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The Dynamics of Return Migration, Human Capital Accumulation, and Wage Assimilation

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This article develops and estimates a dynamic model where individuals differ in ability and location preference to evaluate the mechanisms that affect the evolution of immigrants' careers in conjunction with their re-migration plans. Our analysis highlights a novel form of selective return migration where those who plan to stay longer invest more into skill acquisition, with important implications for the assessment of immigrants' career paths and the estimation of their earnings profiles. Our study also explains the willingness of immigrants to accept jobs at wages that seem unacceptable to natives. Finally, our model provides important insight for the design of migration policies, showing that policies that initially restrict residence or condition residence on achievement shape not only immigrants' career profiles through their impact on human capital investment but also determine the selection of arrivals and leavers.

Key words: International migration, Human capital, Expectations.

JEL Codes: F22, J24, J61

1. INTRODUCTION

Over the past two decades, the dramatic increase in the movement of people has pushed immigration and its contribution to the economic well-being of destination countries to the forefront of political debate. A fundamental policy challenge for receiving countries is to ensure immigration's economic contribution, through policies that select those allowed to settle and work in one's country, and encourage arriving immigrants to maximize their economic output. To design such policies requires a full understanding of how immigrants' decisions are made and

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are affected by policy interventions. One important reason why this is far from straightforward is that immigrants have the option of returning home, which means that their decisions regarding labour supply, skill investment, and consumption are taken in conjunction with decisions about the migration's length and are conditioned on consumption possibilities and amenities in the home country.[1] To model this added complexity requires a framework that accounts for not just the dynamic nature of immigrants' choices, but also for location preferences that affect both return migration and the initial migration decision itself.

To understand how choices of immigrants and their career profiles interact with re-migration decisions and respond to policy intervention, this article develops and estimates a dynamic lifecycle model where individuals decide whether to migrate, and where those who migrate simultaneously choose investment in human capital, labour force participation, and savings, anticipating their optimal migration duration. We estimate this model based on various data sources on Turkish immigration to Germany, using longitudinal survey- and micro-census data over several decades. A first key feature of our model is that human capital is composed of two separate stocks: accumulated work experience and host country-specific human capital. The latter describes skills such as language proficiency, knowledge about and acquired familiarity with the host country labour market and society, and social contacts. This form of human capital not only affects productivity but also determines immigrants' social assimilation and complements consumption. While being valuable in the host country, it is of reduced value back home. We identify the accumulation of host country-specific human capital from a number of observed outcomes, such as language proficiency and immigrants' attachment to the host country.

A second important aspect of our model is that it recognizes that immigrants differ not only in their productivity but also in their preferences for where to live. To see why this is important, consider immigrants Mehmet and Berk, who are identical except for their location preferences. Mehmet more strongly prefers to live in his origin country, and so would like to remain in the host country for 5 years only, while Berk intends to stay there permanently. The shorter pay-off period reduces Mehmet's incentive to invest in host country-specific human capital (such as language proficiency), resulting in lower wage growth. Thus, the different location preferences will lead to different career profiles, and to correlation between earnings growth and the length of a migration.

Suppose now that after 2 years abroad, Berk experiences a persistent shock to his location preference, induced e.g. through an unobserved family event which renders the host country relatively less attractive, leading to a revision of his plans from remaining permanently in the host country to returning home after another 3 years abroad. This change in intended duration will alter incentives to invest in human capital specific to the host country, and thus affect wage growth. While in this example both Mehmet and Berk will return home after 5 years, their career profiles differ, as Berk's initial human capital investment was based on the plan to stay permanently before he was exposed to a persistent shock to his location preference.

This example shows that assuming shocks to location preferences as *iid* is not sufficient to capture the above dynamics, neither is information about the migration's *final* duration, as this does not allow distinguishing between Mehmet's and Berk's career profiles. One novelty of our article is to model shocks as a stochastic but persistent process, identified from information about return plans of immigrants at repeated points over the migration cycle, which reflect underlying changes in persistent location preferences. We obtain such information from a panel survey over three

1. In a comprehensive cross-country review, the OECD (2008) estimates that 20–50% of immigrants leave the host country within 5 years of arrival. Bandiera, Rasul and Viarengo (2013) document that between 60% and 75% of immigrants to the US during the Age of Mass Migration eventually emigrated again. Return migration is also salient in the population we study in this article, with close to half of migrants returning within 15 years after arrival.

decades that includes a unique measure of immigrants' planned migration durations.[2] We use this information to identify persistent shocks to individuals' locational preferences. Thus, our model allows us to re-evaluate the different mechanisms that affect the evolution of immigrants' careers in conjunction with their re-migration plans, and to assess the consequences of this interplay for the estimation of immigrants' earnings profiles, the selectivity of outmigration, and the design of migration policies.

Our analysis makes several fundamental contributions to our understanding of immigrants' behaviour. First, it provides a new perspective on the interpretation of selective outmigration, where those who plan to stay longer invest more into skills, and have thus steeper career paths.[3] This "behavioural selection" affects the composition of the migrant population alongside selection based on unobserved productivity ("ability selection"), as analysed in earlier work (see e.g. Borjas and Bratsberg, 1996; Hu, 2000; Lubotsky, 2007; Dostie, Li, Card and Parent, 2020), and may either re-enforce or counteract such selection on ability.[4] Whereas behavioural selection creates a positive correlation between earnings growth and migration duration, we find that ability selection is non-monotonic over the migration cycle. These findings have important implications for selection biases in the estimation of immigrants' earnings profiles that are used to evaluate economic assimilation and the contribution of immigrants to the host country.[5] It highlights a form of selection previously overlooked, where negative selection may result not from low-productivity immigrants leaving the country but from those who wish to stay longer investing more in human capital.

Second, our model explains the willingness of immigrants to accept jobs at wages that seem unacceptable to natives, such as low-paid employment in the agricultural sector and in parts of the service industry. We show that the preparedness of immigrants to accept such jobs is directly related to migrations being temporary, as consuming part of their earnings in countries with different price levels leads immigrants to be paid different "effective" real wages than natives. Furthermore, variation in expected migration durations leads to heterogeneity in reservation wages among otherwise identical individuals. Our analysis therefore provides reasons why immigrants have lower reservation wages than natives, a key assumption in the analysis of Amior (2017) on how immigration affects native employment and welfare.[6]

Third, our model provides important insights for the design of migration policies. Policies that initially restrict residence or condition residence on achievement shape not only immigrants' career profiles through their impact on human capital investment but also determine the selection of arrivals and leavers.[7] Changes in the composition of new arrivals may in turn have important

2. See van der Klaauw and Wolpin (2008) and van der Klaauw (2012) for a discussion of the value of such information for identification, and Arcidiacono, Joseph Hotz, Maurel and Romano (2020) for a more recent application.

3. In contrast with a Ben-Porath (1967) type model, or analyses that investigate the effect of life expectancy on human capital investment (as in Jayachandran and Lleras-Muney, 2009), the horizon over which investments payoff is in our case endogenous, and migrants adjust their return decision in response to economic shocks in the host country. This complicates the analysis and requires that return migration and human capital investment is modelled jointly.

4. See also the interdependence between location choice and wage progression in Llull and Miller's (2018) analyses of internal migration in Spain.

5. Starting with Chiswick (1978), a large and growing literature studies earnings profiles of immigrants (see e.g. Borjas, 1985; Longva and Raaum, 2003; Barth, Bratsberg, and Raaum, 2004; Bratsberg, Barth and Raaum, 2006; Green and Worswick, 2012). See Dustmann and Görlach (2015) for a review and assessment.

6. See also related work by Dustmann, Ku and Surovtseva (2020) who use variation in real exchange rates to test whether immigrants' reservation wages respond to price differentials, and Albert and Monras (2018), who argue that spatial sorting of immigrants is related to reservation wage considerations.

7. Many immigration policies directly affect an immigrant's investment horizon. For instance, H1-B visas in the US are valid for 3 years, extendable to 6 years. Similarly, guest–worker programmes and student visas in many countries restrict migration duration or tie residence permits to specific conditions like enrolment or job contracts.

consequences for labour market prospects of native workers, as pointed out by Llull (2017, 2018). Based on our estimated model parameters, we simulate and compare the impact of different migration policies on immigrant behaviour, selection and welfare consequences under three different schemes, relative to a baseline in which migrants can freely choose whether and when to return. Under each scheme, a decision for permanent settlement is made after 5 years. Scheme I conditions permanent settlement on employment and the attainment of an earnings threshold, similar to e.g. the Tier 2 visa scheme in the UK. Scheme II ties permanent residence to the integration level of immigrants, measured e.g. by language proficiency, akin to requirements in several European countries. Scheme III imposes no conditions, but introduces uncertainty about the possibility to stay, not dissimilar to the situation in which many refugee migrants find themselves. These counterfactual exercises illustrate that policies intended to regulate immigrant inflows by imposing conditions on the migration's permanency can have large effects on the selection of immigrant inflows, the number of new arrivals, the composition of outmigration, and overall migration durations, which in turn influence immigrants' human capital investment, and hence their contribution to the receiving country. The consequences of the different policies we uncover are unlikely foreseen by policy makers but may be more consequential for the welfare effects of immigration than the primary intended effects.

Our analysis also contributes to the small but growing literature on structural models that allow for temporary migrations. While Colussi (2003), Thom (2010), Lessem (2018), and Kovak and Lessem (2020) focus on the effect of border enforcement on Mexico-US migration, Bellemare (2007) and Rendon and Cuecuecha (2010) investigate job search and outmigration behaviour of immigrants in Germany and the US, and Kirdar (2012) and Nakajima (2015) evaluate the social insurance and fiscal contributions of temporary migrants.[8] The above three aspects that we consider—behavioural selection, the notion of effective wages for temporary migrants, and the implications for human capital investment of immigration policies that limit the duration of stay—are all new to this literature. Moreover, a fundamental novelty is that we allow for persistent changes in optimal expected migration durations over the migration cycle, which in turn affect decisions such as human capital investment and savings, so that short-run shocks can have long-term consequences. This also distinguishes our article both from earlier work that has linked assimilation and human capital investment to expected migration duration (Dustmann, 1993, 1999; Bratsberg, Ragan and Nasir, 2002; Cortes, 2004; Gathmann and Keller, 2018), and from equilibrium models that have been used to investigate the aggregate and distributional welfare consequences of migration policies (e.g. Caliendo, Opromolla, Parro, and Sforza, 2017; Burstein, Hanson, Tian, and Vogel, 2020).

2. BACKGROUND, DATA, SAMPLE, AND DESCRIPTIVES

Our empirical analysis focuses on immigration of Turks to Germany, who constitute the main immigrant population at 14% of all immigrants in 2011 (OECD 2013). This migration movement had its origins in the strong upward trajectory of the West-German economy after 1955, which led to an increase in the share of foreign-born workers from 0.6% in 1957 to 11.2% in 1973. Bilateral agreements between Turkey and Germany in 1961 and 1964 guaranteed equal treatment of Turkish and German workers in terms of social insurance and ensured that retirement benefits could be claimed even after workers returned to Turkey (Holzmann, Koettl and Chernetsky 2005). Importantly, an earlier 2-year restriction on work permits was repealed, thus making migration

8. See Dustmann and Görlach (2016) for a more detailed overview of this literature. Structural models have also been used to analyse *internal* location choices (see e.g. Kennan and Walker, 2011; Buchinsky, Gotlibovski and Lifshitz, 2014; Bryan and Morten, 2019; Morten, 2019; Oswald, 2019; Piyapromdee, 2021).

duration a matter of individual choice (see Hunn 2005, for a detailed historical account). While the recruitment of Turkish workers under the guest–worker agreement ended in 1973, immigration for family reunification and refugee migration after the military coup in 1980 caused a continued increase in the Turkish immigrant population even after this date. Both refugee and family migrants were granted permanent residence, so that migration durations have been chosen by migrants themselves (Martin and Miller 1980; Martin 2002).

Hence, the immigrant population, we study here comes from a source country with a different cultural background and language to the host country. In addition, the economies of the two countries were very different, with Turkey being a mainly agricultural economy during the period we analyse, and Germany highly industrialized. Moreover, there were no legal restrictions on migration durations, and migrants had equal rights to natives in the labour market as well as transferable retirement claims. These aspects, in combination with unique features of the data available to us and which we describe next, and the long horizon over which we can observe individuals, make it an ideal immigrant population to study dynamic aspects of migrants' labour market and migration choices.

2.1. *Data and sample*

We restrict our study to males without tertiary education who were born in Turkey, were aged 16 or older at immigration, and who arrived in West Germany after 1961.[9] Our analysis is based on several data sources, most notably the German micro-census (GMC)[10] and the German Socio-economic Panel (SOEP).[11] The GMC is a 1% repeated cross-section sample of households that provides individual-level information on employment status and earnings. We use a total of 22 waves covering the period 1976–2007,[12] including a total of 48,908 Turkish immigrants in Germany that fit our sample selection criteria. The SOEP, a household-based panel survey initiated in 1984, oversampled the then resident immigrant population. It interviewed in its first wave about 1,500 households with a foreign-born household head, who were subsequently re-interviewed each year. Refresher samples were added in 1995, 1998, 2000, and 2006. The questionnaires used for these interviews are available in the home country language.

The SOEP data are unique not only in that they provide repeated information on a large sample of immigrants over a long period but also that each year they record the updated return plans of immigrants. Such information is rarely available, particularly in longitudinal format. Specifically, individuals were asked whether they wished to remain in Germany permanently, and if not, for how many more years they intended to stay. In addition to the planned length of stay, the survey records a large array of information on personal and household characteristics, including employment histories in both the country of origin and in Germany, income, and in some waves, household assets and annual savings and remittances. The survey also contains measures of spoken and written proficiency in the German language and measures of integration.

For our analysis, we combine an unbalanced panel of 4,481 unique observations during the years 1984–2011 with the 48,908 individuals from the GMC described above. To identify wages for returning migrants after they have left Germany, we rely on a unique survey by the German Institute for Employment Research (IAB) among Turkish migrants who returned to their home country in 1984 (see Hönekopp, 1987; Dustmann and Kirchkamp, 2002, for details). We

9. Of those individuals in our data who satisfy the other criteria, only 5.4% have a tertiary education.
10. doi: 10.21242/12211.1976.00.00.1.1.0 to 10.21242/12211.2007.00.00.1.1.0
11. doi: 10.5684/soep.v28. See Goebel, Grabka, Liebig, Kroh, Richter, Schröder and Schupp (2019).
12. Waves of the GMC prior to 1976 do not report the year of immigration. For immigrants arriving prior to 1976, we use our model to address selection resulting from early returns.

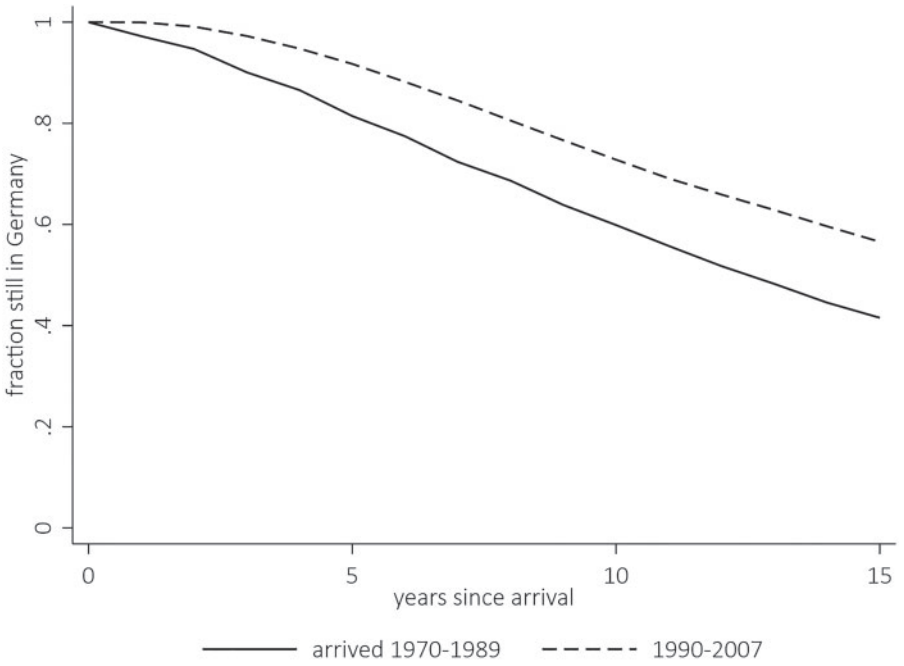

FIGURE 1
Outmigration

Source: German micro-census 1976–2007
Notes: The graph shows the fraction of initial arrival cohorts still residing in Germany by years since arrival. Synthetic cohorts have been constructed exploiting the representativeness of the micro-census samples and information on the year of arrival. The sample is restricted to non-tertiary educated male immigrants from Turkey who arrives to Germany after 1961 at the age of at least 16 years.

estimate the evolution of earnings in Turkey relative to German earnings levels by combining these data with time series information on nominal compensation per employee provided by the European Commission (2015) and gross national income from the World Development Indicators (World Bank, 2014).[13] All monetary variables are deflated to 2005 euros using consumer price indices and exchange rates from the Bundesbank (2013) and the OECD (2013).[14] We obtain unemployment rates and unemployment durations in Turkey from Tansel and Taşçi (2010).

2.2. *Descriptive evidence*

2.2.1. Return migration. We display in Figure 1 the outmigration rate of immigrants as a function of years since their arrival, distinguishing between two broad arrival cohorts (1970–1989 and 1990–2007).[15] The graph shows that within the first 5 years after arrival, between 10% and 20% of each arrival cohort leaves the country, with higher out-migration rates for the earlier

13. The European Commission's (2015) AMECO database provides average nominal compensation per employee back to 1960 for West Germany and to 1988 for Turkey. To extrapolate to earlier earnings levels in Turkey, we use gross national income from the World Bank's (2014) World Development Indicators.

14. See the Supplementary Appendix B.1 for details.

15. We use the representativeness of each cross-section of the GMC together with information on the year in which immigrants arrived in Germany to construct synthetic immigrant cohorts from which we can compute the rate of return migration, following Dustmann and Weiss (2007). Similar patterns have recently also been documented across different admission categories by Bratsberg, Raaum and Røed (2017).

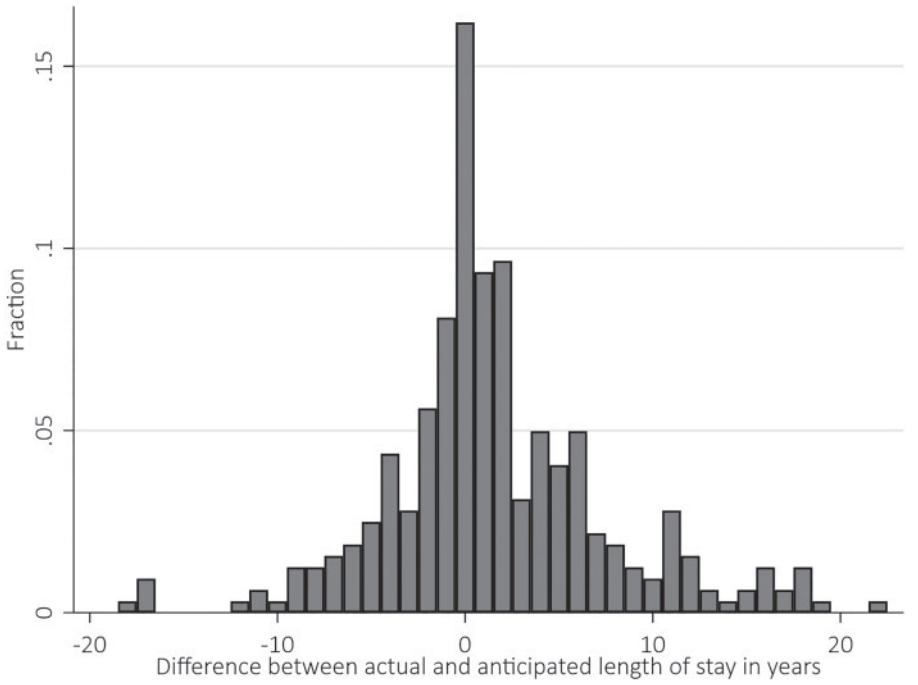

FIGURE 2

Perceived and actual migration durations

Source: SOEP 198–2011

Notes: The figure shows the distribution of deviations of actual from anticipated migration durations for immigrants planning to return and who are observed to actually return during the panel period. The sample is further restricted to non-tertiary educated male immigrants from Turkey who arrives to Germany after 1961 at the age of at least 16 years.

cohorts. After 15 years, between 40% and 50% of each cohort has left. Thus, return migration in the context we study is substantial, in line with the findings of other studies (see e.g. OECD, 2008).

To assess how actual return migration relates to migrants' return intentions, we examine information from the SOEP, which in addition to the planned length of stay records realized returns, based on follow up interviews with family or friends of respondents. Figure 2, which shows the distribution of the deviation of intended and actual return age for those individuals that left the country during the period of observation, suggests a strong link between reported intentions and actual migration durations (about 50% return within 2 years around their anticipated time of return). However, while the mode of this distribution is centred at zero and the distribution is roughly symmetric, there is also substantial dispersion around the mode, due to many migrants over- or under-estimating the length of their stay. Such differences between intentions and final realizations should induce corrections in incentives to invest in host country-specific human capital and in savings over the migration cycle, a dynamic that ought to be captured by our model.

2.2.2. Immigrant characteristics. The differences between those with permanent and temporary intentions are underscored in Table 1. Those who intend to remain permanently arrive at a younger age than those who intend to return, suggesting a stronger attachment to the country of origin when the migration takes place later. Employment probabilities and transition rates into work are also higher for those who consider themselves as temporary, in line with intertemporal

TABLE 1
Summary statistics—Socioeconomic panel

Variable	Stay	Return	Total
	(38.95%)	(61.05%)	(100%)
Age	44.33	45.26	44.90
	(0.297)	(0.210)	(0.173)
Years since immigration	20.33	18.46	19.17
	(0.244)	(0.152)	(0.13)
Age at immigration	24.85	27.06	26.23
	(0.147)	(0.127)	(0.098)
Work	67.1%	76.2%	72.7%
	(0.012)	(0.009)	(0.007)
Not working-to-working transition rate	9.8%	15.4%	12.7%
	(0.014)	(0.016)	(0.011)
Working-to-not working transition rate	7.2%	7.3%	7.3%
	(0.008)	(0.006)	(0.005)
Work experience in Turkey	6.10	8.01	7.27
	(0.145)	(0.132)	(0.010)
Work experience in Germany	17.10	16.49	16.73
	(0.226)	(0.153)	(0.129)
Real annual gross earnings	29,730.08	27,501.97	28,310.87
	(438.51)	(218.84)	(212.53)
Annual savings	1,115.25	1,975.69	1,532.52
	(73.90)	(134.05)	(75.90)
Oral language knowledge of German, scale from 0 (none) to 1 (very good)	0.57	0.51	0.53
	(0.007)	(0.005)	(0.004)
Written language knowledge of German, scale from 0 (none) to 1 (very good)	0.38	0.30	0.33
	(0.010)	(0.006)	(0.005)
Reads German newspapers, scale from 0 (only origin country newspapers) to 1 (only German newspapers)	0.37	0.26	0.31
	(0.010)	(0.008)	(0.007)
Feels German, scale from 0 (not at all) to 1 (completely)	0.34	0.14	0.21
	(0.010)	(0.005)	(0.005)
Intended length of stay	–	6.93	6.93
	–	(0.117)	(0.117)
Fraction who in the following period plan to stay	74.87%	18.22%	40.44%
	(0.012)	(0.008)	(0.008)

Source: SOEP 1984–2011.
Notes: Means of variables by planned migration duration in a given year, with standard errors in parentheses. The sample includes males aged 18–64 without tertiary education and born in Turkey who arrived in Germany after 1961 at the age of 16 or older. Column 1 lists means for observations where individuals report an intention to stay until at least age 65; Column 2 for intentions to return earlier. Employment transition rates are the fractions observed to switch working status; earnings and savings are measured in Euros, deflated to 2005; intended length of stay is measured in years.

substitution of leisure leading immigrants with temporary intentions to have lower reservation wages and accepting more job offers. The table entries on earnings, savings, and language proficiency reflect those illustrated in Figure 3, with immigrants who plan to stay permanently saving less (in both absolute and relative terms) and having on average higher gross earnings than those who intend to return. Providing more detail on the return intentions of immigrants, the last two rows of Table 1 show that those who plan to return wish to stay on average for about 7 additional years and that return intentions vary over time, with only 75% of those who indicated they wanted to stay permanently in year t stating the same in the next year.

Finally, in Table 2, we provide summary statistics from the GMC, which show that means of those variables that we observe in both data sets are reassuringly similar. The population in the SOEP is slightly older and has been in the host country for longer, which is related to the stock sampled character of that data set; we address this in the estimation below by explicitly modelling return migration. Lower log real earnings in the GMC are due to these differences in age and

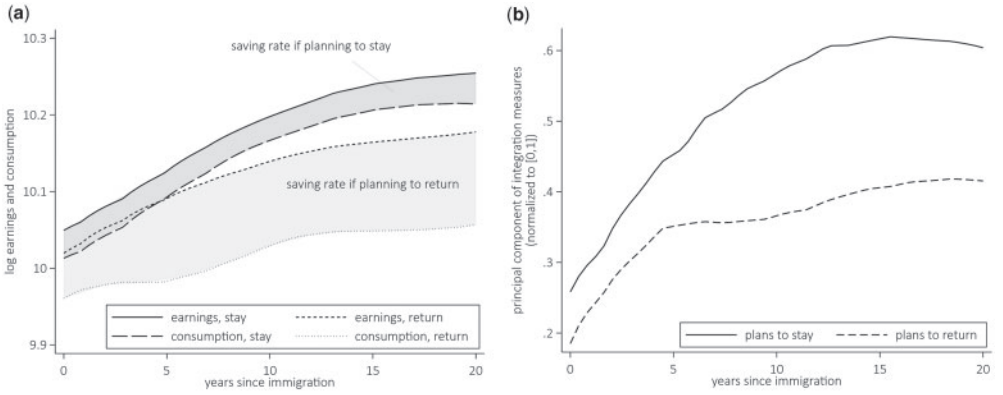

FIGURE 3

Outcomes by intention to stay

Source: German Socio-economic Panel 1984–2011

Notes: Panel (a) shows log annual earning and consumption profiles by stated return intention. "Stay" indicates observations where individuals report an intention to stay until at least age 65; "return" intentions to return earlier. As the difference between log earnings and log consumption, the shaded areas indicate the approximate saving rates. Panel (b) shows the principal component of observed integration measures (spoken and written knowledge of host country language, tendency to read German newspapers, sense of feeling German) by stated return intentions. We first eliminate cohort effects from these outcomes. As information on the various assimilation measures is collected in different waves of the SOEP, we collapse the data by years since immigration and return intention before extracting the principal component. The latter is then normalized to lie between 0 and 1. The sample is restricted to non-tertiary educated male immigrants from Turkey who arrives to Germany after 1961 at the age of at least 16 years.

TABLE 2

Summary statistics—Micro census

Variable	Mean	Std. Dev.	Obs.
Age	42.56	9.31	48,908
Age at arrival	26.24	6.33	48,908
Years since immigration	16.32	9.54	48,908
Post-1973 arrival	43.30%	0.50	48,908
In work	72.41%	0.45	48,908
Log(real annual net earnings)	9.87	0.35	34,511

Source: Micro Census 1976–2007.

Notes: Means of and standard deviations of variables used. The sample includes males aged 18–64 without tertiary education and born in Turkey who arrived in Germany after 1961 at the age of 16 or older. Earnings are calculated based on mid-points of monthly income brackets scaled to annual earnings, deflated to 2005 Euros.

arrival time, and to earnings being measured on monthly (rather than annual) level and reported after taxes (rather than as gross earnings in the SOEP).

2.2.3. Assimilation, earning, and saving profiles. To illustrate that planed migration durations determine choices and outcomes, we display in Figure 3a immigrants' log earnings and consumption profiles, separately for those who intend to return before retirement age, and who intend to remain permanently.[16] Although purely descriptive, these patterns indicate two facts. First, the earnings profile of those stating their intention to stay in the host country permanently is steeper than the profile of those planning to return. This could either be driven by compositional differences and selection, or by a stronger incentive to invest in host country-specific skills

16. We distinguish between individuals that, at interview, intended to stay permanently and temporarily, respectively. That is, Figure 3a treats the data as repeated cross-sections.

TABLE 3
Persistence in migration plans

Parameter	Estimate	
Persistent shock stdev (σ_v)	2.674	2.582
	(0.530)	(0.540)
Transitory shock stdev (σ_q)	4.333	4.386
	(0.328)	(0.322)
Intentions net of year effects		*X*

Notes: Decomposition of intended length of stay into transitory and persistent shocks, allowing for an individual fixed effect and an age trend. Variance estimates are obtained by GMM, based on moments from the Socio-Economic Panel 1984–2011. The data sample is restricted to non-tertiary educated male immigrants from Turkey who arrives to Germany after 1961 at the age of at least 16 years.

among immigrants expecting to stay in the country for a longer time, as they face a longer pay-off period for their investment. Second, the graph shows a larger difference between earnings and consumption for those with the intention to return. Since both earnings and consumption are displayed in logs, the vertical difference between the curves approximately corresponds to the savings rate. The higher saving rate for migrants who plan to return suggests an interaction between consumption and individuals' preferences towards the host country, or alternatively a response to lower earnings and prices for consumption at home (in line with intertemporal substitution of consumption), aspects that our model is able to capture.

A similar divergence between those with permanent and temporary migration intentions is illustrated in Figure 3b, where we plot the principal component from a number of outcomes that reflect host country-specific investments, such as proficiency in speaking and writing the host country language, the tendency to read German newspapers, and the sense of "feeling German" against the years spent in Germany. Again, the figure illustrates large differences, with those with permanent migration intentions exhibiting steeper and more sustained growth of this measure.

2.2.4. Persistent preference shocks. We next examine whether shocks to location preferences (induced by e.g. the death of a relative, meeting new friends, etc.) generate adjustments to return intentions that are simply *iid*, or contain a permanent component. A significant permanent component is likely to reflect changes in the life of the individual and affect investment incentives.

We consider a simple linear dynamic model of immigrant i's planned length of stay in period t, ς_{it}:

$$\varsigma_{it} = \mu_i - t + p_{it} + q_{it}, \text{ with } \quad p_{it} = p_{it-1} + v_{it}, \tag{1}$$

where μ_i is an individual fixed effect, q_{it} captures transitory shocks to migration plans that are independent across time, and p_{it} is a persistent shock that follows a random walk with innovation v_{it}.[17] Eliminating μ_i by differencing Equation (1) allows us to estimate the variances σ_q^2 of q_{it} and σ_v^2 of v_{it}, and thus to assess the relative importance of persistent and transitory innovations from the covariance structure of changes in intentions over time.[18] GMM estimates of the variances in Table 3 suggest both transitory and persistent shocks to stated return intentions, over and above individual fixed heterogeneity, with more than one-third of each period's innovation having a persistent effect on future return plans. Interestingly, the estimates are barely affected when

17. Based on our data, we cannot reject the null hypothesis that the more general firstorder auto-regressive process is a random walk.

18. Specifically, $var(\Delta\varsigma_{it}) = \sigma_v^2 + 2\sigma_q^2$ and $cov(\Delta\varsigma_{it}, \Delta\varsigma_{it-1}) = -\sigma_q^2$ provide a system of equations that identifies the variances of q_{it} and v_{it}, denoted σ_q^2 and σ_v^2 respectively.

conditioning on year fixed effects, pointing to idiosyncratic shocks as the drivers of revisions in intended durations, rather than business cycles or macro shocks. This finding has important implications for our modelling strategy and our understanding of the dynamics of return migration.

The evidence presented above illustrates several important features of the data that we incorporate in our model. First, return migration is substantial. Second, individuals' intended migration durations are indeed informative about their eventually realized return migrations, though these plans are subject to large and persistent shocks. Third, there is evidence that the behaviour of immigrants who wish to return is different from that of those who wish to stay permanently, including their labour market choices, savings choices, and investment in host country-specific human capital.

3. MODEL, IDENTIFICATION, AND ESTIMATION METHOD

We model individuals' outcomes and choices from the beginning of working life. Our analysis focuses on workers born in a specific emigration country E, and who have the initial choice to remain there, migrate to immigration country I, or migrate elsewhere (rest of the world *ROW*). Our analysis focuses on those who migrate to I, and we consider migration to *ROW* as an outside option with a payoff that we estimate. If they migrate to I, individuals make decisions about their labour market status, savings, whether or not to return to their home country,[19] and their investment in human capital. We follow individuals on an annual basis, from the migration decision until retirement, distinguishing between different migration cohorts. We start by presenting the setup of the model after emigration to I. We then describe the initial migration decision.

3.1. *The model*

3.1.1. Unobserved heterogeneity. We allow for fixed and time-varying unobserved heterogeneity along two dimensions. First, individuals differ ex ante in their labour market productivity, denoted by α_i. Second, preferences across individuals for a particular location I or E vary and consist of a transitory shock $\eta_{it}^{j}, j = I, E$, and a persistent shock Ψ_{it}, which represents the preference for the host country versus the home country (we normalize Ψ_{it} to one in the home country). This persistent shock follows a first-order Markov process, with a symmetric transition matrix:[20]

$$P\left(\Psi_{it} = \psi_{k'} | \Psi_{it-1} = \psi_k\right) = \pi_{k'k}, \text{ with } \pi_{k'k} = \pi_{kk'}. \tag{2}$$

These persistent and transitory shocks capture aspects that are important to individuals when making their return decisions, but that we do not otherwise model explicitly, such as family events, finding/leaving a partner or the death of a parent.

We model the joint distribution of ability α_i and the initial location preference Ψ_{i0} in terms of discrete mass points and allow for a correlation between the two. Endogenous immigration further implies that this distribution can differ across arrival cohorts g_i, thus accounting for unobserved changes in the composition of immigrants over time. Allowing individuals to differ along two

19. We use emigration country and home country, as well as immigration country and host country, interchangeably The vast majority (97.8%) of immigrants in our sample report that they would return to their country of origin if leaving Germany rather than moving to a third country.

20. This stochastic structure is in line with the estimation results for Equation (1) in the previous section, which show that persistent shocks are important to describe the return behaviour of migrants, over and above a fixed effect. Symmetry is assumed, since trends in Ψ_{it} are difficult to distinguish from unobserved human capital accumulation described below.

different types of unobserved traits will be important for characterizing selection that potentially biases the estimation of wage profiles and the effect of return decisions. It is also important for the policy analysis we perform in Section 4.4, as immigrants may respond differently to policies that emphasize either productivity or assimilation.

3.1.2. Human capital. Workers may acquire two distinct types of human capital in our model: work experience X_{it}, and host country-specific human capital H_{it}.[21] Work experience is acquired through learning-by-doing (as in e.g. Eckstein and Wolpin, 1989), is partially portable across countries, and increases by one unit per period the individual works, so that $X_{it+1} = X_{it} + \mathbb{I}_{it}^{work}$, where $\mathbb{I}_{it}^{work}$ takes the value one if individual i works in period t and zero otherwise. Given that the model allows for a choice to work, the accumulation of work experience is endogenous. Work experience accumulated in the home country prior to emigration may not be fully portable to the host country. For an individual arriving in period t, we thus represent the value of effective experience at immigration as $X_{it} = \xi X_{it}^{E}$, where ξ denotes the discount factor on experience accumulated in the emigration country, X_{it}^{E}.[22]

Host country-specific human capital is acquired through active investment (as in Ben-Porath, 1967), and evolves after migration as $H_{it+1} = H_{it} + d_H \mathbb{I}_{it}^{H}$, with $\mathbb{I}_{it}^{H}$ being an indicator variable that equals one if the immigrant chooses to invest in H_{it}. In this case, the stock is increased by an amount d_H.[23] We capture investment costs as a disutility, as explained below. We treat H_{it} as a unidimensional latent variable in the model but link it to several observed measures in our data that include skills such as language proficiency, knowledge of the host country, social contact with the majority population, and communication skills. Denote those variables $\iota_{it}^{k}, k = 1, \ldots, K$, which we observe in the data. We specify the following factor model:

$$\iota_{it}^{k} = \Phi\left(\gamma_0^k + \gamma_1^k H_{it} + \omega_{it}^{k}\right), k = 1, \ldots, K, \tag{5}$$

where the γ_1^k's are factor loadings and $\Phi(\cdot)$ denotes the standard normal cumulative distribution function. In our setting, individuals derive utility directly from the common factor H_{it} rather than ι_{it}^{k}, which considerably reduces the dimensionality of the model and allows us to solve and estimate it. Realizations of ι_{it}^{k} are thus not state variables in the model. We assume that the shocks ω_{it}^{k} are normally distributed and *iid*.

Host country-specific human capital H_{it} affects labour market productivity by complementing work experience X_{it}, but it also helps the immigrant to locate job offers. Given the cost associated with the accumulation of H_{it} and its specificity to the host country, migrants have a dynamic trade-off, in which those with a low preference for the host country may not judge it worthwhile to invest much because of the expected short duration of their migration spell.

As with unobserved preference and productivity, selective immigration may cause the initial stock H_{i0} to vary across arrival cohorts g_i (Borjas, 1985). We normalize it to zero for the first cohort, while for the later one, we estimate it together with the other parameters of the model.

21. Multiple dimensions of human capital are considered by for instance Gathmann and Schönberg (2010), Hu and Taber (2011), and Gayle, Golan and Miller (2012, 2015); see Sanders and Taber (2012) for a survey of that literature.

22. To ease computational burden, we do not keep track of home country experience as a separate state variable while individuals are in the immigration country, but only of total effective experience, which is given by the sum of experience accumulated in the host country and discounted home country experience.

23. For computational simplicity, we treat d_H as a fixed parameter that we estimate. The individual is choosing whether to invest or not in each period.

3.1.3. Earnings and employment. Log gross annual earnings in the immigration country are

$$\log y_{it} = \alpha_0^I + \alpha_i + f_y^I(X_{it}) + \alpha_H H_{it} + \varepsilon_{it}^I, \tag{6a}$$

where α_0^I is an intercept, α_i is individual productivity, and $f_y^I(\cdot)$ is a piecewise linear function of work experience with nodes at 2, 5, 10, and 20 years. Host country-specific human capital H_{it} affects log wages in the immigration country linearly with return α_H. As H_{it} accumulates endogenously, depending on a migrant's return migration plans, this component of the earnings equation leads to behavioural selection, distinct from the selection on unobserved ability α_i. The error term ε_{it}^I is *iid* normal across time and individuals, with mean zero and variance σ_ε^2.

For those who return (or decide not to migrate in the first place), real wages in the home country are modelled as:

$$\log y_{it} = \alpha_{0t}^E + \rho_\alpha \alpha_i + f_y^E(X_{it}) + \rho_H \alpha_H H_{it} + \varepsilon_{it}^E. \tag{6b}$$

The first term is a wage intercept, such that $\alpha_{0t}^E < \alpha_0^I$, as wages in the home country are lower than in the host country. It is also indexed by time, as home country wages tend to catch up with those in the host country over the period we consider. The second term is again an ability fixed effect, which we assume to be proportional to the one affecting wages in the host country in Equation (6a). The third term is a non-linear function of experience X_{it}.[24] Finally, to reflect that host country-specific human capital H_{it} may have different a return in the home country, it is scaled by ρ_H.

In each period, employed workers are laid off with probability δ^j, $j = I, E$, while individuals who are unemployed receive a job offer with probability λ^j and decide whether to accept the job or remain unemployed. For the host country, the rates at which jobs are lost and new job offers arrive are functions of age age_{it} and host country-specific human capital H_{it}, since better knowledge of the host country may improve job finding and job retention. For the home country, δ^E and λ^E are age-specific job loss and job finding probabilities. See Supplementary Appendix B.1 for details.

3.1.4. Budget constraint. We assume a standard intertemporal budget constraint under which asset holdings A_{it} depend on past assets, net wages (or unemployment benefits b_{it}^j if the individual is not working), and consumption c_{it} in location $j = I, E$,

$$A_{it+1} = (1 + r_t^j) A_{it} + \mathbb{I}_{it}^{work} net(y_{it}; j) + \left(1 - \mathbb{I}_{it}^{work}\right) b_{it}^j - c_{it}, \tag{7}$$

$$A_{i0} = 0, A_{it} \geq 0.$$

Here $net(\cdot; j)$ is a function that relates gross earnings y_{it} to net earnings and models the tax schedule in each country. To approximate the unemployment compensation scheme in place over the period of study, we specify unemployment benefits b_{it}^j as a function of predicted earnings had the individual been working.[25] Once migrants return, their assets are converted by a factor

24. We observe both home and host country work experience for Turkish immigrants in Germany in the German data, but not in the Turkish data. However, we can calculate the potential experience of returning migrants, which we use to approximate the wage migrants can expect to earn after a return.

25. The German benefit rate is a function of past earnings, which we model using data from the SOEP (see Supplementary Appendix B.1 for details). There was no unemployment benefit in Turkey during most of our period of analysis; these were introduced only in 2002, but at a replacement ratio of only 9%. We therefore set $b_{it} = 0$ for individuals who have returned home.

x_t to account for the purchasing power of the host country currency in the home country. This implies that the price of consumption differs across locations. Hence, as in Thom (2010), migrants who plan to return soon will have stronger incentives to accumulate savings, as consumption is relatively cheaper in their home country.

3.1.5. Preferences. An individual's utility function is defined over consumption c_{it}, leisure $(1-h_{it})$, host country-specific human capital H_{it}, and investment in it, $\mathbb{I}_{it}^{H}$:

$$u_{it} = \underbrace{c_{it}^{\phi_c}(1-h_{it})}_{A}\underbrace{(\Psi_{it}(H_{it}+1)^{\phi_H})^{\mathbb{I}_{it}^{I}}}_{B} - \underbrace{e(age_{it})\mathbb{I}_{it}^{H}}_{C} + \underbrace{\eta_{it}^{I}\mathbb{I}_{it}^{I} + \eta_{it}^{E}(1-\mathbb{I}_{it}^{I})}_{D}. \tag{8}$$

Term (A) describes utility from consumption and leisure, where h_{it} takes an estimated value h if the individual works and equals zero if not. Term (B) switches on in the host country and consists of the relative preference for location I, Ψ_{it}, and host country-specific human capital H_{it}. It enhances utility of consumption, reflecting that those with a high relative preference for the host country enjoy consumption more than those with a low preference, as motivated by the empirical patterns shown in Figure 3a. Moreover, it allows utility from consumption in the host country to be positively affected by host country-specific human capital H_{it}, by e.g. enhancing information about consumption possibilities and creating connections to natives through language and knowledge of culture. As returns from consumption and leisure in the host country can be affected by the level of H_{it}, endogenous accumulation of H_{it} may lead to past and potentially short-term events having permanent effects on immigrants' future choices. Term (C) reflects the effort cost of investment in host country-specific human capital H_{it}. It is age dependent, to capture that older individuals may find it more difficult to acquire new language skills or to form social contacts.[26] Finally, term (D) measures *iid* preference shocks in the emigration and immigration countries, η_{it}^{E} and η_{it}^{I}, which we assume to follow an extreme value type I distribution.

3.1.6. Dynamic specification of the model. In each period, individuals choose their consumption, labour supply, and, if located in the host country, whether to invest in host country-specific human capital or not and whether to return to the home country or not, conditional on the state vector[27]

$$\Omega_{it} = \left\{ age_{it}, year_t, X_{it}, H_{it}, A_{it}, \mathbb{I}_{it-1}^{work}, \mathbb{I}_{it-1}^{I}, \alpha_i, \Psi_{it}, \eta_{it}^{E}, \eta_{it}^{I}, \varepsilon_{it} \right\}.$$

The value function is then defined by the following Bellman equation, which describes how these choices affect contemporaneous and future utility:

$$V(\Omega_{it}) = \max_{c_{it}, \mathbb{I}_{it}^{\mathrm{H}}, \mathbb{I}_{it}^{work}, \mathbb{I}_{it}^{I}} u\left(c_{it}, \mathbb{I}_{it}^{\mathrm{H}}, \mathbb{I}_{it}^{I}, \mathbb{I}_{it}^{work}; \Omega_{it}\right) + \beta E_t V\left(\Omega_{it+1}\right), \tag{9}$$

26. We specify the effort function to be linear in age: $e(age_{it}) = e_0 + e_1 age_{it}$.

27. Calendar time ($year_t$) enters the state space as we account for changes in the macroeconomic environment different cohorts experience.

where β is a discount factor and E_t is the expectation operator conditional on information in period t.[28] Expectations are taken over the vector of future shocks to preferences for location, income shocks, and labour market (firing and hiring) shocks. We assume that exchange rates and mean country of origin wages follow deterministic paths based on observed macroeconomic time trends (see Supplementary Appendix B). The choices of consumption, investment in host country-specific human capital, labour supply and location are made subject to the constraints explained above.

We assume that the decision to return to the home country is final—an assumption that characterizes well the population we consider. Once migrants have returned, they only choose their consumption and labour supply. We further assume that individuals who quit work do so involuntarily. However, when out-of-work, individuals choose whether to work or not if they receive an offer, making labour supply and work experience endogenous. Finally, we set the retirement age at 65, from which point individuals receive retirement benefits y_R^j, $j=I,E$, and only make consumption decisions, until age 80 (end of life in our model). To compute retirement benefits, we fix the state variables X_{it}, H_{it}, and Ψ_{it} at their values at age 64 (see Supplementary Appendix B.2 for more details on the model's dynamic specification and how we solve it).

3.1.7. Initial conditions. Initially, individuals are located in their home country and make a one-time decision of whether to migrate or not, by comparing the welfare achieved in either location:

$$\max\left\{V^E(\Omega_{i0})+\eta_{i0}^E; V^I(\Omega_{i0})+\eta_{i0}^I-C_t; V^{ROW}+\eta_{i0}^{ROW}-C_t\right\}, \tag{10}$$

where $V^E(\Omega_{i0})$ and $V^I(\Omega_{i0})$ are the values individuals attribute to being in the emigration country and the immigration country, respectively, and $V^{ROW}(\Omega_{i0})$ captures the option of migrating elsewhere ("rest of the world"). Since we do not have repeated information on individuals before they migrate, our model starts at the time of the emigration decision. We initialize work experience by drawing it from the empirical distribution of actual migrants observed in the data. Preference shocks associated with either choice are denoted by η_{i0}^E, η_{i0}^I, and η_{i0}^{ROW}, which are independently extreme value distributed with spread parameter τ, and C_t is the utility cost arising from migration. This cost is indexed by time, as we allow it to take different values prior to 1973, between 1976 and 1980, and after 1980. Before 1973, Germany operated a guest–worker recruitment scheme, when the cost of migration was presumably lower. The period 1976–1980 corresponds to the political unrest that led to the 1980 coup in Turkey.

3.2. *Estimation and identification*

We estimate our model using an indirect inference estimator that minimizes the distance between moments from the data and the equivalent moments simulated using the model (see Gourieroux, Monfort and Renault, 1993).[29] The data moments are computed from the GMC and SOEP, as well as data collected in Turkey on returned migrants (see Section 2.1), which is used to approximate the earnings migrants can expect after a return. Identification relies on static,

28. We set $\beta=0.95$.

29. The minimized criterion is the squared difference between observed and simulated moments, weighted by their inverse (observed) standard deviation (as for instance in Haan and Prowse (2017), who also apply this estimator to data from the German Socio-economic Panel). We report asymptotic standard errors.

conditional, and dynamic moments obtained from the data, usually through auxiliary regressions. We match moments that relate to the evolution of earnings, transitions between work and non-work, the evolution of savings and social integration, and actual and intended returns. As some of the outcomes, we use are collected only in a sub-set of years, and are partly taken from different data sources, we target moments from multiple separate auxiliary regressions. We provide further details, including an analysis of the mapping of parameters into moments, in Supplementary Appendix C.

Our model has two unusual features compared to previous structural models. First, the model contains a latent state variable (host country-specific human capital H_{it}) which contributes to wage growth. Second, the model includes an autocorrelated stochastic preference shock Ψ_{it}. Both these features present a challenge for identification that we address below.

3.2.1. Identifying persistent preference shocks. Typical dynamic discrete choice models such as Keane and Wolpin (1997) contain only *iid* shocks, and their identification using observed decisions is well understood. In our case, however, there are both *iid* and persistent shocks to preferences and we use data on repeated measures of intended migration durations to identify the dynamics of the persistent preference shocks that we anticipated in Section 2.2.[30] To construct the model counterpart of migration intentions, we draw, for each simulated individual, a number of future paths for shocks to earnings, employment and preferences. Each of these paths implies a sequence of choices as well as an optimal duration of stay in the host country, which we combine to construct the density of future return dates. We then take the *median* of these return dates as our model's equivalent to the intention stated by an individual at a given point in their migration history, as observed by us in the data. We use the median because it produces a more robust measure of intentions than does the mean, which is sensitive to outliers.[31]

3.2.2. Identification of host country-specific human capital. We identify the accumulation of latent host country-specific human capital H_{it} through a factor model of several observed measures of host country-specific skills and knowledge (see Equation (5)). The model predicts how H_{it} is accumulated, and accordingly the evolution of the outcome variables of the factor model can be simulated. To account for selective return migration, this factor model is estimated jointly with other model parameters. The simulation distinguishes two immigrant cohorts, one that arrives in 1970 at the height of the guest–worker programme, and one that arrives in 1990. The initial level H_{i0} varies across immigrant cohorts. Since H_{it} is unobserved, we need to normalize its initial level for one cohort and identify the variation across years of arrival through level differences in the observed measures across cohorts.

30. Without data on intended migration durations, the model is in principle identified as changes in the location preference will affect investment in human capital. However, in practice, we only observe the stock of human capital (e.g. the level of language skills), and changes in this stock as a response to a preference shock are very difficult to detect. Moreover, variables such as language capital are measured with error, so that changes in the stock have a non-zero autocovariance structure that confounds the effect of preference shocks. Finally, there is no disinvestment in skills in case of a negative shock to location preference, so that data on human capital can only be informative on *increases* in the location preference for the host country. In contrast, intended migration durations respond to both positive and negative shocks to preferences.

31. See van der Klaauw and Wolpin (2008) for a related estimation strategy What distinguishes our approach from theirs is that we use repeated intentions for each individual, which allows for revised intentions as individuals age and experience new shocks.

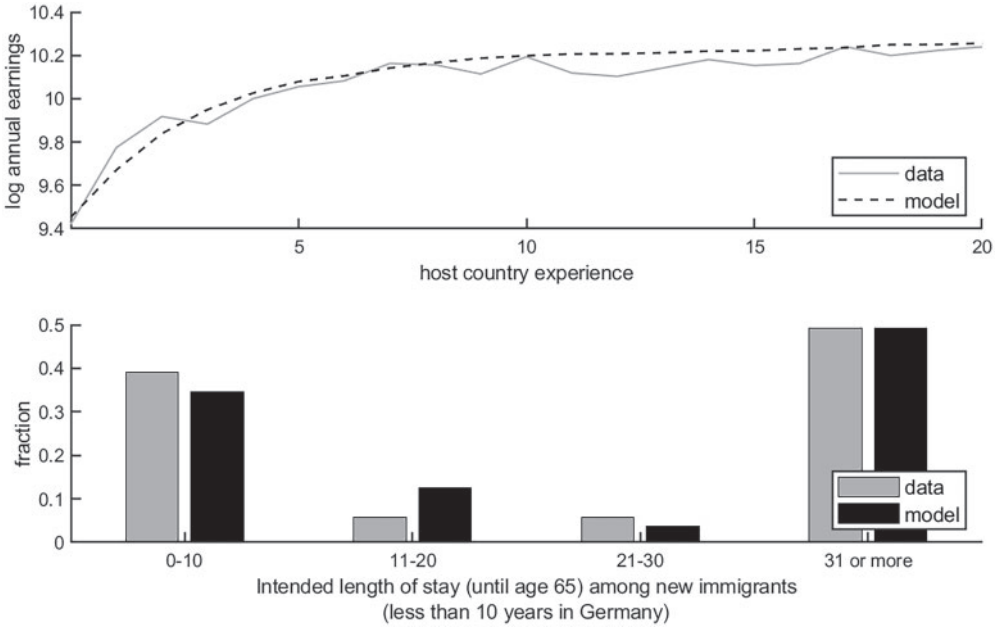

FIGURE 4

Model fit—Earnings profile.

Notes: Simulated profiles are based on a simulation of 40,000 individuals. Data profiles based on SOEP 198–2011. Earnings are denoted in 2005 Euros. For immigrants planning to stay permanently, intended length of stay is computed as time until age 65.

3.2.3. Identification of the remaining parameters. The wage equation for migrants who have returned to their home country is estimated from the IAB survey of returning migrants.[32] To identify the other parts of the model, we match conditional moments from the data with those produced by the model. We refer the reader to Supplementary Appendix C for further details.

3.3. *Model fit*

The top panel of Figure 4 shows the log of annual earnings against host country experience as observed in the SOEP sample (grey line) together with the profile predicted by the model (black line). The specification chosen for the earnings function, with a linear spline over five experience intervals, fits the empirical earnings profile very well. The second panel shows the distribution of planned migration durations for newly arriving immigrants. Rather than the full distribution, we only target the mean and standard deviation of this distribution, as well as correlations with other observed outcomes. Nevertheless, our model replicates this distribution well.

32. Since these data are not linked to individual-level outcomes in Germany, we need to make assumptions about the unobserved components of the equations. We thus specify that individuals with a high and low productivity (α_i) in Germany correspond to individuals with above and below median schooling level in the Turkish sample respectively, and that the returns to host country-specific human capital H_{it} is zero after a return to Turkey The latter is supported by the fact that return migrants in our context rarely continue working in the same sector. According to the survey of returning migrants, the most common industries in Germany prior to return are steel furnace (29%), coal mining (20%) and ship building (5%), whereas after return the most frequent industries in Turkey are agriculture (31%), department stores (21%) and transportation (11%). Returns to foreign experience, as discussed by Reinhold and Thom (2013) for Mexican returnees from the US are thus likely less relevant in our case.

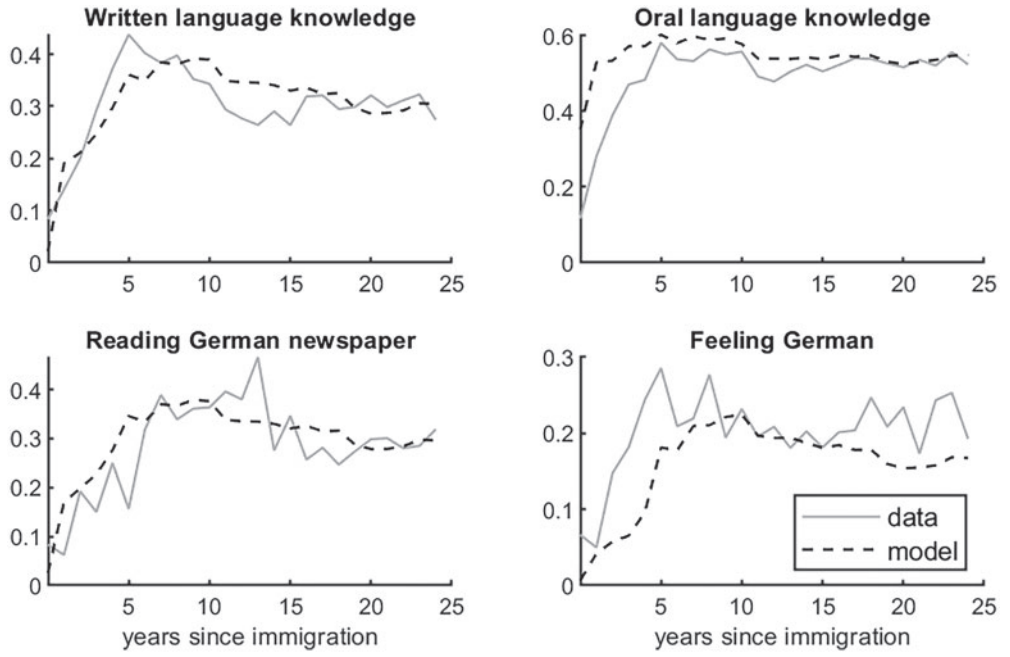

FIGURE 5

Model fit—Integration outcomes.

Notes: Simulated profiles are based on a simulation of 40,000 individuals. Data profiles based on SOEP 198–2011. Earnings are denoted in 2005 Euros. For immigrants planning to stay permanently, intended length of stay is computed as time until age 65.

Our model also matches well measures of host country-specific human capital H_{it} such as oral and written language proficiency, the tendency to read German newspapers, and the degree to which immigrants feel German. The fit of these outcomes by time spent in the host country is shown in Figure 5. In Supplementary Appendix C, we provide further evidence of the model's fit for employment transitions, as well as the full set of moments used in the estimation. In the same appendix, we further present evidence of the model's external validity (similar to the analysis of Todd and Wolpin, 2006). Since the relative price level in Turkey determines the purchasing power of assets accumulated in Germany once back in Turkey, it is an important determinant of economic migrants' choices. We show that the model is able to predict well the effect of relative prices on savings decisions, an aspect that we do not explicitly use in the estimation of our parameters. In Supplementary Appendix D, we show the fit of the model regarding migrant inflows over time and how they respond to exogenous macroeconomic determinants.

4. RESULTS

4.1. *Estimated parameters*

The model has 43 parameters that we estimate. We now discuss a subset of these parameters, with a focus on those that characterize the effect of host country human capital H_{it} on individuals' earnings profiles, their employment transitions, and utility.

4.1.1. Earnings. The estimates in Table 4 show that a one standard deviation increase in host country human capital H_{it} raises earnings by about 9.5%. For a cohort of immigrants who all

TABLE 4
Estimate—Earnings equatio

Parameter		Estimate	Std. err
Marginal effect of host country human capital	(α_H)	0.095	(0.008)
Marginal effect of host country experience:	$(f_y(X))$		
At up to 2 years ($\times 100$)		20.986	(1.567)
At 3–5 years ($\times 100$)		6.722	(0.965)
At 6–10 years ($\times 100$)		2.194	(0.161)
At 1–20 years ($\times 100$)		0.529	(0.668)
At more than 20 years ($\times 100$)		0.045	(0.316)
Effectiveness of home country experience	(ξ)	0.315	(0.039)
Intercep	(α_0)	8.769	(0.245)
Difference between high and low productivity	$(\alpha_H - \alpha_L)$	0.285	(0.089)
Standard deviation of earnings shock	(σ_ε)	0.184	(0.034)

Notes: Estimates are obtained by indirect inference, based on 40,000 simulations and empirical moments from the Socio-Economic Panel 1984–2011 and the German micro-census 1976–2007. The data sample is restricted to non-tertiary educated male immigrants from Turkey who arrives to Germany after 1961 at the age of at least 16 years. We weight moment differences by the inverse of their standard deviation. Host country human capital is measured in standard deviations.

arrive at age 25, we find a 1.1 standard deviation difference in the accumulation of H_{it} between those who have a low or high preference for the host country upon arrival, which contributes to an earnings gap between the two groups of 0.11 log points after 10 years in the host country.

The accumulation of host country labour market experience increases wages annually by about 0.2 log points over the first 2 years, which quickly decreases to 0.07 log points in Years 3–5, and returns drop off even further in later years. This reduction in the marginal effect of experience in a host country has also been documented for the US (Borjas, 1985; Lubotsky, 2007). Moreover, home country experience is only partially transferable: the estimate of 0.32 for the parameter ξ suggests that on average, individuals lose about two-thirds of general human capital acquired through working when emigrating from Turkey to Germany (cf. Friedberg, 2000). Finally, we allow for unobserved productivity differences, and the estimates in Table 4 show that these account for a difference in earnings between low and high productivity individuals of about 0.3 log points.

4.1.2. Employment transitions. Host country-specific human capital H_{it} not only affects earnings but also employment transitions over the life-cycle. We find that a one standard deviation increase in H_{it} raises the job finding probability by 4.1 percentage points, while it lowers the risk of job loss by 1.3 percentage points (see Supplementary Appendix Table A11). Both job offer and job loss functions vary with age, with a decrease in job offer rates and an increase in job loss rates at older ages.

4.1.3. Utility. Term (A) of Equation (8) captures the utility from consumption and leisure. The coefficient estimate of ϕ_c of 0.26 (see Table 5) implies a relative risk aversion of 0.74, which is in line with estimates found in other studies.[33] Furthermore, disutility from working reduces the utility flow from consumption by a factor $(1-h)=0.84$ (or by 16%) if an individual works.

Term (B) in Equation (8) scales utility from consumption and leisure in the host country through relative preferences for the host country Ψ_{it}, and accumulated host country-specific

33. Our estimate is comparable to Rendon and Cuecuecha (2010) and Imai and Keane (2004), who find relative risk aversion to be 0.56 and 0.74, respectively. Allowing for heterogeneous risk preferences, Belzil, Maurel and Sidibé (2021) report a mean value for relative risk aversion of 0.73.

TABLE 5
Estimate—Utility function

Parameter		Estimate	Std. err
Consumption exponent	(ϕ_c)	0.257	(0.012)
Cost of working	($1-h$)	0.836	(0.042)
Host country human capital exponent	(ϕ_H)	0.475	(0.034)
Relative preference for destination	(Ψ_{it})		
Low preference		0.446	(0.003)
High preference		9.870	(0.614)
Increase in probability of initially high preference by 1990 cohort ($\times 100$)		0.865	(0.052)
Correlation of preference with productivity		−0.718	(0.002)
Persistence in annual transitions	(π_{kk})	0.954	(0.000)
Investment effort cost, constant	(e_0)	1.202	(0.007)
Investment effort cost, effect of age	(e_1)	3.608	(0.221)
Increase in host country human capital if investing	(d_H)	1.071	(0.081)
Increase in initial host country human capital by 1990 cohort	(H_{i0}^{1990})	0.696	(0.114)

Notes: Estimates are obtained by indirect inference, based on 40,000 simulations and empirical moments from the Socio-Economic Panel 1984–2011 and the German micro-census 1976–2007. The data sample is restricted to non-tertiary educated male immigrants from Turkey who arrives to Germany after 1961 at the age of at least 16 years. We weight moment differences by the inverse of their standard deviation.

human capital H_{it}. Considering first H_{it}, the estimated parameter ϕ_H of 0.48 implies that for an immigrant who arrives at age 25, the host country-specific human capital accumulated on average during the first 10 years in the host country raises utility from consumption by 37.8% relative to the utility from consumption derived at arrival. This means that temporary shocks to employment and earnings, through their effects on planned migration duration and thus on the accumulation of H_{it}, can have long-lasting effects on later behaviour. For instance, immigrants losing a job plan to return approximately 4.9 years earlier and are 42.5% less likely to invest in H_{it}. As a consequence, this channel will lead to migration policies that affect the accumulation of H_{it} having long-term effects on immigrants' behaviour and welfare, something we discuss in the context of our policy simulations in Section 4.4. Similarly, immigrants' preference for the host country upon arrival, Ψ_{i0}, and the evolution of this preference over time, also affect the utility of consumption and leisure. The process for Ψ_{it} is highly persistent, with an estimate for the annual probability of no change in preferences (π_{kk}, see Equation (2)) of 0.95. This implies that an immigrant's initial preference towards the host country governs many of his decisions during the first few years after arrival. Unobserved productivity α_i and location preference Ψ_{i0} at arrival are negatively correlated, so that low ability individuals tend to stay longer.

As we discuss in Section 3.1, we allow different immigrant arrival cohorts to face different macroeconomic conditions. We also allow for different initial preferences for the host country and different levels of host country human capital at arrival. We model the difference in preferences by allowing for different probability distributions for the preference parameter Ψ_{i0} at arrival. The estimates in Table 5 show that the probability that an immigrant draws a high value of Ψ_{i0} at arrival is 0.9% higher for later arrival cohorts. Similarly, our estimate for host country human capital at arrival indicates a 0.7 standard deviations higher level for the later arrival cohort, meaning that everything else equal, later arrivals have a $0.095 \cdot 0.7 = 6.6\%$ higher earnings potential at arrival. Thus, the later cohort has not only a higher relative preference for the host country but also arrives with skills more valuable in the host country's labour market.

Term C of the utility function includes an effort cost of investment in host country human capital, which can vary with age (with intercept e_0 and slope e_1). Our estimates of these parameters show that a 20-year-old immigrant faces a 33% lower cost of investing in host country-specific human capital H_{it} than an immigrant aged 30. Thus, our model implies not only that those who

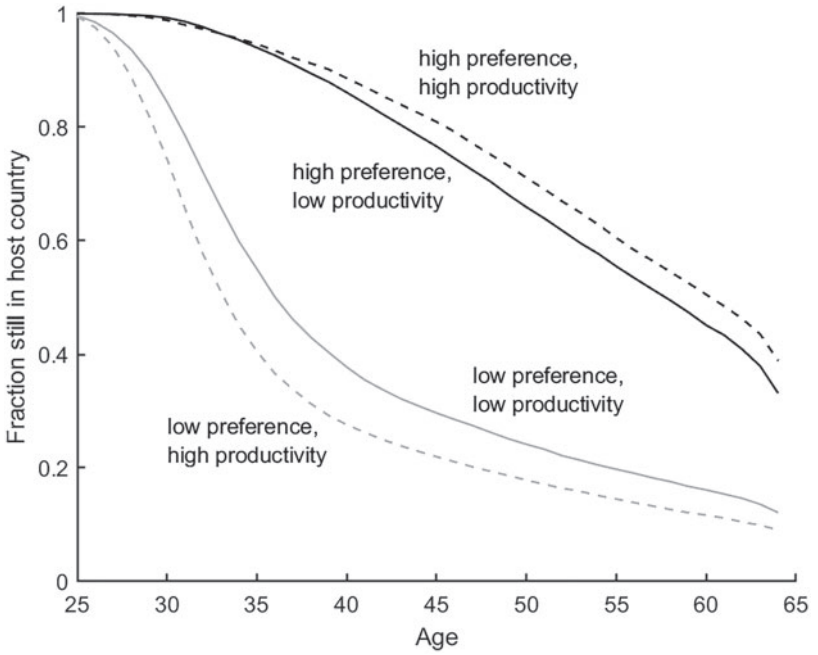

FIGURE 6

Survival rates by type.

Notes: Simulation of 40,000 immigrants who all arrive at age 25. The figure displays the fraction of the initial immigrant cohort left in the host country by age and unobserved type. "Low preference" and "high preference" refers to initial preference for the receiving country. "Low productivity" and "high productivity" refers to the time constant unobserved level in log earnings.

arrive at a later age invest less in H_{it} due to a shorter pay-off period but also that investments into H_{it} require more effort for older individuals, and thus become more costly. This is in line with early findings of the role of age at arrival in a reduced form context by Friedberg (1992) and Eckstein and Weiss (2004).

4.2. *Immigrants' career profiles*

We now analyse two key features of immigrants' careers: the selection of returning migrants and the role of the interplay between human capital accumulation and return plans for the evolution of wages. We do this by simulating the life cycle career paths of different arrival cohorts, based on our estimated parameters, distinguishing between four groups: immigrants who arrive with a high and a low initial preference for the host country (Ψ_{i0}), and, within each preference type, high and low productivity individuals, based on the realization of ability α_i. We then track these four groups over their life cycle.

4.2.1. Length of stay, integration, and migrant selection. We first investigate what determines selective out-migration. In contrast to the standard Roy type model, where selection is driven by unobserved ability only (see e.g. Borjas, 1987; Borjas and Bratsberg, 1996), in our model, selection is also affected by preferences for the host country, both directly and indirectly through effects on behaviours. This is shown by the survival rates of immigrants in Figure 6, where solid and dashed lines represent low and high productivity individuals, and grey and black lines low and high preference individuals, respectively. The figure shows that those with an initially

high preference for the host country remain longer on average than those with a low preference. Within each of the two preference groups, two counteracting mechanisms determine selection. First, among migrants with both a strong attachment to the home country ($\Psi_{it} < 1$), an income effect raises the demand for time spent in the home country, creating a negative selection of those who stay longer. Second, for high productivity individuals, a substitution effect implies a larger opportunity cost of a return, which creates a positive selection of stayers. For the estimated parameter values we obtain, we find that the first effect dominates. For migrants with a preference for the host country ($\Psi_{it} > 1$), both effects act in the same direction, and we find positive selection of stayers.

To understand better the composition of returning immigrants with respect to ability, Figure 7 plots the average wage fixed effects of returning migrants as a function of time. The figure illustrates how selection on ability varies over the cohort's migration cycle. Those who leave first are more likely to come from the group with low preference for the host country but high productivity (thus having a low incentive to invest in host country-specific human capital but a high relative taste to consume in the home country), leading to positive selection on productivity. Over time, this group becomes smaller, and the flow of return migrants is increasingly dominated by low preference-low productivity individuals. As time passes, more high preference but low productivity individuals return home.[34]

4.2.2. Estimation of earnings profiles.. The selection of immigrants through return migration along these two dimensions affects wages in two ways. First, immigrants select according to fixed productivity differences. Second, heterogeneity in preferences leads to behavioural selection, where immigrants accumulate host country-specific human capital to different degrees, with those who have steeper earnings profiles because they invest more in host country human capital (due to longer migration expectations), also staying longer on average.

To investigate the implications of our model for the estimation of immigrants' earnings profiles, consider a simplified (relative to our model) earnings equation

$$y_{it} = \alpha_i + \beta x_{it} + \alpha_H H_{it} + \varepsilon_{it},$$

where (log) earnings y_{it} are a linear function of unobserved productivity α_i, observed experience x_{it}, host country human capital H_{it} which is typically unobserved, and an unobserved transitory component ε_{it}, independent of α_i, x_{it}, and H_{it}. In this illustration, we focus on continuously employed individuals, so that x_{it} also reflects the total time an immigrant has spent in the country. Taking expectations conditional on observed experience and location $L_{it} = I$ yields

$$E\left[y_{it}|x_{it}, L_{it} = I\right] = \beta x_{it} + E[\alpha_i|x_{it}, L_{it} = I] + E[\alpha_H H_{it}|x_{it}, L_{it} = I]. \tag{11}$$

Equation (11) reveals the two potential sources of bias. First, out-migration depends on unobserved productivity α_i, with selection being positive or negative depending on whether the income or substitution effects dominate (see above), which induces a negative or positive bias in OLS

34. Contrast this to the standard one-factor Roy model used in the migration literature (see e.g. Borjas and Bratsberg, 1996), which provides unambiguous predictions about the sorting of individuals into non-migrants, temporary migrants and permanent migrants along the ability distribution. The standard Roy model assumes migration choices based only on income maximization, while migrants in our framework maximize utility, which is a function of both income and location. Hence, in addition to the substitution effect, which unambiguously makes a stay in the host country more attractive for high ability migrants, in our model selection of return migrants is also determined by an income effect that leads migrants with a preference for the home country to demand more time at home the higher their income.

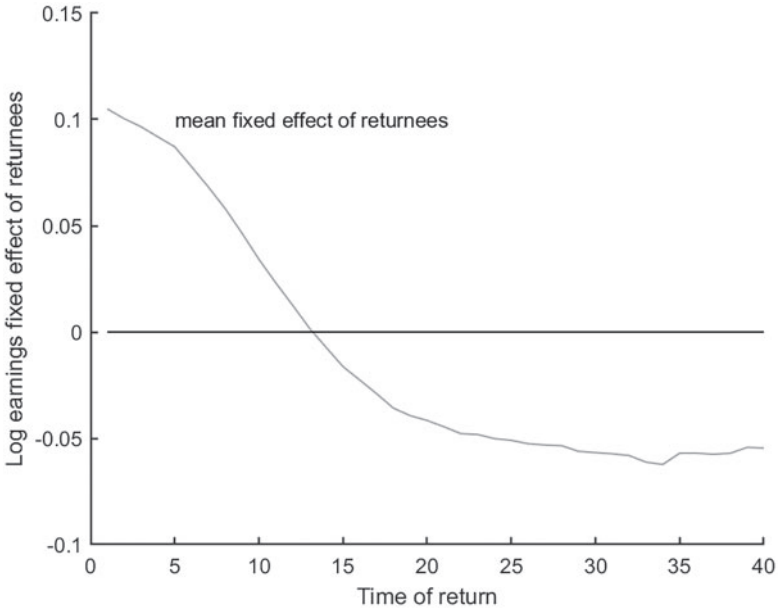

FIGURE 7

Selective return migration.

Notes: Simulation of 40,000 immigrants who all arrive at age 25. The figure shows the average log earnings fixed effect of migrants that return at different points in time.

estimates of the returns to experience β, respectively. Second, those who wish to stay longer accumulate higher levels of host country human capital H_{it}, which induces an upward bias in OLS estimates. See Supplementary Appendix F for further illustration of these biases.

If unobserved productivity was the only source of selection, simple difference estimation would eliminate the first type of bias.[35] However, the second source of bias persists and will typically be positive as $E[\alpha_H \Delta H_{it} | x_{it}, L_{it} = I] > 0$. Eliminating this second bias requires additional information, which in our framework is achieved by explicitly modelling host country-specific human capital and using repeated information on return intentions. In Supplementary Appendix F, we quantify the bias affecting returns to host country experience. We show that an OLS estimator leads to a downward bias of up to 30%, while a first-difference estimator overestimates the returns by about 10%.

4.3. *Reservation and effective wages*

A lower price level in the country of origin implies a higher valuation of accumulated savings by immigrants with a positive probability to return than by natives, who with probability one will consume all their wealth in the host country. Accordingly, as each unit of host country currency buys more units of consumption goods at home than in the host country, spending a higher fraction of earnings at home leads to a higher "effective" real wage in the host country (in terms of average lifetime consumption). As a result, real effective earnings of the population of immigrants, and in particular of those planning to return, are higher than their observed earnings, leading to lower

35. The approaches by Lubotsky (2007) and Hu (2000) rely on that assumption.

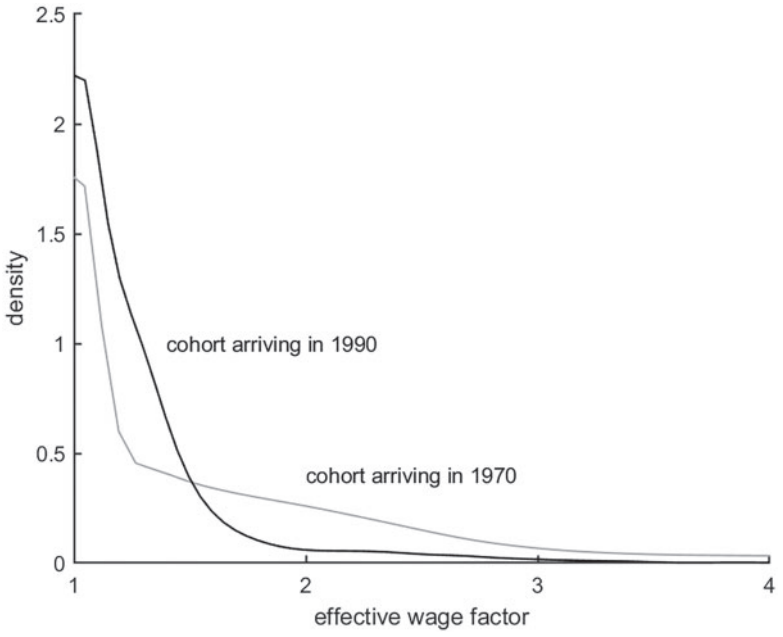

FIGURE 8

Effective wages of temporary migrants.

Notes: Simulation of 40,000 immigrants who all arrive at age 25. The figure shows, for different arrival cohorts, the density of the factor by which effective wages exceed wages paid in the host country if some migrants expect to consume part of their earnings in the country of origin. The difference results from a higher purchasing power of the host country currency in the country of origin.

nominal reservation wages.[36] This effect is reinforced if immigrants have a higher savings rate as a consequence of a preference for consumption in their home country, due to complementarity between consumption and origin country amenities.

We illustrate the heterogeneity in *effective* earnings of immigrants by simulating and plotting their distributions, separately for the 1970 and 1990 arrival cohorts (Figure 8).[37] These distributions are truncated at one (corresponding to a permanent migrant, whose *effective* real wage is equal to his real wage), with means at 1.62 and 1.22, respectively. One important implication of this is that the temporariness of migrations can lead immigrants to accept wages that are lower than those of natives, which may partly explain why immigrants are often seen to work in jobs below their qualification level.

4.4. *Immigration policies*

The observation that immigrants' economic choices depend on anticipated migration durations has important implications for immigration policies, many of which restrict the period of stay.[38]

36. In our model, the implicit reservation wage can be backed out as the wage offer that makes an unemployed individual indifferent between accepting a job or remaining unemployed (see Supplementary Equation A3 in the Appendix).

37. We obtain this distribution by scaling earnings by the fraction of (discounted) lifetime income spent in the home country and by the difference in purchasing power at the time of return.

38. These policies include schemes like the US H1-B visa. Similar programmes are in place in Canada and other traditional immigration countries like Australia, with its subclass 482 work visa. For details on these and temporary worker schemes in more recent migrant destinations like the Gulf Cooperation Council countries, see Martin (2015).

The decision of the government about whether to allow a migrant permanent status is often delayed until several years after immigration and made conditional on employment, earnings thresholds, or the attainment of integration targets, such as language proficiency. These schemes not only affect the emigration decision and thus number and types of immigrants but also their career profiles and longer-term contributions, as they affect human capital investment and return migration choices.

To better understand the implications of such policies, we simulate three policy environments in which immigrants are granted permanent residence only after 5 years, under different sets of conditions (Schemes I–III). We then use our model to understand the effects on immigrants' welfare and their fiscal contribution of each of these policy regimes, accounting for selection of who immigrates and who returns to the home country.[39]

Under Scheme I, a permanent residence permit is awarded only if by Year 5 the immigrant is in work and has attained an earnings threshold. Such a condition applies for instance to Tier 2 visa holders in the UK.[40] We assume that the right to stay beyond 5 years is granted if at that point an individual is in work and achieves earnings of at least €20,000. Under Scheme II, permanent residency is granted only if certain skill requirements, such as language proficiency, are met, a policy that resembles those in place in various countries.[41] We assume that immigrants are required to achieve at least the 30th percentile of their cohort's host country human capital distribution. Under Scheme III, permanent residency is granted after 5 years with no additional requirements, but only to a fraction of each arrival cohort. This reflects the uncertainty faced by immigrants where the hosting country does not commit ex ante to allowing permanent residence, as is often the case for refugees. In our simulation below we assume that a permanent residence permit is issued with a 30% probability and does not depend on individual characteristics and choices. We consider the impacts of these policies relative to a baseline where immigrants are given indefinite right to work and remain upon entering the country.

Each of these policies affects immigrants' earnings, welfare, and fiscal contributions, both through selection, and via changes in behaviour. All three schemes reduce the expected length of stay, which affects the accumulation of host country human capital negatively. However, by tying permanent residency to individual achievement in Schemes I and II, this is counteracted by incentives to invest into human capital for those who expect this to be sufficient to be granted permanent status. One major difference between Scheme II, which conditions residence on sufficient investment in host country human capital, and Scheme I, which grants permanence to immigrants who pass an earnings threshold, is that the former favours immigrants with a high preference for the host country and strong investment in host country human capital, while the latter favours high productivity immigrants. These groups differ in their economic behaviour even after permanent residence has been granted. Moreover, such policies also affect the expected returns to emigrating in the first place for different groups of individuals, and thus immigrant

39. Policies similar to those we investigate here are in place in various countries. Immigrants to the UK, for instance, can apply for a permanent residence card after 5 years (https://www.gov.uk/apply-for-a-uk-residence-card/). Similar possibilities exist for non-EU immigrants to Germany (http://www.bamf.de/EN/DasBAMF/Aufgaben/Daueraufenthalt/daueraufenthalt-node.html) and EU15 and EFTA immigrants to Switzerland (http://www.swissinfo.ch/eng/work-permits/29191706).

40. See https://www.gov.uk/settle-in-the-uk/y/you-have-a-work-visa/tier-2-general-visa for details on the requirements for settlement in the UK under this route.

41. For instance, immigrants applying for settlement in the UK need to pass the so-called "Living in the UK" test, as well as meet English language requirements (https://www.gov.uk/settle-in-the-uk/y/you-have-a-work-visa/tier-2-general-visa). Similarly, the German Residence Act of 2004 states that "A foreigner shall be granted the permanent settlement permit provided that […] he or she has a sufficient command of the German language, …" (Bundesministerium der Justiz und für Verbraucherschutz, 2017).

TABLE 6
Immigration policy

Panel (a)		**Policy**		
		Scheme I	Scheme II	Scheme III
Outcome	Baseline without restrictions	Permit if in work and earning above €20,000	Permit if above 30th percentile of host country human capital	Permission declined at random with 30% probability
Average annual gross earnings during years spent in the host country	25,142.16	+2,201.24	+2,072.20	−1,940.95
Average annual taxes paid by those in the host country	3,973.86	+781.72	+788.52	−632.83
Earnings tax	2,106.58	+620.61	+590.75	−434.54
Consumption tax	1,867.28	+161.11	+197.77	−198.29
Change in tax paid per capita among entire initial arrival cohort (thus accounting for taxes lost from migrants leaving)		−1,360.95	−651.11	−1,921.16
Average annual consumption during years spent in host country	16,975.29	+1,464.66	+1,797.92	−1,802.64
Panel (a)			**Policy**	
Outcome	Baseline	Scheme I	Scheme II	Scheme III
Reduction in immigration		−26.32%	−3.43%	−26.61%
Voluntarily return in first 5 years	9.29%	23.14%	34.35%	20.88%
Enforced return in Year 5	–	22.49%	17.00%	24.70%
Decrease in gain from migration for individuals with				
Low preference, low productivity		−19.92%	−27.10%	−10.92%
Low preference, high productivity		−15.89%	−22.02%	−8.99%
High preference, low productivity		−32.44%	−2.72%	−24.27%
High preference, high productivity		21.67%	−1.55%	−26.13%

Notes: Simulations based on 40,000 individuals per policy regime, who at age 25 in 1970 decide to migrate from Turkey to Germany. The reference is a regime of free duration choice. The table shows the effects of schemes under which residence permits beyond 5 years are granted (I) to immigrants surpassing and earnings threshold of €20,00; (II) to immigrants who at least achieve the 30th percentile of host country human capital; and (III) at random with 30% probability. Taxes include both earnings and consumption taxes. All monetary units are deflated to 2005. Welfare changes are computed for the time of arrival.

selection. Subtle differences in immigration policies will therefore have lasting impacts on the composition and behaviour of immigrant populations.[42]

4.4.1. Comparing policy schemes. To illustrate and compare the impact different policy schemes have on behaviour and selection, we consider here a cohort of individuals who at age 25 in 1970 choose to migrate to Germany during the period of the guest–worker programme, and whose right to stay permanently is determined 5 years after arrival.

The first column in Panel (a) of Table 6 shows mean annual earnings (in Euros) during all years a migrant is in the host country, taxes paid, and annual consumption expenditure for the

42. For an analysis of integration policies aimed at eliminating barriers to occupational entry for permanent migrants, see the recent paper by Lessem and Sanders (2020).

baseline scenario with no restrictions imposed. Under Scheme I (second column), immigrants who do not pass the earnings threshold are forced to leave the country after 5 years. This policy selects high productivity migrants, resulting in average annual earnings gains among the resident migrant population of €2,201 if benchmarked against the baseline scenario, and an increase in tax payments of €782 (€621 in income taxes and €161 in VAT).[43] However, the policy also affects return migration, with a higher fraction of migrants leaving within 5 years (either voluntarily in anticipation that a permanent stay is unlikely, or involuntarily, see Panel b), so that the changes in Column 2 are driven both by composition effects and behavioural adjustment. Moreover, since the restriction imposed by this policy induces voluntary returns and leads to temporarily unemployed individuals leaving, overall tax contributions per capita of the initial immigrant cohort are reduced by €1,361 per annum.[44]

Next, consider Scheme II, which grants a permanent residence conditional on meeting a host country human capital requirement. Since immigration generally is biased towards individuals with a high preference towards the host country, who after migration are more willing to invest in host country human capital, such a policy deters only a small proportion of individuals from migrating. This policy further increases the investment incentive for immigrants who in the absence of the policy would have chosen to stay beyond 5 years, but would have invested less than the required threshold, thus generating a positive effect on earnings, consumption, and taxes paid per capita, with an average annual tax gain of €789 (see Column 3). This policy leads to a tax loss of €651 per capita (across all arriving immigrants) due to individuals leaving the host country earlier than under the baseline scenario.

The last column of Table 6 shows the effect of Scheme III, introducing uncertainty about being granted permanence at a future date, where we assume that individuals are randomly declined permanence with a 30% probability after 5 years. As the possibility of having to leave after 5 years reduces the expected return to investments in host country-specific human capital, this decreases average annual earnings over the life cycle by €1,941, leading to lower consumption expenditures, as well as to a reduction in fiscal contributions, with an average annual decline in taxes of €633 per immigrant. Accounting for those who are induced to out-migrate due to uncertainty or forced to leave in Year 5, this increases to €1,921.

Panel (b) shows that each of these schemes has a strong effect on migration durations, with between 21% and 34% of immigrants leaving voluntarily within the first 5 years, in anticipation of potentially being forced to leave. Moreover, these policies also influence the composition and number of newly arriving immigrants. Whereas Scheme II—which favours immigrants with a strong preference for the destination—only has a small effect on total immigration, Schemes I and III reduce immigration by about 25% (see row "Reduction in Immigration"). In addition, policies such as the ones studied here will affect not only the overall inflow but also the composition of those who emigrate in terms of unobserved preferences and productivity. This can be seen by comparing the effects on welfare of different types of immigrants contrasted to the baseline scenario (last four rows of Panel (b)). For instance, lifetime welfare for high preference immigrants is substantially reduced under Schemes I and III, while Scheme II is relatively more attractive for this type.

It is important to note that our model is silent about equilibrium effects. Incorporating equilibrium effects would foremost allow wages to adjust to changes in immigration. If the wage elasticity of immigration were negative, and the policies we investigate reduced immigration and shortened migration duration, immigrants' earnings and tax payments could be more positive than predicted by our model. However, wage effects of immigration are found to be small, if at all

43. Our approximation of the earnings tax schedule is described in Supplementary Appendix B.1.
44. Whether this leads to an overall fiscal gain or loss depends on transfers and welfare payments to immigrants.

present.[45] Moreover, the policies we study affect only a very small share of the overall workforce. We therefore do not expect these second-order effects to affect our results in any substantial way.

5. CONCLUSIONS

An immigrant's decision to leave the host country before the end of one's productive life is an aspect of migration as fundamental as the initial migration decision itself. Yet although the decision to emigrate has been studied extensively, far less is known about immigrants' decisions to return migrate, and how this affects other aspects of behaviour well before the return date.

In this article, we develop a framework that models this decision in a context of uncertainty, and where individuals can revise their migration plans over the migration cycle. We show that return plans are an important source of heterogeneity in immigrants' earnings and career profiles, and an essential driver for a type of selective outmigration that is unrelated to unobserved ability, with important implications, among others for the estimation of immigrants' earnings equations. Return plans also affect immigrants' reservation wages, thereby explaining why many immigrants are willing to take jobs for wages unacceptable to natives. Moreover, the relation between immigrants' career paths and the expected migration duration implies that migration policies that introduce restrictive conditions for permanent residency not only affect immigrants' careers and contribution to the host country but also selection of those who out-migrate, and the composition of new arrivals.

By emphasizing the interplay between immigrants' return plans and their decisions and choices over the migration cycle, this article highlights novel aspects for the evaluation of immigrant selection, the determinants of their earnings paths, and the way policies impact on immigrant welfare and on host country populations. The issues we raise in this article have important implications for the evaluation of welfare effects of immigration, and for the design of migration policies.

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Supplementary Data

Supplementary data are available at *Review of Economic Studies* online. And the replication packages are available at https://dx.doi.org/10.5281/zenodo.5795066.

Data Availability Statement

The data and code underlying this research is available on Zenodo at https://doi.org/10.5281/zenodo.5795066.

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45. The survey by Longhi, Nijkamp and Poot (2005) reports mean and median wage elasticities of −0.12 and −0.04 in a sample of 345 estimates collected from the literature. A study that estimates the wage effect of immigration for our context is that by Bonin (2005), who uses German register data for 1975–1997, and finds an elasticity of −0.10. To investigate this further we conduct robustness checks by using wage elasticities reported by Bonin (2005) and Monras (2020) to estimate upper bounds of possible equilibrium effects and found little changes to our results. Results are presented in Supplementary Appendix E.

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