On the Prognosis of Third Generation Migrants' Occupational Status in Germany

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Abstract

This article introduces the modelling of the future development of third generation immigrants' occupational status in Germany for a period of 30-40 years. It focuses on the connection of this development with the change of the ethnical and socio-structural population composition, the latter being formed by demographical change and, especially, by migration history. These changes of the population composition are assumed to influence the state of integration of the third generation (composition effects) in addition to causal mechanisms. The method being used is the dynamic microsimulation, which – by its modularized structure and stochastic extrapolation technique – allows to model multidimensional processes that cannot be simply formulized by mathematical functions. First findings suggest that using this approach the demographic development can be decently reproduced. Furthermore, a weak composition effect was identified.

Key Words: Microsimulation, future projection, panel analysis, migration research, demography

1. Introduction

Through mass immigration, Germany has evolved to a country of immigration since the 1960s. Currently, most immigrant groups in Germany are significantly disadvantaged in many areas of life. The extent of these disadvantages varies depending on the observed group of migrants or the considered attribute. There are important disadvantages at almost all stages of the educational career (choice of the kindergarten: B. Becker 2010, B. Becker & Biedinger 2016; school enrolment: Tuppat & B. Becker 2014; transition to secondary school: Kristen & Dollmann 2010, Dollmann 2016; graduation: Gresch & Kristen 2011). Furthermore, in numerous studies strong disadvantages can be found for various indicators of occupational status that are in large part due to time preceding educational disadvantages (Diehl et al. 2009, Imdorf 2011, Damalang & Haas 2006, Brück-Klingberg et al. 2011, Seibert & Solga 2005, Sürig & Wilmes 2011, Kalter et al. 2011, Basilio & Bauer 2010, Sürig & Wilmes 2011, Erlinghagen & Scheller 2011, Hunkler 2016).

Ethnic disadvantages do not occur only temporarily immediately after immigrating. They are often reproduced in the second generation (Kalter et al. 2011: 257, Kalter 2008a, Diehl et al. 2009: 49, Treichler 2014: 208, Olczyk et al. 2016). However, these studies show that, compared to the first generation, in the second generation most groups were able to reduce their drawbacks significantly. Whether such findings indicate a transgenerational establishment of inequality between migrant groups and the societal mainstream or a process, in which ethnic inequality *does* reduce, but rather slowly, is discussed controversially (Esser 2008). This question remains a fundamental issue in the field of migration research (Alba 2008, Portes & Rumbaut 2006, Zhou 1999).

The project presented here shall contribute to the answer of this question. First results are shown in the course of this paper. The project is called “Longitudinal modelling of the future development of occupational status in the third generation of migrants using the dynamic microsimulation”, which is funded by the German Research Foundation. Main goal is to model the middle-term (30-40 years) future integration development of third generation migrants living in Germany. The specific feature of this modelling approach is that the development of integration is connected to the demographically induced change in the ethnic and socio-structural population composition. This allows studying the effect of the interaction of causal mechanisms with composition effects on the development of (labor) integration (in the third generation of immigrants). The focus lies on the third generation, since it is the first generation whose parents were born in Germany. Thus, the integration development in this generation is particularly ground-breaking for the long-term integration development.

The research question can be examined only with a future projection, since the majority of members of the third generation of immigrants is just growing up or is not even born yet. A broad empirical database is available to model the development of relevant mechanisms for integration. Likewise, natural changes of the population can be traced well with official data. Furthermore, since demographic processes (if one excludes migration) are relatively sluggish, they can be reliably projected into the future. The future projection is realized using the dynamic microsimulation.

Firstly, the state of migration research is outlined in “Theoretical Background“, considering in particular the integration of immigrants living in Germany. This section reveals immediately that a future projection of the integration development in the third generation of migrants is necessary. In “Methodical Considerations”, the potential and the limitations of a simulative prediction method in the context of the present research question are discussed and the chosen method (dynamic microsimulation) is introduced. In the following sections, the simulated model is specified in the light of previous theoretical considerations and empirical analyses. A presentation of the results for a first simulated scenario follows. The paper closes with conclusions and an outlook regarding further work in this research project.

2. Theoretical Background

How ethnic inequality respectively integration/assimilation[1] of migrants in Germany will develop in the future is controversially discussed in the field of migration research. Subject

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[1] Ethnic inequality exists when the distribution of a “vertical” attribute significantly differs between migrant groups or between particular groups of migrants (also: combined to a large group of “people with a migration background”) and the autochthone population (examples of the countless studies about ethnic inequality: Alba et al. 1994, B. Becker & Biedinger 2006, Kalter 2008a, Siegert & Roth, 2013). The term “ethnic” is misleading, as he does not necessarily refer to “ethnic groups” (for a critical inspection see Wimmer 2008) in the German migration research, but to analytically disjunct migrant groups. Here such a view is followed, in which it is not assumed that these groups have a sense of community and a separate identity. The terms assimilation and integration are inconsistently used and rarely precisely delineated. Hartmut Esser is one of the few who strictly systematizes these terms (1980, 1999, 2001, 2009). In his logic, assimilation can be regarded as a special case of integration, where immigrants give up caring and expanding their origin-specific

of the basic research in this area is the question whether almost universal patterns of incorporation exist for migrants in a host country, which can be applied to diverse migration situations and thus allow a reliable forecast of the future development of integration. However, until now, no clear forecast can be derived from basic studies:

In traditional integration approaches (in the context of immigration to the United States: Park 1928, Eisenstadt 1953, Taft 1953, Gordon 1964) assimilation was – despite some restrictions – the only expected outcome of the incorporation process of migrants (Kalter 2008b). However, this automatism is doubted since at least the empirical finding of "anomalies" in the United States in the 1960s (Zhou 1999: 197). In this context, competing approaches evolved (e.g. Alba 2008, Portes & Rumbaut 2006, Zhou 1999; for an overview see Esser 2008, Ballarino & Panichella 2013), from which different predictions can be derived.

All these concepts are characterized by a relative openness in respect of the future development of the integration of migrants. Therefore, a "successful" integration, in the sense of the absence of ethnic inequality, is from this perspective only *one* possible outcome of a contingent process, which is subject to certain conditions and mechanisms. These mechanisms can in turn be influenced by different, sometimes hardly predictable events and developments (e.g. political interventions). Projections of the future development of integration should therefore always be based on *scenarios*. A precondition to create well-founded scenarios is a previous empirical research of the mechanisms that favor integration or vice versa solidify ethnic inequality.

The most important attribute from the perspective of the research on social inequality (Kalter & Granato 2002, Lindenberg 1986) is the occupational status (Esser 1999, 2001). For this reason, this attribute serves as the main dependent variable when integration mechanisms are analyzed. The occupational status itself mainly depends on the formal education acquired in the educational system, whereas the acquisition of such certificates in turn heavily depends on ethnic and social origin (Kalter et al. 2011).

However, it is not enough to reduce the pool of relevant receiving-country-specific resources to education certificates and parental resources. In addition, the receiving-country-specific *cultural* and *social* capital is also able to explain a relevant part of ethnic inequality referred to occupational status (social capital: Granato 2009, Hunkler 2010, Schacht et al. 2014, Kalter 2006; language as a cultural capital: Esser 2006, Gresch & Kristen 2011, Hunkler 2010, Dustman & Soest 2002, Kempert et al. 2016). Moreover, to get a nearly complete picture, the "institutional side" (school, employers) has to be considered, because institutions can contribute to ethnic inequality – either through support (reduction of inequality) or through direct or indirect forms of discrimination (increase of inequality: Radtke 2004, Gomolla & Radtke 2009, Fereidooni 2011, Imdorf 2011, Sprietsma 2009, Fibbi et al. 2006, Bertrand & Mullainathan 2004, Diehl & Fick 2016).

To sum up, the future integration on the labor market results from the interaction of different mechanisms. This interaction has to be modelled as precisely as possible when creating

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capital (such as the native language and contacts with people of the same origin). Since it is not necessary in this project to distinguish between assimilation and other forms of integration, both terms are used interchangeably. Further, since migrant groups are focused and no single individuals, ethnic inequality can be understood on such a group level as the absence of integration/assimilation.

a prediction model. Only when the constructed scenarios are based on empirically well-funded knowledge the scenario-conditioned forecast may turn out to be reliable.

However, the future development of the occupational status of migrants does not only depend on mechanisms that influence the professional status at the individual level causally. Demographic processes[2] can also have an impact on this development by causing composition effects (Kalter & Granato 2002). When considering particular generations of migrants, it is often not considered that their age structure and their composition by countries of origin can change over time. This is especially true for Germany, since larger groups of migrants have immigrated in different time slots (Gresch & Kristen, 2011: 213). In addition, these gradually immigrated groups differ significantly in terms of education. Following this and some plausible assumptions[3], the composition of a succeeding generation (like the second or third one) with different "successful" migrant groups logically changes over time. Therefore, even if fertility rates, life expectancy and the distribution of educational and professional success would remain perfectly constant within migrant groups, the average performance of this generation would still change with time. This is meant by composition effects here. Thus, when modelling the future integration development, composition effects triggered by demographic processes have to be considered as well. Only then, it is possible to obtain a forecast result which is generated by the interplay of causal mechanisms on individual level with composition effects.

The focus regarding the future integration development lies on the *third* generation of migrants. For this generation, as opposed to the second generation, the effect of *social origin*, which is central for education and occupational status, is no longer affected by the necessity to transfer capital acquired in the country of origin by the parents. This is because parents of members of the third generation are already born in Germany. Due to the significant distance of this generation to the act of migration, the integration in the third generation is an important stage in the intergenerational integration development.

Empirical analyses with respect to the performance of the third generation in the education system can be found, inter alia, in Kristen & Dollmann (2010), B. Becker (2011) and Hans (2015). However, to our knowledge no study concerning *the occupational status* of this generation exists. This is most likely because the majority of the third-generation members are still growing up or are not yet born. Nevertheless, there is already an enormous amount of empirical information (social origin, intermediate stages in the education system), which makes it possible to estimate the distribution of professional status (and its development) in the third generation reliably by a future projection.

Finally, it should be noted that there are three main motives to conduct a future projection based on current integration trends here: Firstly, we are, as described above, interested in the *future* development of integration of persons living in Germany with a migrant background for theoretical reasons. Secondly, the focus lies on migrants from the *third* generation. Since their members are still too young on average, to analyze their achievements on

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[2] About the demographic transition in Germany see e.g. Kluge et al. 2014, Birg 2003, Sommer 2007, Fuchs 2009, Statistisches Bundesamt 2009.

[3] A strong effect of social origin, which is exhaustively documented in Germany, needs to be assumed also for migrants (e.g. Kalter et al. 2011), along with some demographic regularities (e.g., that in all groups the mean age when becoming the first and following children is similar and that there is no selective and significant childhood mortality – which is not the case in Germany).

the labor market with existing data, knowledge about the integration development in this generation can only be obtained via a forecasting method, especially because demographically caused composition effects also influence this development.[4] Thirdly, our intention is to show that a future projection, in particular a microsimulation, is an appropriate method for studying relevant sociological questions.

3. Methodological Considerations

3.1 Why Projection Instead of Analyzing Existing Data?

The third generation of immigrants, who came in the course of the labor recruitment in the 1950s and 1960s or during the wave of resettling from Eastern Europe to Germany, has a low average age. Most of the third-generation members are children, adolescents, or not born yet. In addition to that it is difficult to identify members of the third generation in popular datasets in Germany.[5] Only a few data sources allow such an identification requiring high efforts to connect the cases among each other. Therefore, an analysis of the development of occupational status of the third generation with empirical data is actually not possible. With a future projection, however, there is already a way to make statements about this development – even now. This option is rarely used or even considered in the social sciences because of existing reservations (Gilbert & Troitzsch 2005). Particularly, the attempt to make statements about processes and states in the future, is viewed skeptically (ibid.). This is caused, inter alia, by the poor fit of statistical models compared with empirical data – especially in the field of sociology. Often, a significant amount of unexplained variance remains, which prevents a prediction with an acceptable level of safety. In addition, many developments that are of particular interest for sociologists can be significantly affected by unforeseen events and policy interventions.

This skepticism is caused by the incorrect assumption that with prediction methods a real prediction of the future is sought. However, prediction models can also be understood as quasi-experimental designs, which measure the extent of the response to a stimulus (ibid.: 26). This can help to understand how a development could look like when the conditioning factors of these development have such a complex interplay that a reliable prediction of this development is not trivially achieved by simple logical reasoning or calculating.

This paper focusses on the interplay of demographic processes that can trigger composition effects in conjunction with developments on the individual and group level. With the here presented approach it is possible to examine the overall performance in the third generation of immigrants for the case that the effects of causal mechanisms (e.g., mediated by political interventions) interact with the demographically induced change in the composition of this generation. Since the processes, particularly the demographic transition (Birg 2003), are assumed to be dynamic and non-linear, the result of such an interaction cannot be calculated with a simple model of multivariate statistics, which requires committing oneself to known mathematical functions and probability distributions.

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[4] In fact, the National Education Panel Survey (NEPS; Blossfeld et. al 2011) constitutes a new, very detailed data source for investigating education. Due to its used instruments, it also allows to identify migrants from the third generation. However, the panel is quite new and needs some more years (waves) to achieve a level of accumulated information that makes it valuable for conducting analysis with it.

[5] It is not sufficient to ask, whether the parents are born in Germany (as it is the case for the second generation). Information about the grandparents are needed.

In addition, this approach allows for the first time to systematically test various controversially discussed hypotheses about the future integration development of migrants living in Germany, accounting for demographic dynamics.

3.2 Methodological Requirements

The main goal is to model the future development of occupational status of third generation migrants, which results from the interaction of causal mechanisms at the individual level with the demographically induced change in the composition of this generation. Since occupational status and demographic change are subject to processes at the individual level (language acquisition, education, labor market performance, bearing children, dying, etc.), the method must allow for modelling causal mechanisms at the individual level. In addition, although developing independently to a certain degree, these processes have to be modelled jointly. Therefore, a modularization of processes should be possible.

Additionally, a *development* should be projected and not just a *state* at a point in the future. Therefore, the extrapolating method must allow for recursive updating over multiple time points. Since the relevant causal mechanisms are formulated at the individual level, the projection should result in a longitudinal data set at the individual level, which can be aggregated for particular time points within the update period. Only then, causal effects can be separated from compositional effects.

All these criteria are fulfilled by the *period-oriented dynamic microsimulation* (Sauerbier 2002, Gilbert & Troitzsch 2005, Leim 2008, Hannappel & Troitzsch 2015). Alternative equation-based projection methods, such as conventional statistical methods (e.g., structural equation modelling) or macro simulations are not suitable, because they require to specify the relationship between the professional placement and its mechanisms by a connected set of mathematical functions in advance. Furthermore, a macro simulation reaches modelling limits fast when partitioning an aggregate into subgroups (Gilbert & Troitzsch 2005). This is incompatible with a big set of connected/nested hypotheses at the individual level.

The more popular method, the agent-based simulation of connected actors, appears to be inappropriate in the present case (for a review see for example Flache & Mäs 2015, Gilbert & Troitzsch 2005: 172-198). This approach focusses on developments at group level (groups of migrants by country of origin and generation), which are subject to *results* of acting individuals, rather than to interactions between individuals. Certainly, these results are highly dependent on interactions and negotiations between individuals. However, the quantitative analysis of the nature of interactions (starting, maintaining, finishing interactions) is not as well advanced in the social sciences, such that quantitative parameters could be delivered for a simulation without a huge amount of arbitrary decisions. It is furthermore important for the present research question to extrapolate a dataset which is large and representative for the population living in Germany, containing up to hundred attributes per person. This is not a main feature of agent-based simulation of networked actors.

3.3 The Period-Oriented Dynamic Microsimulation

A big advantage of a microsimulation in general is the possibility to implement very detailed empirical information which allows to mimic the “reality” (especially non-linear dynamics) accurately. A huge dataset at the individual level (e.g., n = 200,000; several hundred variables) can serve as starting data, such as a microcensus from official statistics.

Given that the extrapolation is organized by separate modules, a high number of extrapolation parameters can be specified, which can also be estimated empirically.

In the microsimulation, primarily attributes of *individuals* from starting data are extrapolated, but it is also possible to model processes at meso- and macro-level as well as cross-level-feedback-processes. The extrapolation works stochastically/non-deterministically, which also makes the modelling more realistic. Therefore, with this stochastic approach it is for example possible to implement the error variance from a regression model into the simulation as a random distribution, which affects the simulated values (with good reason). The extrapolation of an attribute *y* is organized in a so-called *module*. Core of a module is an updating algorithm (Leim 2008: 38 f.). It guarantees, inter alia, that only persons pass through the module of *y*, whose values of *y* may change. This can prevent that, for example, women between 80 and 90 years go through the birth module – or men. If relevant for *y*, the algorithm also checks to which subpopulation a person belongs. This is the case, when assumptions exist, on which attributes *y* depends. The whole population is then divided into subpopulations according to the combinations of the values of these attributes. The parameters for extrapolating are then estimated for each subpopulation separately (e.g., probability to die for men aged 75 or for women aged 80).

The stochastic updating technique in its classical form (see below for an extension made here) bases on cumulative relative frequencies for the values of *y*, estimated from empirical data. These frequencies are interpreted in the simulation as cumulative probabilities (Hannappel & Troitzsch 2015: 461 f.). If assumptions exist, on which attributes *y* depends, then for each subpopulation (each combination of the values of the independent variables) a separate frequency distribution of *y* is estimated.

In a simulation run, values of *y* are assigned to each individual. If these values can be regarded as events, then it is simulated for each individual whether one of the events has happened or not. In order to realize this, usually a number from a uniform distribution in the interval [0,1] is drawn randomly for each individual. In the next step it is checked, in which co-domain of the cumulative probability distribution the random number falls. The corresponding value of *y* is then assigned to the individual. It is the new simulated *y*-value for the time point at which the simulation actually proceeds.

Finally, the update algorithm reorganizes the dataset subject to the changes during the simulation (for example, when two persons move in together as a simulated event, they have to get a new household id and to be deassigned from the old ones). With this step, the extrapolation of one-time interval (usually one year) is completed. The dataset, which results from this extrapolation, now acts as starting dataset for the next run. This process can be repeated until the desired number of simulated time points is reached (Hannappel & Troitzsch 2015: 466).

If equally long time intervals are updated successively, as just described, this is called *period-oriented*, whereas in the *event-driven* approach, which is not used here, the time until the occurrence of an event is simulated. From this follows that “time” is treated as discrete in the case of a period-oriented microsimulation. The result is an artificial panel dataset on individual level, which can be analyzed with common panel analytical techniques.

With *dynamic* models in the context of microsimulations it is meant that the updated dataset can change in its size and composition (Leim 2008: 30 f.). Further, it is possible to model feedbacks from different levels, which can change the behavior of individuals (e.g., policy interventions). In contrast, in a static microsimulation only the characteristics at the individual level and the weights of the cases are manipulated, which leads to new total values, as for example tax receipts (Flory & Stöwhase 2012). Concatenations of processes and demographically caused changes of the size of a dataset cannot be modelled with this method.

3.4 Software to Conduct a Period-Oriented Dynamic Microsimulation

Currently, only a few software packages exist for the implementation of a dynamic microsimulation, which meet the requirements for efficient processing of complex datasets. Most of them are thematically highly specific, thus not suitable for the purposes of this project.[6] Since the conceptual logic of a microsimulation requires object-oriented programming (Leim 2008: 39), the simulation can be programmed in the object-oriented language of the statistics package R. This also has the advantage that no additional tool for analysis before and after the simulation is needed. An own "free" programming also allows to expand the extrapolation technique, as suggested here, to linear and especially to so-called linear *mixed* models (Rabe-Hesketh & Skrondal 2012). For the present paper, the model was implemented using Stata (for pragmatic reasons). In the further course of the project, we want to switch to R.

4. Implementation of the Simulation and First Results

4.1 Theory-Based Modelling

First of all, the specification of a microsimulatic prediction model requires the formulation of a base model. This base model determines which observations with which characteristics are included in the simulation and how the characteristics are influencing each other. In a second step, rules need to be implemented that determine how these characteristics will change over time based on the settings specified in the base model (projection into a fictitious future). Theory-based (longitudinal-)analysis with empirical data will be conducted here for both steps to build the prediction model on the basis of valid knowledge from the present and early past. However, some of the extrapolating rules are based on unexaminable bridge-hypotheses. This is due to two reasons: Firstly, it is impossible to generate empirical results in some cases – either because there is no existing empirical data on some phenomena in the present or because the data cannot exist yet as the phenomenon itself is going to happen in the future for the first time (like the development of influencing factors on the occupational status of the *third* generation of migrants). Secondly, it is a simulation's main goal to model assumed *to-be-changes* (stimuli) to proof if and how these changes affect the dependent variable(s). As an example, it could be assumed that a political intervention in the future will increase the probability of acquiring higher education for Turkish youths of the second generation stronger than expected on the basis of results from the early past. With the help of the simulation it can then be investigated how this assumed increase would affect this group's labor market performance in contrast to a scenario without this fictitious political intervention.

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[6] Possibly, UMDBS (Sauerbier 2002) constitutes an exception, but its inherent restrictions (the software is rather out-of-date) limit the scope of application (e.g. it can only process 32,000 observations). Meanwhile, more advanced software solutions have been developed, like LIAM2 (Bryon et al. 2011) or JAMSIM (Mannion et al. 2012). In case of a complex model with a particular set of requirements these tools still struggle to deliver the necessary freedom for adjustments. For these kind of tasks, changes at the source code level are inevitable (Li & O'Donoghue 2013: 32).

The base model, which is used here, is illustrated in Fig. 1. As the German Microcensus works as the starting dataset, the starting population in the simulation matches its population-definitions.[7,8] The reason to include the whole population and not only the third generation of migrants in the simulation and analysis is, that demographical changes can only be predicted correctly when information on Germany's whole population is given. Furthermore, the inclusion of the second generation is mandatory if effects of social origin on the third generation's performance are to be simulated.

Fig. 1 shows the characteristics which are included in the simulation and the corresponding effect structures. The occupational status is the main dependent variable. Based on the latest state of research a resource-orientated theoretical perspective is used to explain occupational status (see e.g. Kalter 2006, Esser 2009).[9] The base model was created on this theoretical perspective and was slightly adjusted and optimized after some empirical analysis. A closer look on the illustrated mechanisms reveals educational and occupational degrees as the main resources (Kalter et al. 2011, R. Becker 2011, Seibert & Solga 2005). Besides these, "softer" receiving-country-specific resources like cultural and social capital (see e.g. Kalter 2006) need to be considered. Above all, institutions (school, employers) are implicitly considered as sources that can contribute to inequality. This is guaranteed by empirical determining the "net" effect (under control of all other influencing factors) of belonging to an immigration group, which is explicitly not interpreted causally (see footnote 9).

The sub-model for "demography" ensures that natural population movements are modelled separately for each ethnical group. Only then, compositional effects can be generated correctly during the process of simulation. Besides the well documented effect of ethnical group membership on childbearing (e.g. Milewski 2010: 97, Birg 2003), the effects specified here strongly follow a sociologically based microsimulative modelling of the demographical change as seen in Leim (2008) and Wolters (2010).

After the base model's specification, the rules for the prospectively simulated developments are determined in the next step. These rules are then organized in modules. Each endogenous variable defines an own module.

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[7] Total population in private households and institutions with their main and secondary residence in Germany:
Website GESIS: http://missyms.gesis.org/studie/erhebung/studienbeschreibung/ (checked at last 09/08/2016).

[8] Indeed the majority of the simulation is conducted by using the German Socio-Economic Panel (GSOEP). However, the GSOEP's population-definition is almost identical to the microcensus definition (see Spieß 2008 for details).

[9] The effect of the "ethnic group" is not interpreted as causal. It rather represents a catch-all-category which also covers differences due to discrimination against particular ethnic minorities. In the analysis for estimating extrapolation parameters these effects (differences between ethnic groups) are reduced as much as possible in order to explain them with causal mechanisms. The unexplained rest (ethnic residuals, ethnic penalties – Kalter 2006) is, although not causal, included in the simulation to make the model as complete as possible. The implementation of these ethnic-group-effects is also necessary due to technical reasons: In the upcoming scenarios in this project the developments within particular migrant groups will be manipulated. Therefore, for every concerned group an influence parameter is needed.

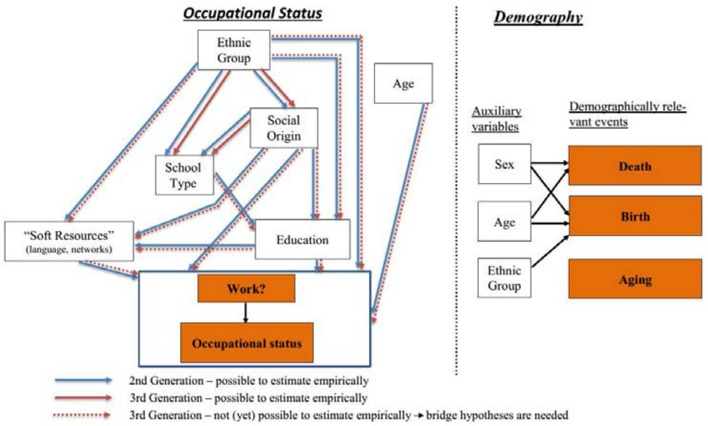

Figure 1: Base model for the microsimulation

For a first scenario, a simple approach is chosen here: Empirical findings regarding the developments in the early past are adopted from longitudinal analysis and serve unmodified as module parameters for groups of observations with the same combinations of attributes (so-called analytical groups) during the extrapolating process in the simulation. Influences, which can be transferred directly from analysis to simulation, are illustrated with solid arrows.[10] However, dashed arrows represent influences which cannot be estimated reliably for the analytical groups. In this context, these are influences in the third generation of migrants which refer to characteristics during the advanced adolescent- and early-adult-ages. Because of this, the unexaminable assumption is formulated, that these influences are identical to those from the second generation. Such a first scenario builds the basis for investigating whether the assumed compositional effects can be reproduced in the simulation or not.

In the next step of this project, which is not yet done, theory-driven scenarios are going to be defined, which can model the developments *within* different groups of migrants and which illustrate processes of mobility between generations of migrants. For example, such developments could arise due to consequences of interventions in education-policy (better support for migrants) or changes of the social climate (like a decrease/increase of discrimination against migrants). With the help of statistical methods, it will then be possible to distinguish in the simulation results between effects of exactly these processes and compositional effects.

4.2 Empirical Analysis (Extract) and their Implementation into the Simulation

Due to lack of space only one example for results from longitudinal analyses is reported. From those results, extrapolating parameters for the simulation are derived. Table 1 shows regression models for the crucial dependent variable "occupational status".[11] The population under analysis consists of all identified persons with second generation migration background as well as natives as the reference group from the German Socio-Economic Panel (GSOEP), if valid values on all variables exist for these observations. Self-programmed cross-references (connecting children with their parents) were needed to ensure

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[10] Furthermore, it is possible to estimate all depicted influences for natives as well as for the first generation of migrants. This is not explicitly shown here.

[11] "Occupational status" has been operationalized with help of the vertical magnitude-prestige-scale (Wegener 1988). The scale was logarithmized due to its skewness.

reliable assignments of social origin (education and occupational status). These cross-references use the full potential of the GSOEP-data.

Since occupational placement is, especially due to its crucial age-effect, a time varying variable, random-effects-models were used for analyzing the panel-data (Rabe-Hesketh & Skrondal 2012, Hsiao 2014). Through a decomposition of the residual into a person-specific time-constant part and a time-varying leftover it is considered that a repeated survey of a person cannot be seen as a stochastically independent process referring to a person's first survey. In accordance with integration research's common practice hierarchical modelling techniques are used (see e.g. Kalter 2006): Firstly, the influence of the migrant group (under control of age and sex) is introduced to investigate in the next steps whether this influence can be reduced by adding independent variables derived from resource-theories.[12] Indeed, the consideration of one's own level of education and social origin leads to a distinct reduction of the non-causal effect of belonging to a migrant group (= reduction of group differences). It further confirms the common finding that influences of these resources are highly significant. This is why model 3 (grey) is adopted for simulation purposes. Analogous model estimates exist for all other endogenous variables, whereas the specific method is subject to the depended variable's level of measurement and the determination whether the considered variable is seen as time-constant or time-varying.

$$y_{it} = \alpha + \sum_{k=1}^{K} \beta_k x_{kit} + u_i + \varepsilon_{it} \quad (1)$$

Adopting results from such regression models means that the common microsimulation approach, which derives extrapolation parameters from cross-tables of empirically investigated frequencies (see e.g. Leim 2008, for details see Hannapel & Troitzsch 2015: 462, see above), needs to be extended (see Milne et. al. 2015 for a similar application and McLay et al. 2015 for a general overview). Indeed, dependent variables' probabilities can be distinguished (e.g., likelihood of dying depending on one's age) with the common approach. However, if too many characteristics are controlled simultaneously, the number of cases in each cell is likely to decrease substantially.

Therefore, the estimated regression equations derived from the empirical panel analysis are implemented into the microsimulation to predict simulated values and to overcome this problem. The stochastic updating-element in the case of a random-effects-model (see equation 1) is defined by randomly drawing both residual components (highlighted in grey) for each individual. The person-specific error u_i is drawn once in the simulation, whereas the residual ε_{it} is calculated randomly in every simulation wave.[13] Adding both residual values to the fixed part of the equation results in the simulated y-value for each individual.

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[12] Until now any consideration of "soft resources" is missing. Sophisticated multiple imputation techniques are needed to cope with a severe design-induced item nonresponse to avoid a drastic loss of sample size because different questionnaires with different filter management were used in the GSOEP over the years. This development is not yet completed.

[13] For both error components i.i.d. is assumed and both are normally distributed: $u_i \sim N(0; s)$ and $\varepsilon_{it} \sim N(0; t)$. They are independent from each other and independent of the independent variables. s and t are estimated by variances which are calculated from the empirically determined residuals' parts for the analyzed sample.

In contrast to this “linear” method to extrapolate *values* stochastically in the simulation, in the case of categorical dependent module variables, the *probability* for a category or event (for example, the probability to die in the case of the death module) is determined on the basis of the estimated equation in a [random-effects] logit model, given meaningful independent variables [and the randomly drawn person-specific intercept].

Table 1: Longitudinal regression of occupational status

Occupational Status		***Random effects models (three variants)*** ▨ Chosen for simulation		
Country of origin	Germany	*Reference*	*Reference*	*Reference*
	Turkey	-0.314 ***	-0.063 ***	0.019
	“Foreign Worker”-Countries	-0.275 ***	-0.024 *	0.041 ***
	Eastern Europe	-0.151 ***	-0.059 ***	-0.017
	Other	-0.027 **	-0.013	0.023
Sex	Male	*Reference*	*Reference*	*Reference*
	female	-0.054 ***	-0.063 ***	-0.081 ***
Age	Age	0.013 ***	0.016 ***	0.013 ***
	Age^2	0.000 ***	0.000 ***	0.000 ***
Social origin	Education parents		0.026 ***	0.008 ***
	Occupational status parents		0.003 ***	0.002 ***
Resources	Education			0.140 ***
Dependent variable: magnitude prestige scale logarithmized; own computations; database: The German Socio-Economic Panel (1984-2012); *p < 0.1 **p < 0.05 ***p < 0.01.	Intercept	3.811 ***	3.767 ***	3.318 ***
	sd(Intercept)	0.353	0.327	0.274
	sd(Residual)	0.155	0.161	0.161
	ρ	0.839	0.805	0.742
	Chi^2	6,044.670 ***	6,134.330 ***	15,905.420 ***
	r^2 within	0.012	0.019	0.020
	r^2 between	0.076	0.157	0.391
	n (individuals)	39.271	22.151	21.083
	N (person-years)	263.873	127.755	124.540

4.3 Modules and Life-Course-Perspective

Fig. 2 shows which individuals go through which module at which age in the simulation. Module variables that are unlikely to change once a “crucial age” is reached are kept constant such that the models do not grow unnecessarily complex (this applies mainly for social origin and educational background). Two transitions are modelled referring to schooling: First the transition from elementary to secondary school at the age of eleven. Secondly, individuals who do not already attend higher education schools (Gymnasium) after this transition, are given the chance to change to these schools at the age of 16 in the simulation (this reflects the real situation in Germany).

Occupational status is modelled in two steps. First, it is ascertained whether a person is employed or not. Only if this is the case, the occupational placement is simulated. An indirect life-course-perspective follows from the fact that occupational placement is modelled in strong dependence of the individual’s age. However, no autoregressive processes are generated by making the actual occupational placement depended on its predicted value, because predicting coherent life-courses is not the aim of this model. It is more important to get reliable results on group level in order to investigate compositional effects further. Modelling autoregressive processes is not mandatory needed for this task. However, adding autoregressive elements to the regression models from tab. 1 would be possible without much effort.

For details on the organization of the demographic modules “birth” and “death” it is needed to refer to Leim (2008) and Wolters (2010) due to lack of space.

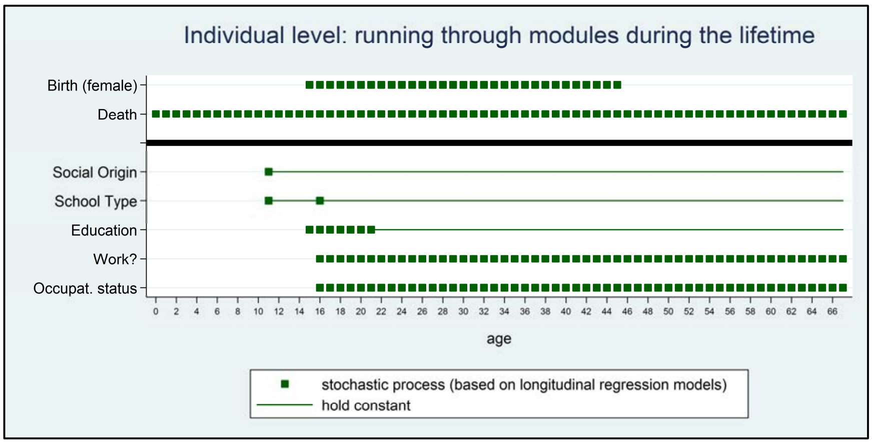


Figure 2: Modules in the microsimulation model

4.4 Starting Dataset for the Simulation

The scientific-use-file of the German Microcensus 2009 serves as the starting dataset. This dataset portrays Germany’s demographic structure, especially combinations of country of origin and generation, at a sufficient level. Although there are more recent microcensus-datasets available, this rather old dataset is used, because questions regarding the origin of the participants’ *parents* are asked in addition to the standard questions (participants’ country of birth, chronology of citizenship) every four years since 2005 (MZG 2005). Thus, the identification of secondary generation members becomes possible even if their parents do not live in the same household. Pre-analysis showed, that the addition of household-extern information to household-intern information leads to a significant improvement in identifying persons with migration background, who did not migrate themselves. It further protects from rough miss evaluation of intra-generational age-structures. According to the four-year-rhythm, the microcensus 2013 would also allow such analysis, but has not been available in time.

Table 2 shows the marginal distribution of core variables of the dataset and the mean age in each group. Due to capacity reasons, a ten-percent sample is drawn from the “Germans”, who only serve as the reference category. It becomes apparent that “Germans” are older on average than individuals with migration background. Differences in age are further noticeable within the group of persons with migration background as well. Unsurprisingly, the average age is lower in numerical higher generations of migrants. Nevertheless, there are also differences within generations. The lower average age of migrants from East-European countries in contrast to people from the former recruitment countries like Turkey provides the basis for the development of compositional effects, because due to this age-differences the offspring (2nd generation) from these groups reaches the working age later.

Overall the number of cases shows that the second generation, which is the most important generation for the simulation (because of the crucial effect of social origin for the third generation), is represented in a sufficiently high amount. This even accounts for the particular groups of migrants within this generation.

Table 2: Frequency distribution and mean age by migrant-group and -generation (upper value: mean age; lower value: absolute frequency)

	German	First generation	Second generation	Third generation	***Total***
German	45.34 41,875	(-) 0	(-) 0	(-) 0	45.34 41,875
Turkish	(-) 0	43.52 7,753	15.36 6,423	6.36 806	29.45 14,982
Eastern Europe	(-) 0	42.92 11,222	9.67 3,284	7.18 39	35.32 1,4545
Former "foreign-worker"-countries	(-) 0	48.53 3,563	18.73 2,139	7.53 383	35.47 6,085
Other	(-) 0	43.54 22,709	13.17 8,017	6.85 428	35.22 31,154
Total	45.34 41,875	43.77 45,247	13.90 19,863	6.77 1,656	38.35 10,8641

4.5 Simulation Results

A simulation was conducted with a forecast horizon of 50 years (2010-2060). A time interval compromised one year. Therefore, a longitudinal data set was produced with 50 time points. For space reasons, the general demographic trends are not shown here graphically, but the main points shall be mentioned:

As expected, the population is declining over time. Since the focus is on the third generation of migrants, no new immigration is modelled here. The shrinking of the population (2060 the size of the population decreased to 56.7% of the population in the year 2010) due to low fertility rates is therefore plausible. Concomitantly, the average age is rising in the autochthone population and in all regarded groups of migrants.

The change in the composition of the group with a migrant background *by generations* is also as expected: While at the beginning of the simulation, the first (65%) and the second generation (35%) dominate, the third generation overtakes the first generation in 2050 and almost measures up to the second generation, which is the dominating generation since 2042.

In order to identify composition effects in the third generation, the development of the target variable in this generation must be traced back to the development of the composition of this generation by migrant groups, which differ in their success on the labor market and in the educational system (see fig. 3). It becomes apparent that the proportion of Turkish origin migrants and those from the former recruitment countries decreases over time, while the proportion of migrants from Eastern European countries is increasing. The latter are, as pre-simulation longitudinal analyses show, better educated and have a better labor market performance on average, as the former groups. These differences are projected in the simulation into the future. Additionally, this scenario is constructed in a way that no changes of education and labor market performance *within* the migrant groups can appear. This allows to isolate composition effects easily.

But the fact that the average occupational status develops positively (fig. 3 on the right) has another reason: the strong (quadratic) effect of age on the occupational status (see tab. 1). Since the average age of the third generation (also fig. 3 on the right) naturally grows during the simulation, the projected occupational status necessarily also increases in time. The ethnic composition effect, which is, as expected, less strong than the age effect, cannot surface in that way.

Therefore, this effect of age was controlled in a next step (this was done in the analysis of already simulated data): The distribution of age was kept constant for each simulation step and the analysis was reduced to a specific age group. The young age group of 18-30 was chosen, since, as already stated, members of the third generation are very young on average, when the simulation starts. In order to keep the age distribution constant within this group, in every simulated wave a subsample of the third generation was randomly drawn so that the age was uniformly distributed per wave. This method is subject to a loss of information. This loss is, however, acceptable in order to achieve a perfect age-control (we work on methods to reduce this loss). Nevertheless, a database that allows acceptable illustrations separated by migrant groups is not reached until 2020, so that the starting point for the presented results is 2020 (fig. 4).

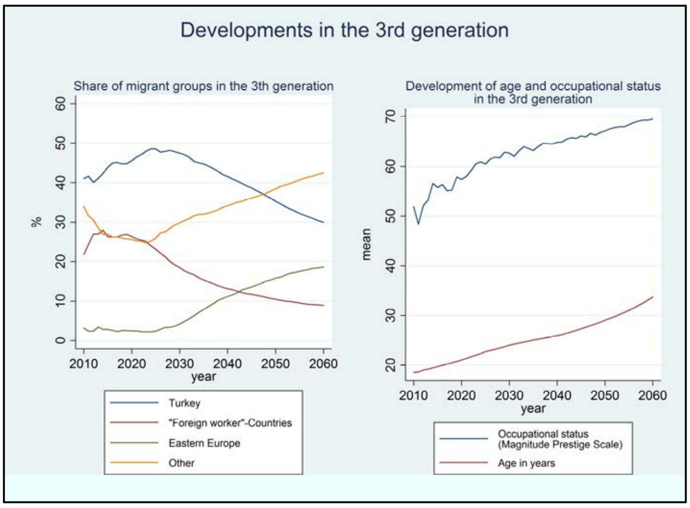
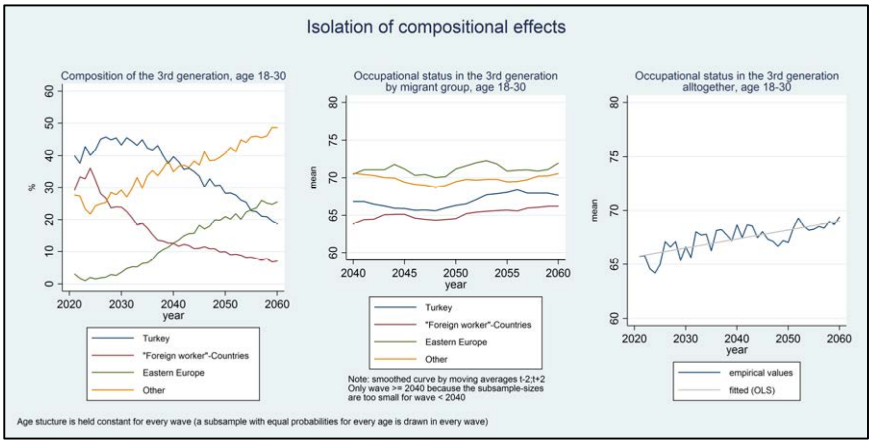


Figure 3: "Absolute" developments in the simulation

Fig. 4 shows the results under control of the age effect. The left graph shows that the development of the shares of the particular migrant groups under age control is similar to the same development without such control (fig. 3). The development of occupational status *within* the migrant groups can be seen in the middle graph in fig. 4 and appears to be relatively constant, in spite of little fluctuations. This follows directly from the constructed simulation scenario here, in which the transition probabilities for occupational success for a particular migrant group are constant during the whole simulation time. Finally, the right graph shows the migration-group-related composition effect. The positive development of the occupational status over time, which is visible in spite of fluctuations, induced by the use of random experiments in groups with small case numbers, *can solely occur due to the changing composition of the third generation* (s. left graph). The OLS regression line, which lies behind the empirical curve, emphasizes the positive effect of time. It is impossible that a trend in *individual* changes caused this result. It solely results from the fact that migrant groups with different educational levels and consequently different labor market performances "enter" the third generation at different time points. In particular, migrants from Eastern Europe, who have immigrated later on average than migrants from the typical recruitment countries, and who therefore reach a significant proportion of the third generation lately in the simulated future, are responsible for the positive slope of the regression line, because they have a relatively good labor market performance (mediated through educational achievements: Segeritz et al. 2010).



Note: smoothed curve by moving averages t-2;t+2
Only wave >= 2040 because the subsample-sizes are too small for wave < 2040

Age stucture is held constant for every wave (a subsample with equal probabilities for every age is drawn in every wave)

Figure 4: Composition effects in the simulation

This composition effect appears to be not very strong. The regression coefficient *b* is 0.084 (highly significant at the 0.1% level – despite the fact that, while testing H0: *b*=0, the aggregated data was treated as individual data, which is dramatically decreasing the sample size). However, the presented simulation here is based on a yet to be optimized database. It is expected that this effect with optimized data (particularly more precise construction of migrant groups) will emerge more clearly.

This simulated scenario pictures a very rigid development, in which the affiliation to a migrant group determines the labor market success - mediated by other variables such as education, which also depend on the migrant group membership. This first model presented here should especially provide the basis to easily check whether the assumed composition effects can be (re)produced in the simulation. In the next step, we want to define scenarios that also model developments *within* migrant groups, based on relevant approaches in migration research. Such developments might result for example from education policies (e.g., better support for immigrants) or socio-climatic developments (e.g., reduction of discrimination). Using statistical methods, it will then be possible to distinguish between the effects of these processes within the migrant groups and composition effects. Following this path, the interplay of causal and composition mechanisms can be understood deeply.

5. Conclusions

First results of an ongoing research project about the future development of third generation immigrants' occupational status were presented, using the approach of dynamic microsimulation. In a first scenario, it was shown that the expected demographic developments can be reproduced and, especially, composition effects regarding the development of third generation immigrants can be identified. The composition effect was extracted in two steps: firstly, the development of occupational status *within* migrant groups was kept constant by the scenario definition. Secondly, the longitudinal age distribution was kept constant by the analysis of the simulation results. By doing so, only the change in the composition of third generation immigrants (by specific migrant groups with varying performance levels) can be made responsible for the observed increase of occupational status of the third generation over time. Thereby, it becomes obvious that the sequence of immigration waves in Germany since the 1950s up to the 1990s possesses the potential to produce composition effects, when a generation of migrants as a whole is examined longitudinally.

As the research projects proceeds, some optimizations are planned. Resulting from theoretical considerations, more scenarios will be created, which allow for the inclusion of differing assumptions about the future integration development. Particularly, changes of the extrapolation parameters *within* migrant groups and in the relation of the second to the third generation will be modelled. Furthermore, it is also considered to model "emigration", as long as empirical hints can be found for emigration to be selective concerning the success on the labor market of migrants living in Germany. In addition, the quality of data (for both the starting data and the empirical analyses) will be improved. Soon the scientific-use-file of the German Microcensus 2013 will be released, which is the most recent dataset of its kind containing additional questions about the parental migration history. Moreover, there are negotiations with the German Federal Office of Statistics about the usage of raw data of microcensus surveys. This is because for the construction of the immigration background and the assignment to a group of migrants as well as to a generation, different information is needed (country of birth, history of citizenship; regarding both the respondent and his parents). However, the values (countries) of the corresponding variables are aggregated differently in the scientific-use-files of the German Microcensus (sometimes, nearly all Western Europe countries are merged to one category, in other cases, the particular countries stand on their own). Common ground in the microcensus is the distinction between four migrant groups as presented in this paper. However, from an integration theoretical point of view, a more sophisticated and precise differentiation of these groups would be essential. If the sample size allows for it, the definition of migrant generations will also become more specific, since there is evidence for considerable differences in the level of integration when a more precise distinction is used (Segeritz et al. 2010).

The regression models resulting from empirical analyses will also be extended. Particularly, "soft resources" such as language skills and the inclusion in inter-ethnical networks will be integrated in the empirical models using multiple imputation methods. For the determination of the probability to give birth, the *education* of prolific women will be prospectively incorporated. Likewise, multiple births will be modelled. Occasionally, the models will be elaborated by the inclusion of additional interaction effects. Furthermore, the models based on the GSOEP have to be replicated employing the microcensus data – where it is possible – to test the robustness of the empirical findings.

Two important steps to validate the quality of the simulation results will follow up these optimizations: With sensitivity analyses, the robustness of the results will be validated as a first step by examining the effects of small changes of the extrapolation parameters on the "overall result". In an unsystematic way this has already been conducted in the presented model and the manipulations only yielded minor effects on the course of labor market integration of third generation immigrants. As a second step an empirical test of the simulation results – a so-called "validation" (Hannapel & Troitzsch 2015: 482 f.) – will be conducted, in which the simulation results for the first years will be compared to available empirical findings. For this task the microcensus 2013 will also be a suitable dataset. Additionally, a reduced form of validation is already possible by adapting the starting dataset based on the microcensus 2009 to the restricted data (no parental migration history for children available, who do not live together with their parents anymore) of the microcensus 2010, and repeating the simulation in consideration of these restricted definitions.

Finally, the simulation will be enhanced to a "real" Monte-Carlo-simulation by repeating the whole simulation several times. Thus, the variance resulting from the random components of the stochastic extrapolation method can be represented and it will therefore be possible to calculate confidence intervals. In the next step, this simulation-inherent variance will be combined with the variance resulting from the fact that the starting data is just a random sample of the interesting population.

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