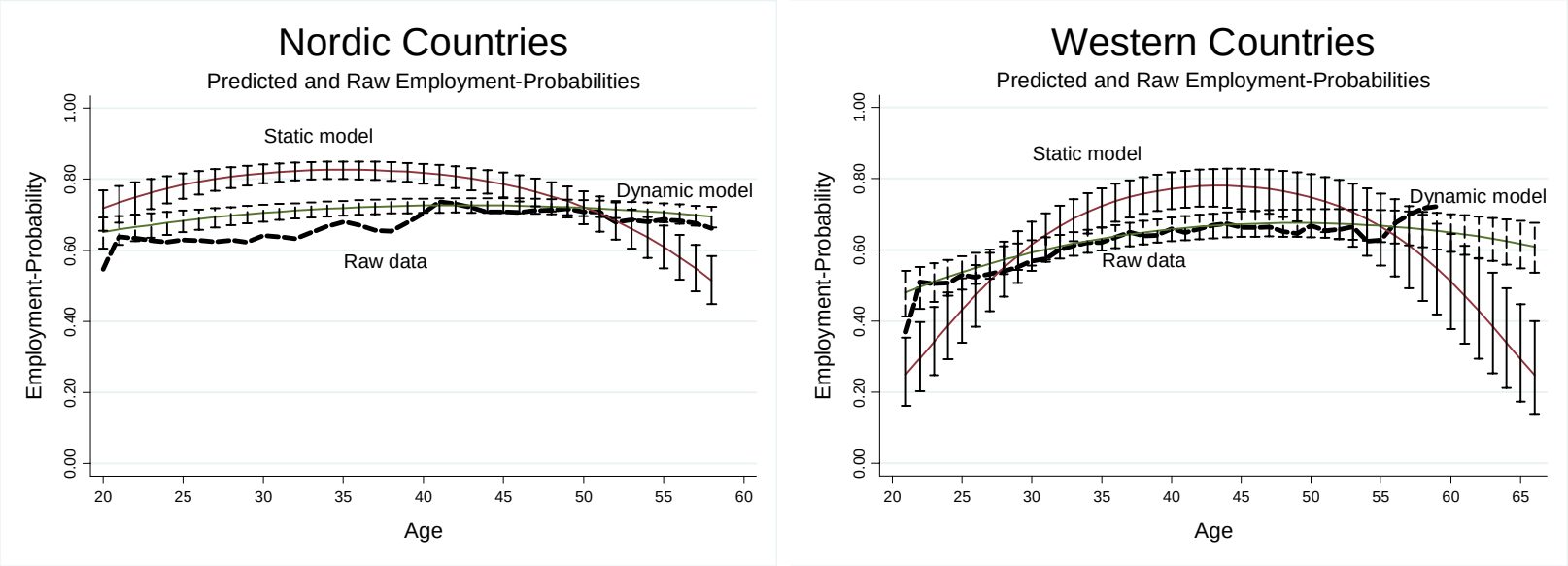
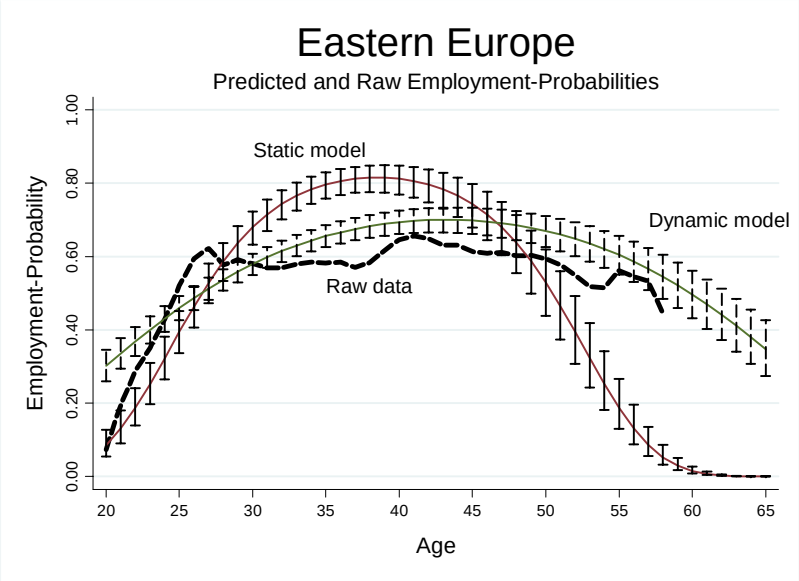
Age

Figure 2. Age-employment-probability profiles by region of origin, models and raw employment probabilities. The raw employment probabilities are presented with bold 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.

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Predicted and Raw Employment-Probabilities
Static model
Dynamic model
Raw data
Employment-Probability
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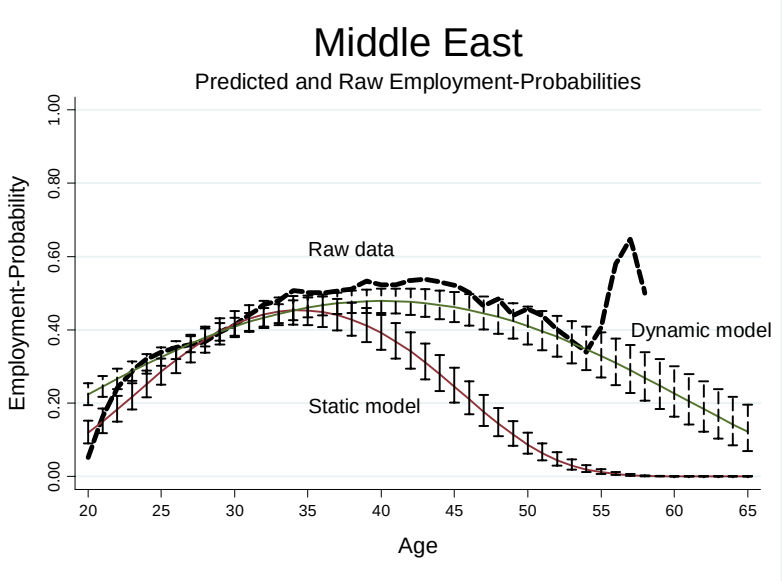
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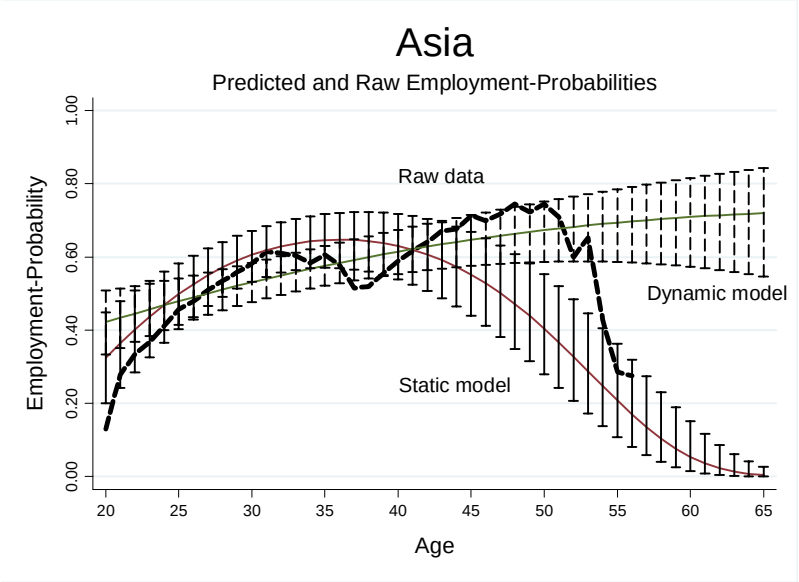
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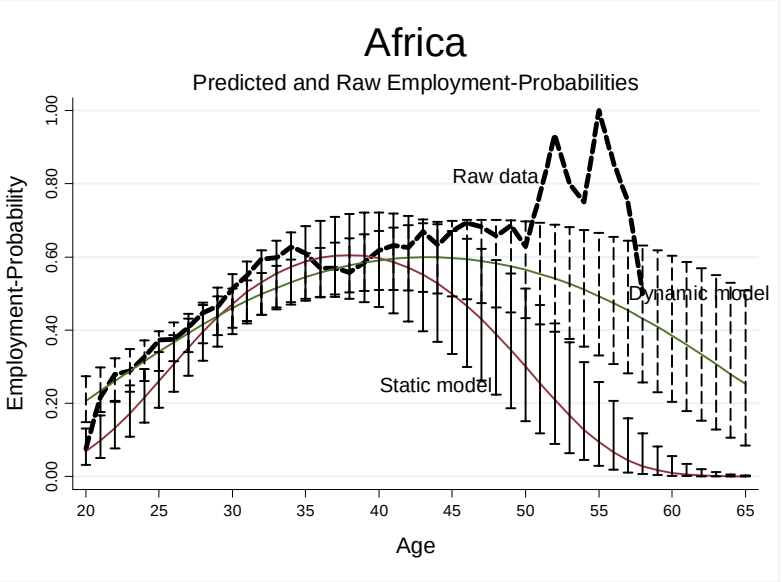
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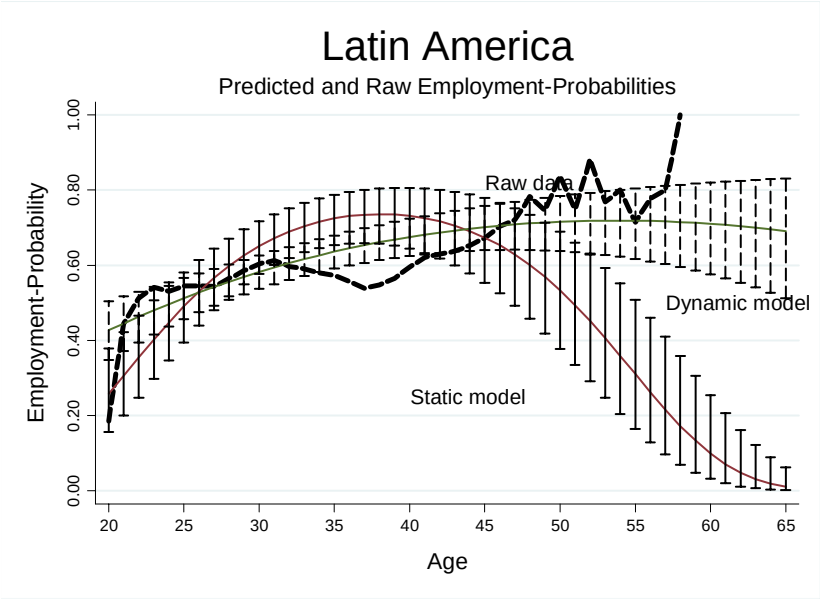
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Employment-Probability
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Raw data
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Static model
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Table 3a. Structural state dependence on the 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
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 2a.

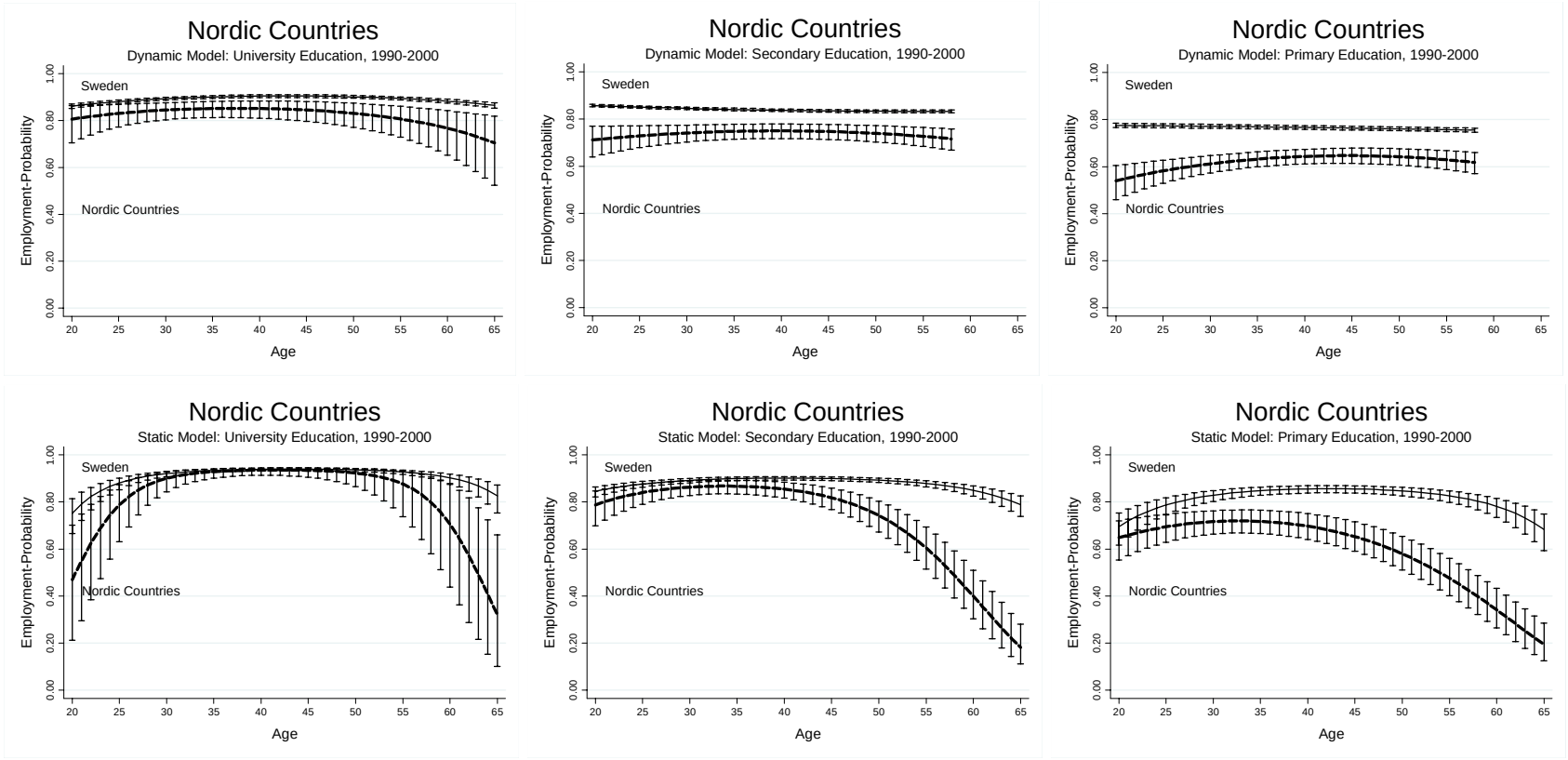
Table 3b. Relative employment probabilities and years to assimilation of immigrants (by education, region of origin and model, percentage points)

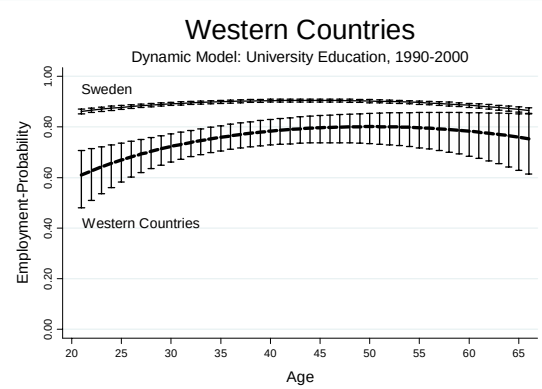
	Upon Arrival	Years since migration						
		1-5	6-10	11-15	16-20	21-25	26-30	*TYA*
Nordic Countries								
dynamic								
University	-0.06	-0.05	-0.04	-0.04	-0.05	-0.06	-0.07	11-15(P)
Secondary	-0.15	-0.13	-0.11	-0.10	-0.09	-0.09	-0.09	16-20(P)
Primary	-0.24	-0.21	-0.17	-0.15	-0.13	-0.12	-0.12	21-25(P)
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)

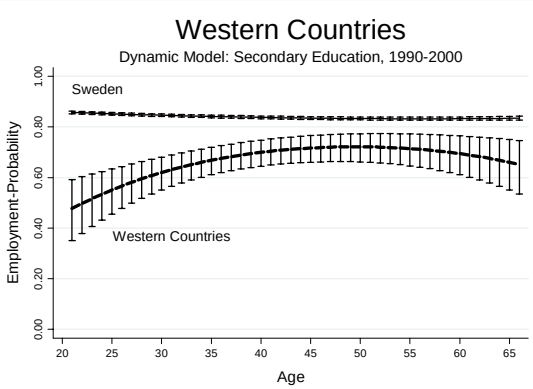
	Primary	-0.56	-0.52	-0.47	-0.43	-0.30	-0.29	-0.28	26-30(P)
static									
	University	-0.72	-0.70	-0.45	-0.26	-0.24	-0.36	-0.66	16-20(P)
	Secondary	-0.76	-0.68	-0.51	-0.41	-0.41	-0.51	-0.68	11-15(P)
	Primary	-0.52	-0.53	-0.53	-0.56	-0.63	-0.71	-0.79	NA
Asia									
dynamic									
	University	-0.50	-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)

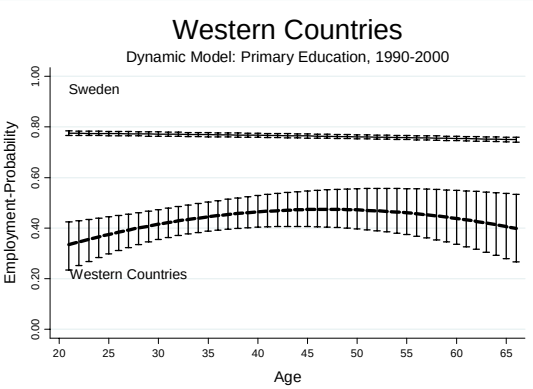
Notes: Bold figures indicate that the employment probabilities of an immigrant group exceed those of native Swedes. All figures reported in the table are significantly different to zero at the 1% significance level. *F* indicates full assimilation, *P* partial assimilation. *NA* is "not applicable".

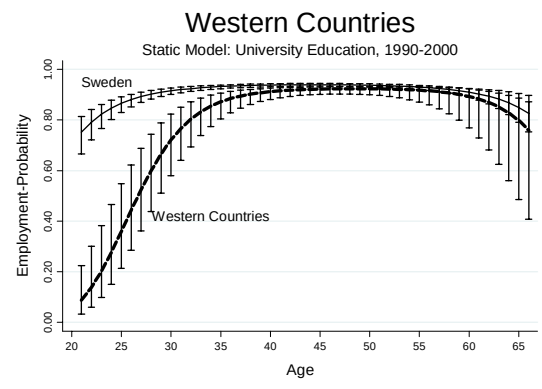
Figure 3. Age-employment-probability profiles by education, region of origin and models. The vertical lines are the 95% confidence intervals obtained by averaging the individual confidence intervals around the point estimates of employment probabilities. See also Figure 1 and 2.

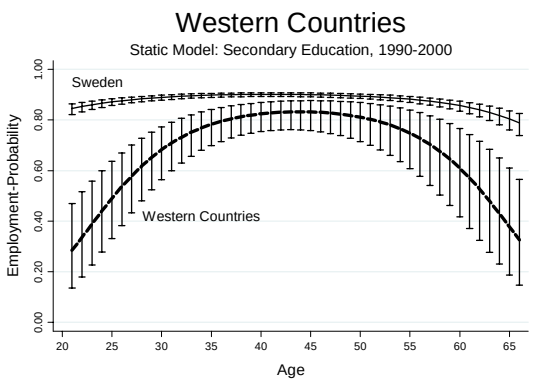


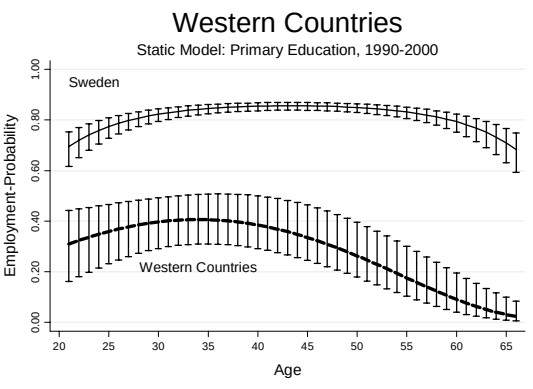

Western Countries
Dynamic Model: University Education, 1990-2000
Sweden
Western Countries
Employment-Probability
Age

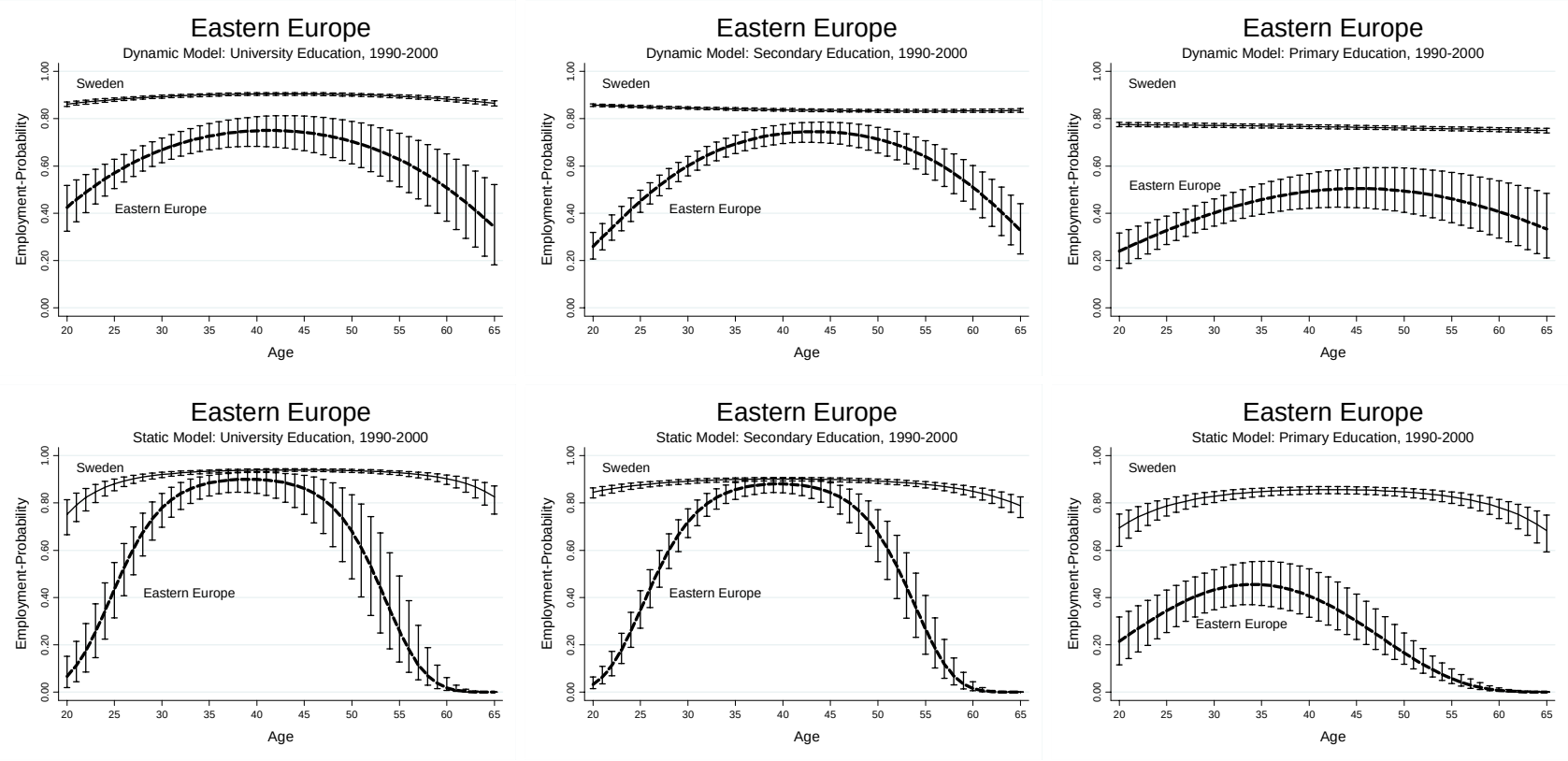

Western Countries
Dynamic Model: Secondary Education, 1990-2000
Sweden
Western Countries
Employment-Probability
Age

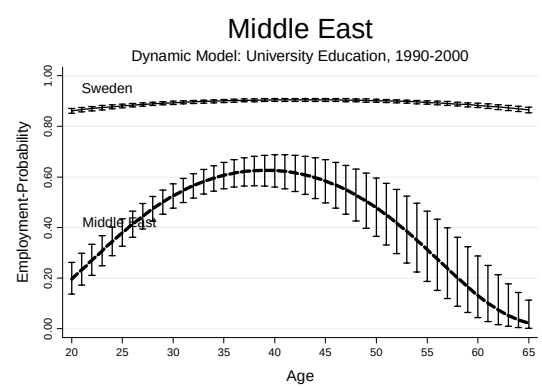

Western Countries
Dynamic Model: Primary Education, 1990-2000
Sweden
Western Countries
Employment-Probability
Age


Western Countries
Static Model: University Education, 1990-2000
Sweden
Western Countries
Employment-Probability
Age


Western Countries
Static Model: Secondary Education, 1990-2000
Sweden
Western Countries
Employment-Probability
Age


Western Countries
Static Model: Primary Education, 1990-2000
Sweden
Western Countries
Employment-Probability
Age


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


Middle East
Dynamic Model: University Education, 1990-2000
Sweden
Middle East
Employment-Probability
0.00
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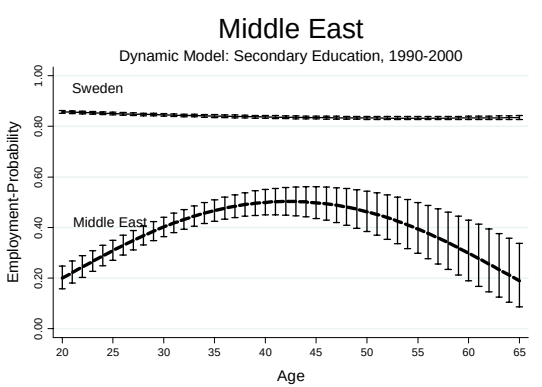
Age


Middle East
Dynamic Model: Secondary Education, 1990-2000
Sweden
Middle East
Employment-Probability
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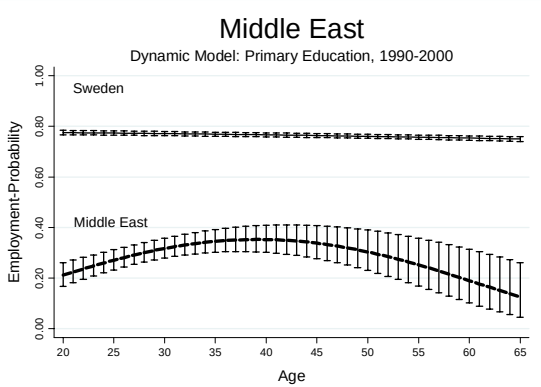
Age


Middle East
Dynamic Model: Primary Education, 1990-2000
Sweden
Middle East
Employment-Probability
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1.00
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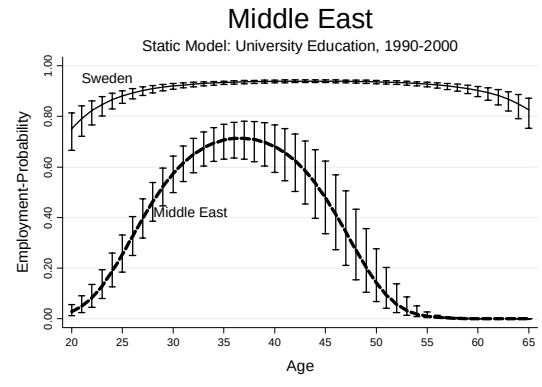
Age


Middle East
Static Model: University Education, 1990-2000
Sweden
Middle East
Employment-Probability
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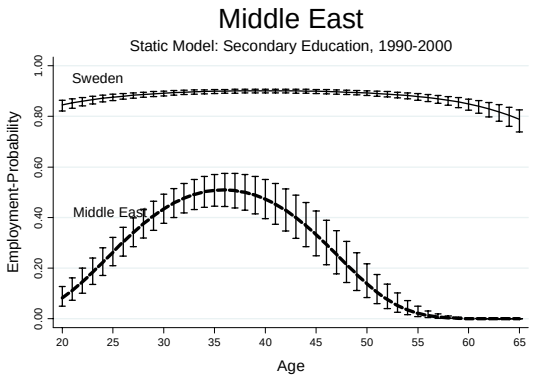
Age


Middle East
Static Model: Secondary Education, 1990-2000
Sweden
Middle East
Employment-Probability
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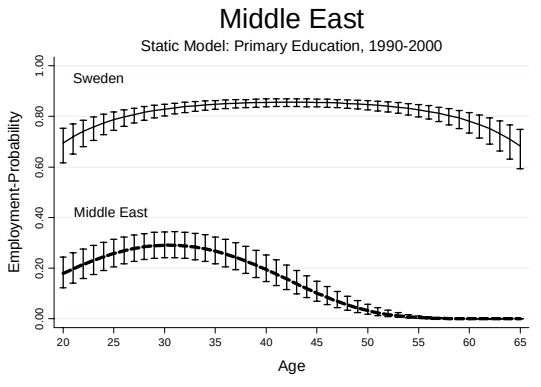
Age


Middle East
Static Model: Primary Education, 1990-2000
Sweden
Middle East
Employment-Probability
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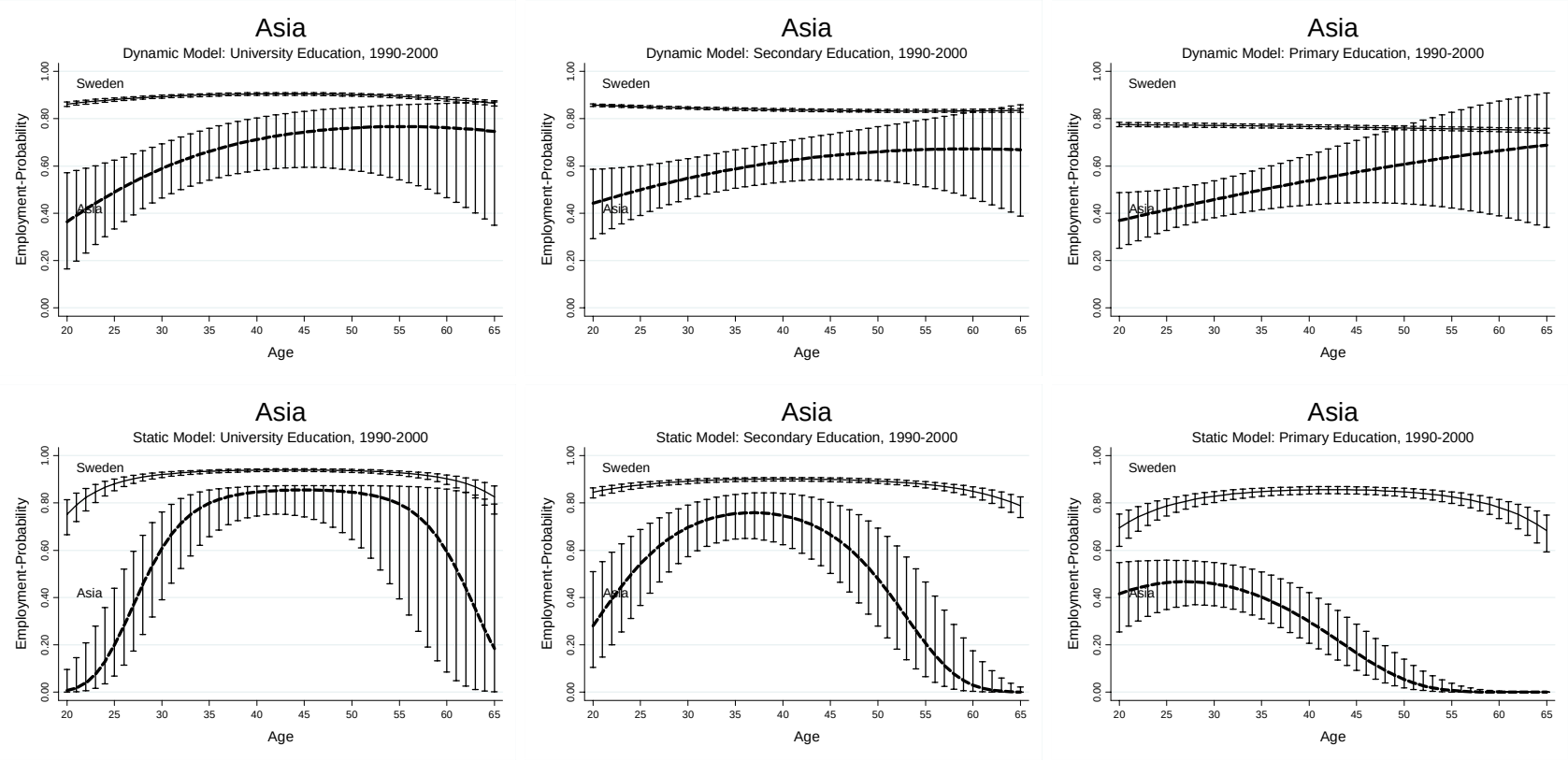
Age


Asia
Dynamic Model: University Education, 1990-2000
Sweden
Asia
Employment-Probability
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0.60
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Age
Asia
Dynamic Model: Secondary Education, 1990-2000
Sweden
Asia
Employment-Probability
Age
Asia
Dynamic Model: Primary Education, 1990-2000
Sweden
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Employment-Probability
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Static Model: University Education, 1990-2000
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Employment-Probability
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Static Model: Secondary Education, 1990-2000
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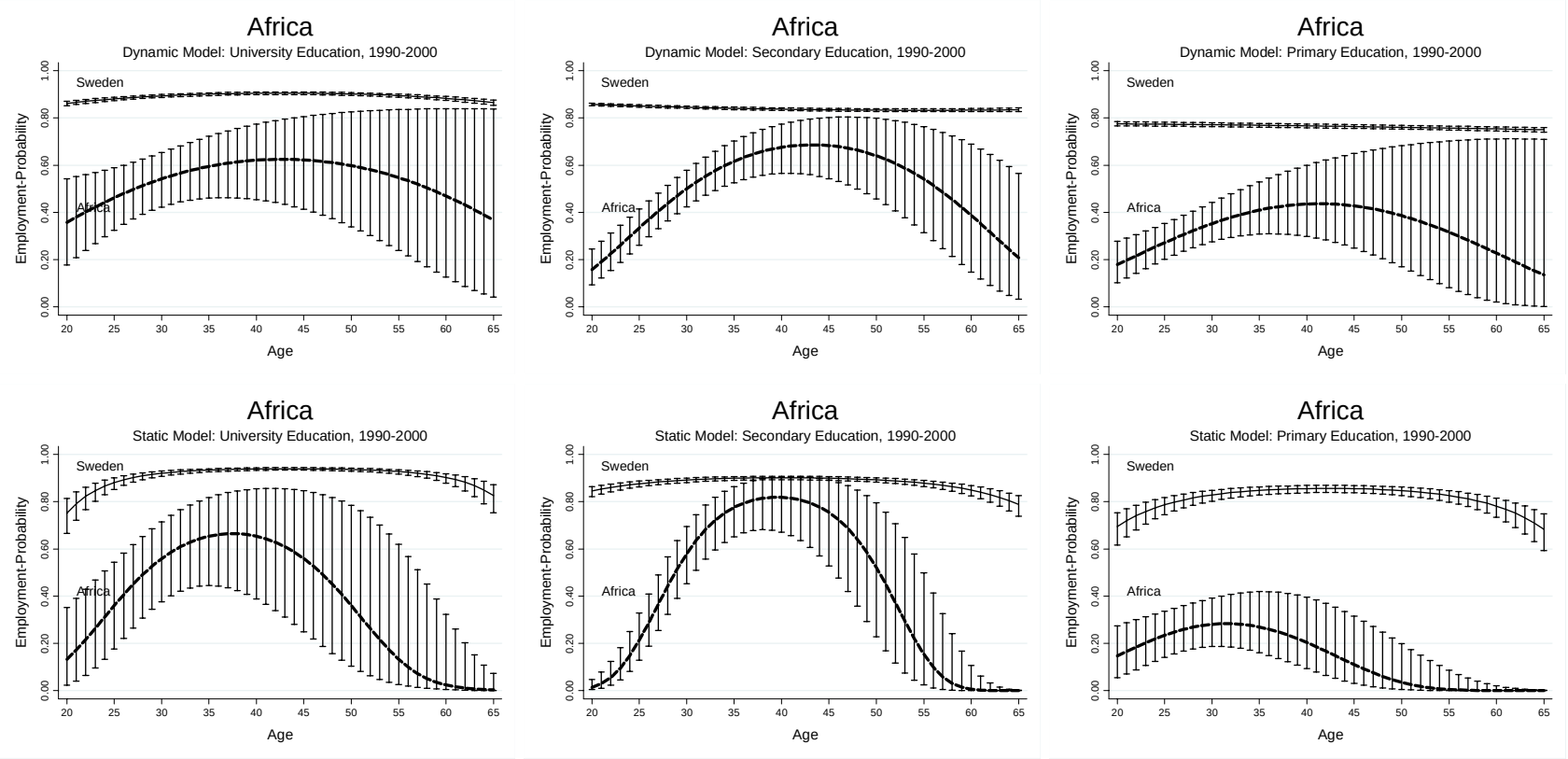
Static Model: Primary Education, 1990-2000
Sweden
Asia
Employment-Probability
Age


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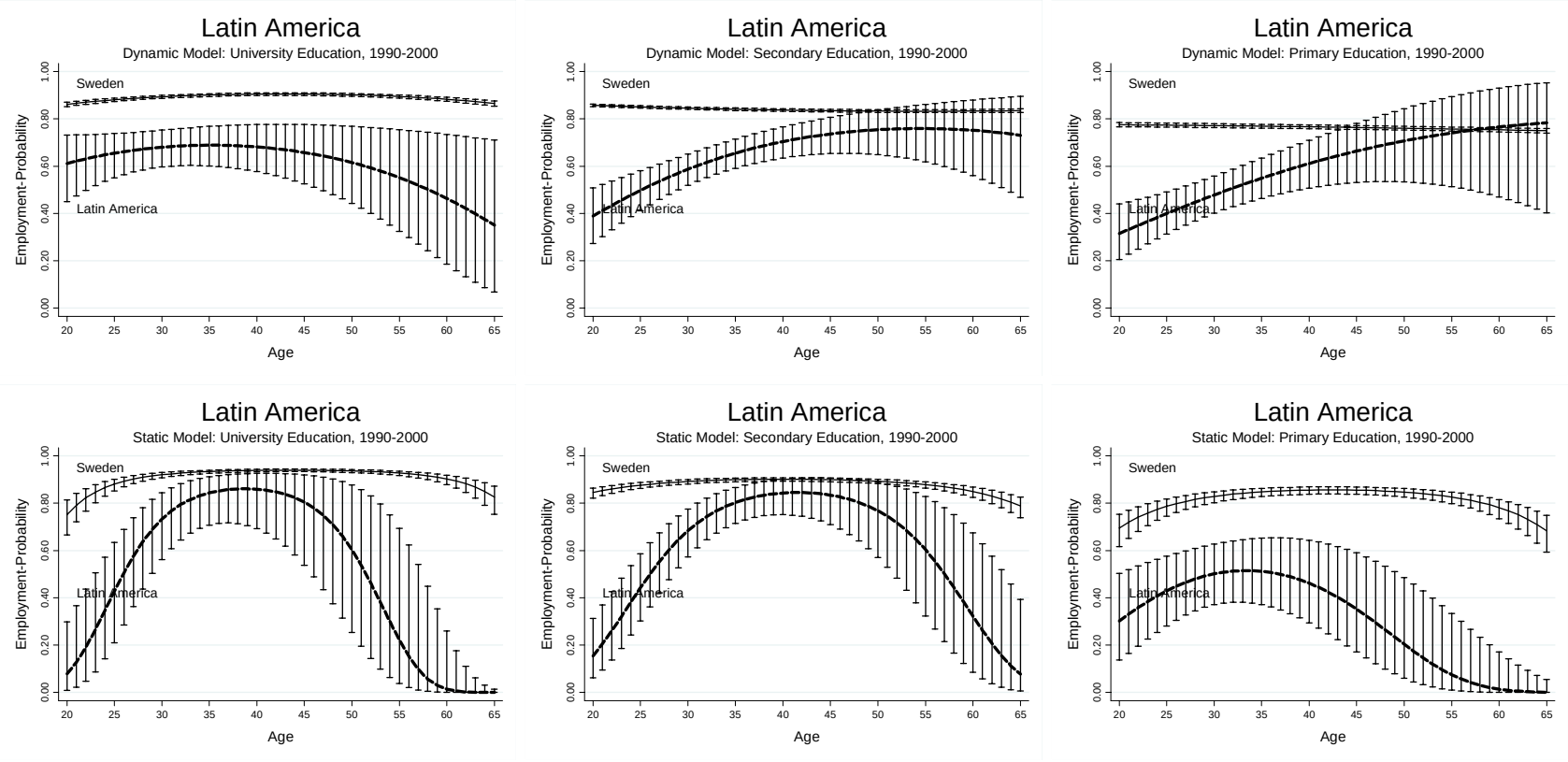
Employment-Probability
Age


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