FAKULTÄT FÜR !NFORMATIK
Faculty of Informatics

Ein Agentenbasiertes Modell von Migrationsflüssen von der Türkei nach Deutschland

DISSERTATION

zur Erlangung des akademischen Grades

Doktor/in der Sozial- und Wirtschaftswissenschaften

eingereicht von

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an der
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An Agent-Based Model of Migration Patterns from Turkey to Germany

DISSERTATION

submitted in partial fulfillment of the requirements for the degree of

Doktor/in der Sozial- und Wirtschaftswissenschaften

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Erklärung zur Verfassung der Arbeit

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To my parents and Deniz

Abstract

Migration is a complicated economic, political, cultural and social issue. From the economic perspective, it means the movement of factors of production from one country to another, thereby changing the relative quantity of factors and returns to all factors of production in the destination economy. This labour market effect is one of the main reasons of controversy on migration. While workers already residing in the destination country who have to compete with immigrant workers feel disadvantaged, employers who hire immigrants are supportive of immigration.

Nevertheless, immigrants are at the same time consumers and household producers. Since they are consumers, they increase the demand for all factors of production in the destination country including labour. Thus, migration need not have a negative effect on wages of national workers. Immigration also contributes to the spread of knowledge from the source country to the destination country and thus can lead to economic growth and long-term improvement of living standards at the destination. Due to these reasons, most economists in immigrant destination countries such as the USA and Europe view immigration more positively than the overall populations (Bodvarsson, Van den Berg; 2013).

The number of migrants over the world has significantly increased in the last two centuries. In 2013, approximately 3.2% of the world population was living in a different country than their country of birth (UN-DESA, OECD; 2013). It is anticipated that, if the trend continues, the share of immigrants in the total world population will reach 4-5% within 25 years (Bodvarsson, Van den Berg; 2013). Since member states of the European Union are among the most popular destination countries because of their political stability as well as economic and social welfare, immigration is a serious issue for the Union. The Turks constitute the largest immigrant community in Europe (approximately 2.7 million people). Thus, migration is one of the most important socioeconomic aspects with regard to EU-Turkey relations.

Migration between Europe and Turkey has been taking place for many decades. Nevertheless, the motive behind migration has changed from nation-building, religious and ethnic reasons in the first half of the 20th century to labour migration, family reunification and asylum seeking in the second half of the century.

The European Union of the 21st century is doubtlessly a different organization from the European Economic Community where Turkey had first applied for membership (Brusse, Griffiths; 2004). On the one hand, the policy areas of the supranational organization have increased immensely; and on the other, the number of member states has grown to 28. Not only has this situation made the Union bigger and politically stronger, but also has the so-called ‘enlargement capacity’ of the EU decreased after the big 2004 enlargement. Moreover, the demographic structure of the Union has changed.

During the continuing negotiation process, the adoption and implementation of the Community acquis has led to significant changes in employment policies and the functioning of the Turkish labour market (Kluve, 2006). Due to the continued economic growth in Turkey in the 2000s, regions in Anatolia have started to reach higher economic standards. Nevertheless, higher unemployment rates, especially youth and female unemployment rates in East and Southeast Turkey persist leading to internal as well as international migration flows. Political developments continue to be another incentive of Turkish migrants.

The point of departure of this dissertation thesis is the above-mentioned dynamic changes in political, economic and demographic structures of the EU as well as of Turkey. The goal of the thesis is to analyse the labour market dynamics in Europe with regard to Turkish immigration after the EU enlargement. Therefore, an agent-based migration model is developed.

The first chapter introduces the research goal, scientific and societal relevance, terminology, problems with the international migration data, the research question and structure of the thesis.

Chapter 2 provides a historical overview of migration flows between Europe and Turkey. It firstly gives a qualitative description of international migration flows to the EU by phases – as defined by Stalker (2002) and Castles, Haas and Miller (2014), respectively. Then, migration patterns towards the EU are described more detailed in decades, followed by the section on migration patterns from Turkey.

Chapter 3 serves as the theoretical base of the thesis. It gives a review of sociological, micro- and macroeconomic, geographical as well as unifying theories on international migration. After comparing the theories in literature, it provides a theoretical framework, which is used as the basis for selecting the determinants of migration in the agent-based model.

The aim of Chapter 4 is to illustrate three different demo-economic models found in literature as examples of deterministic forecasting methods: (i) the Birg model (1982) on the interactions of job creation, migration and natural population increase, (ii) IDEM (Italy Demographic Economic Model) – a multi-regional model for Italy designed for purposes such as regionalizing national macroeconomic forecasts of the Italian Treasury and the evaluation of economic impacts of regional development plans, and (iii) the International BACHUE model investigating relationships between various demographic, economic and income distribution variables over time in a developing economy.

Agent-based models of migration covering different aspects of the phenomenon were reviewed in Chapter 5. Following Klabunde and Willekens' (2016) classification, they were grouped in (i) minimalist models, (ii) microeconomic models, (iii) psycho-social and cognitive models, (iv) models based on heuristics

without direct empirical correspondence, (v) models based on decision theory and direct observation, and (vi) models based on purely empirical, observational rules without mention of a theory.

Chapter 6 then provides the first attempt of an agent-based model of migration flows between Turkey and Germany. Using migration data provided by the German Statistical Office (Statistisches Bundesamt), it aims to reproduce the migration patterns from 1991 to 2015, by taking economic and political factors in the source and destination countries and the effects of migrant networks into account. It can be considered as a model based on decision theory and direct observation.

It was attempted to model international migration as a result of agents' decision based on a number of social, economic, demographic and political factors: age, earnings, employment opportunities, family and kinship networks, political stability in source and destination countries and immigration policies. Hence, Turkish migration was reviewed from a different angle, with a unified theoretical approach.

In the final chapter, a brief overview of the theoretical parts and the main results of the model are provided.

Kurzfassung

Einwanderung ist ein kompliziertes Phänomen mit wirtschaftlichen, politischen, kulturellen und sozialen Aspekten. Von der wirtschaftlichen Seite bedeutet es die Bewegung von Produktionsfaktoren von einem Land zu einem anderen. Dadurch ändern sich die relative Quantität der Faktoren sowie die relativen Erträge zu den Faktoren. Arbeitsmarkteffekte sind einer der Gründe der Auseinandersetzungen über Einwanderung: Einerseits fühlen einheimische Arbeitsnehmer benachteiligt, weil sie mit (billigerer) ausländischer Arbeitskraft um Arbeitsplätze konkurrieren müssen, andererseits ist billigere Arbeitskraft zum Vorteil der Arbeitgeber.

Einwanderer sind nicht nur Arbeitskräfte, sondern gleichzeitig auch Konsumenten und Haushaltproduzenten. Da sie Konsumenten sind, erhöhen sie die Nachfrage nach Produktionsfaktoren im Zielland einschließlich Arbeit. Wirtschaftlich gesehen muss Einwanderung nicht unbedingt eine negative Auswirkung auf den Löhnen von einheimischen Arbeitern haben. Einwanderung kann auch zur Verbreitung von Wissen (vom Quellenland zum Zielland) und dadurch zu einer langfristigen Verbesserung des Lebensstandards führen. Dennoch ist Einwanderung komplizierter und hat auch soziale und politische Aspekte, die gelegentlich die wirtschaftlichen Auswirkungen überwiegen können.

Einwanderung zwischen Europa und der Türkei hat mehrere Jahrzehnte stattgefunden. Die Motive hinter Migration haben aber von Nationenbildung und religiösen und wirtschaftlichen Gründen in der ersten Hälfte des 20. Jahrhunderts zu Arbeitsmigration, Familiennachzug und Asylanträgen in der 2. Hälfte des Jahrhunderts umgewandelt. Seit den 1960er Jahren, wo die Einwanderung von türkischen Arbeitnehmern angefangen hat, hat sich die wirtschaftliche und politische Lage in europäischen Ländern auch bedeutend geändert. Die EU im 21. Jahrhundert ist ohne Zweifel eine andere Organisation als die Europäische Wirtschaftsgemeinschaft, wo sich die Türkei beworben hatte (Brusse and Griffiths, 2004). Einerseits ist die Union größer und politisch stärker geworden, sondern ist auch ihre Aufnahmekapazität gesunken.

Der Ausgangspunkt der unterliegenden Dissertationsarbeit ist die oben angeführten dynamischen Änderungen in den politischen, wirtschaftlichen und demographischen Strukturen in Europa und der Türkei. Das Ziel der Arbeit ist, die Arbeitsmarktdynamiken in Europa mit Hinsicht auf die türkische Einwanderung zu analysieren. Dafür wird ein agent-basiertes Modell entwickelt.

Das erste Kapitel ist eine Einführung, wo das Forschungsziel, die wissenschaftliche und soziale Relevanz des Themas, die Terminologie, die Probleme mit internationalen Migrationsdaten, die wissenschaftliche Frage und die Struktur der Arbeit vorgelegt werden.

Das zweite Kapitel gibt einen historischen Überblick über das Einwanderungsgeschehen zwischen Europa und der Türkei. Zunächst wird eine qualitative Beschreibung der Migration in die EU in Phasen wie sie von Stalker (2002) und von Castles, Haas und Miller (2014) definiert werden, gemacht. Dann werden Migrationsmuster in die EU in Jahrzehnten und die Migrationsmuster von der Türkei aus beschrieben.

Das dritte Kapitel dient als die theoretische Grundlage der These. Es stellt eine Rezension von soziologischen, mikro- und makroökonomischen, geographischen sowie vereinigenden Theorien von internationaler Migration zur Verfügung. Nach der Diskussion der Theorien wird ein theoretischer Rahmen für das Agent-basierte Modell gemacht.

Das Ziel des vierten Kapitels ist, drei verschiedene demo-ökonomische Modelle in der Literatur zu beschreiben, die Beispiele von deterministischen Prognosemethoden sind: (1) das Birg Modell (1982) von Interaktionen von Arbeitsschaffung, Migration und natürlichem Bevölkerungswachstum, (2) das IDEM (Italian Demographic Economic Model) – ein multiregionales Modell für Italien und (3) das Internationale BACHUE Modell, das die Beziehungen verschiedener demographischen, wirtschaftlichen und Einkommensverteilungs-Variablen in einem Entwicklungsland analysiert.

Agent-basierte Modelle in der Literatur, die sich mit unterschiedlichen Aspekten der Einwanderung beschäftigen, werden im fünften Kapitel geschildert. Nach Klabunde und Willekens' (2016) Klassifikation werden die ABM in (i) minimalistische, (ii) mikroökonomische, (iii) psychosoziale, (iv) heuristische Modelle ohne empirische Korrespondenz, (v) Modelle auf Grundlage der Entscheidungstheorie und direkter Beobachtung und (vi) Modelle auf Grundlage von empirischen Regeln ohne Erwähnung einer Theorie gruppiert.

Im sechsten Kapitel wird ein erster Versuch gemacht, das Einwanderungsgeschehen zwischen Deutschland und der Türkei in der Periode von 1991 bis 2015 durch ein agent-basiertes Modell zu simulieren. Es wird erzielt, die Migrationsmuster zu reproduzieren, wobei ökonomische und politische Faktoren im Ziel- und Quelland sowie die Migrantennetzwerke berücksichtigt werden. Migration wird als Ergebnis von einem individuellen Entscheidungsprozess dargestellt. Es kann als ein Modell auf Basis der Entscheidungstheorie und direkter Beobachtung angesehen werden.

Im siebten und letzten Kapitel wird ein Rückblick in die theoretischen Teile der Dissertationsarbeit und die Haupteigenschaften und Ergebnisse des Modells zusammengefasst.

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III Theoretical Framework of International Migration

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Abbreviations

ABM	Agent-based model
BAMF	Bundesamt für Migration und Flüchtlinge
EU	European Union
CEEC	Central and Eastern European counties
IMF	International Monetary Fund
MENA	Middle East and North Africa
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization

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Chapter 1 INTRODUCTION

Jacques Chirac, as Prime Minister of France: 'If there were fewer immigrants, there would be less unemployment, fewer tensions in certain towns and neighborhoods, and lower social cost.'

Liberation: 'That has never been formally proven.'

Chirac: 'It is easy to imagine, nevertheless.'

[From an October 30, 1984 interview[1]]

1.1. Background

Indeed reasons and consequences of migration seem to be easy to imagine. However, migration is a complicated economic, political, cultural and social issue. The views of scientists from different disciplines on migration are different. Sociologists take into account a large number of determinants of international migration while giving only secondary emphasis to important economic determinants. Mainstream economics uses the human capital model, seeing migration as an investment to a person's welfare, in this manner looking from a narrow perspective. Politicians and policymakers instead have a different perspective and can reflect national biases, particularly in more developed parts of the world.

From the economic perspective, immigration means the movement of factors of production from one country to another, thereby changing the relative quantity of factors and the returns to all factors of production in the destination economy. This labor market effect is one of the main economic reasons of controversy on migration. While workers already residing in the receiving country who have to compete with immigrant workers feel disadvantaged, employers who hire immigrants are supportive of immigration.

Nevertheless, immigrants are at the same time consumers and household producers. Since they are consumers, they increase the demand for all factors of production in the destination country including labor. Thus, migration need not have a negative effect on wages of national workers. Immigration also contributes to the spread of knowledge from the source country to the destination country and thus can lead to economic growth and improvement of living standards at the destination in the long-term.

Immigration's effects on the economy are debated in most developed receiving countries. Political discussions consist mainly of the three questions: First, how do immigrants affect the host country economy? Second, which impacts do immigrants have on the natives' employment opportunities? Third, which immigration policy does/would benefit the host country the most? (Borjas, 1994:1667)

[1] Bodvarsson, Ö.B., and Van den Berg, H., 2013:1 from Simon, 1989, p. 208.

The impact of immigrants on the host country economy depends on the productivity level and equivalence of the skills level of immigrants with the skills demanded by employers. Immigrants who have high productivity levels and can rapidly adapt to the labour market of the host country, can significantly contribute to economic growth. In this case, immigrants will not increase expenditures on social assistance programs. On the other hand, if immigrants lack the skills needed for the employment and cannot adapt to the labour market, the costs resulting from income maintenance programs and ethnic wage differentials will significantly increase (Borjas, 1994:1667).

The second question concerns wages, and arises from the common belief that large inflows of migrants have a negative effect on the employment opportunities of natives. It has to be questioned which native workers are affected mostly by immigration and how much native wages will decrease.

The immigration policy which will mostly benefit the host economy largely varies among countries. In the past decades, several countries such as the United States have been granting visas to applicants who had relatives already residing in the country. Other countries like Australia and Canada encouraged applicants who had 'desirable' characteristics such as high socioeconomic skills. Yet other countries, e.g. Western European countries Germany and Austria, granted temporary residence permits to 'guest workers', who eventually became permanent residents.

Immigration experience of the second half of the 20th century has shown that governments' decision on the 'right' immigration policy has a substantial impact on economic activity in the long term as well as in the short term (Borjas, 1994:1668). The degree of effectiveness of the implementation of immigration policies also has a significant effect on economic activity. In order to estimate the economic impacts of immigration, the most essential but to the same extent difficult tasks are to determine the factors which motivate people in source countries to move, and to understand the economic consequences of particular immigration policies (Borjas, 1994:1669). Again, past experience has shown that the economic effects of immigration are case-specific. They vary with time and place, and can be positive or negative.

Most economists in immigrant destination countries such as the USA and Europe view immigration more positively than the overall populations (Bodvarsson and Van den Berg, 2013:5). Despite the controversies and the barriers set by states against it, migration is accepted worldwide as a human right – right of freedom to move from one country to another. However, it can also be perceived with strong opposition in the nesting country if immigrants cannot socially integrate.

Over the last two centuries, the number of migrants in the world has increased immensely. This can be explained through several reasons. One reason is that transport costs have decreased while the danger of the voyage has been largely eliminated. Another reason is that income discrepancies between countries has increased enormously. Increased international communication as a result of technological progress has made the information on income discrepancies available to everyone. Finally, in developing countries the working age population, which is the most likely part to immigrate, has increased.

Accumulation of economic growth in the developed parts of the world, increasing economic and demographic disparities between developing and developed countries, destruction of rural communities through substitution of human capital by advanced technology in agriculture, climate change, political conflicts and last but not least, globalization of economic activity will cause further increases in international migration. In 2013, approximately 3.2% of the world population was living in a different country than their country of birth (UN-DESA, OECD, 2013). It is anticipated that, if the trend continues, the share of immigrants in the total world population will reach 4-5% within 25 years (Bodvarsson and Van den Berg, 2013).

Since EU member states are among the most popular destination countries because of their political stability as well as economic and social welfare, immigration is a serious issue for the Union. Migration between Europe and Turkey has been taking place for many decades. Nevertheless, the motive behind migration has changed from nation-building, religious and ethnic reasons in the first half of the 20th century to labor migration, family reunification and asylum seeking in the second half of the century.

The first decades of the 20th century was mainly characterized by wars in Europe and Turkey. After the Balkan Wars (1912-1913), Muslim populations have mass-migrated from the Balkans to Anatolia (Turkey). Another major movement was the forced migration of the Armenian population living in Anatolia by the Ottoman Empire in 1915. In 1922 and 1923, a major population exchange based on religious identity took place between Greece and Turkey. All of these migrations were based on religious and ethnic motives.

After 1960, the major immigrant flows were from Turkey towards Europe. The 1960s were characterized by labor migration due to high labor demand in Western Europe. The 1970s were a period when mainly return migration and family unification migration took place. In the 1980s, due to political turnovers in Turkey ethnic migration and asylum seeking characterized the migratory flows. In the 1990s, converging migration patterns were seen in Europe, where most Western European states became net immigration countries.

Three major developments were witnessed during the 2000s: The enlargement of the EU with eight Central and Eastern European counties (CEECs) in 2004, and the entrance of Bulgaria and Romania to the Union in 2007 have led to a large flow of labor force from CEECs to the EU15. On the other hand, the global financial crisis of 2008/2009 has had substantial effects on European economies and labor migration. Migration from Turkey towards Europe has significantly decreased. Also, reverse migration and retirement migration from the EU towards Turkey have been increasingly taking place in the last decades.

Data on the number of migrants originating from Turkey who are currently living in the EU are highly controversial. It is difficult to find data, and even more difficult to find supporting data on the same ethnic group recorded by the source and hosting countries. However, the countries nesting the highest

numbers of Turkish immigrants are Germany, France, Bulgaria, and the Netherlands. Since the Turkish community in Europe is the largest minority, it is found to be relevant to look at the migration dynamics between European countries, particularly Germany, and Turkey within the context of this dissertation thesis.

1.2. Research Goal

The goal of this dissertation thesis is to analyze migration flows between Turkey and Europe, to explore the main motivations of migrants and finally to build an agent-based model of international migration that simulates migration scenarios between Turkey and Germany. Demographic, social, political as well as economic variables will be taken into account, so that the issue can be discussed from a political economy view.

Discipline-specific theoretical perspectives on migration – sociological, macro- and micro-economic or geographical theories – can only partly explain population flows. On the other hand, theories providing a synthesis of different approaches, such as the migration systems theory (Kritz, Lim & Zlotnik, 1992), and the synthesis theory of international migration (Massey, 2002) are difficult to be applied in practice due to the incomplete availability and limited quality of international migration statistics (Bijak, 2011:46f.).

Given the policy relevance of migratory flows between Turkey and Europe, it is worth looking at it once again in depth.

The aim of the underlying thesis is to use a new methodology with which migration scenarios between Turkey and the EU can be formulated. The scenarios will base on explicit relations between demographic and economic processes. The goal of the scenarios will be to illustrate the interdependences between migration flows, changes in demographic structures and changes on labor markets (e.g. wages, demand, etc.).

1.3. Scientific Relevance

A large number of migration theories have aimed to explain the international migration puzzle: the neoclassical economic theory, the dual labor market theory, the new economics of labor migration, the relative deprivation theory, the world systems theory, the network theory and the institutional theory. They use different concepts and assumptions. Massey et.al. (1993) provide a detailed overview of these theories as well as their evaluation.

Massey et.al. (1993, 1998) and Schoorl (1995) categorize the theories of international migration into two groups: theoretical approaches explaining the initiation of migration, and theoretical approaches

explaining the perpetuation of migration. The neo-classical economic theory, the dual labor market theory, the new economics of labor migration, and the world systems theory attempt to explain the initiation of migration. To the second group belong the network theory and institutional theory explaining the course of migration flows over time. These latter theories try to explain why the volume of international migration may increase although the initial incentive(s) have decreased.

Nevertheless, the mechanisms illustrated in the theoretical models of migration are not sufficient to explain all international migration flows, such as mass migration or movements in a disproportionate direction. A good example could be the Turkish and Italian European migration flows during the 1970s and 1980s. Large migration flows from Turkey to several Western European countries continued despite the *Anwerbestopp* in 1974. On the contrary, migration flows from Italy to Germany ended to a large extent due to the *Anwerbestopp*. This difference between the Italian and Turkish cases cannot be captured by the mechanisms in the theories explaining the continuation of migration. The main reasons for the continuation of Turkish migration were Turkey's political instability and increased economic backwardness relative to Germany in the 1970s, whereas Italy's economy had largely recovered.

The international migration systems approach (Kritz and Zlotnik, 1992), on the other hand, aims to integrate the main aspects of several migration theories. According to the systems approach, capital and people are exchanged between countries within a particular economic, social, political and demographic context (Jennissen, 2004:31). Jennissen (2004) incorporates causalities that he derives from the aforementioned theories of international migration in the systems approach so that it becomes evident that the economic part makes up a significant part of the theoretical background of international movements.

International migration theories as well as the systems approach, by nature, have to be general. Unlike theories, models relate to a specific event and have a large degree of flexibility. Numerous models reveal different research objectives, as well as methods of decomposing this doubtlessly complex interdisciplinary issue into analytically measurable parts. In order to reconstruct the dynamic occurrence of international migration between Turkey and Europe, and subsequently to analyze its consequences, an agent-based model is built in the underlying dissertation thesis. It is case- and time-specific and has a unifying theoretical approach.

1.4. Societal Relevance

Migration is an important part of broader social transformations, but has at the same time its own internal dynamics, and power to affect social transformation. As a complicated phenomenon, migration is "linked to class, gender, generation, ethnicity and other social cleavages, which are embodied in hierarchies of power and social status, in positions in home and host communities, and in work and

domestic relationships – all of which may be transformed in the course of the migratory process" (Van Hear, 2010:1531).

International migration patterns shape social transformation in both sending and receiving countries in various ways. In case of developed receiving societies, changes produced by international migration may be significant but may remain 'on the surface' affecting the social order only marginally and leaving the social values and social structure greatly unchanged (Van Hear, 2010:1532). Changes generated by migratory movements in less developed sending societies may be greater: 'The culture of sending regions and even entire nations may be thoroughly transnationalized.' (Van Hear, 2010:1532).

Beyond doubt, the culture in receiving societies is affected by the changing ethnic composition generated by international migration. There may be cultural conflicts and even ghettoization under unfavorable conditions in relation with adverse economic conditions. On the other side of the coin, the culture in sending societies also changes – in case of long-term migratory flows a 'culture of migration' may emerge (Jennissen, 2004:6; Massey et al, 1993).

Migration has also economic effects on sending and receiving societies. Labor market structures are changed – there may occur labor shortages in sending countries, while the labor force participation of migrants may contribute to production and economic growth in receiving countries. Through changing lifestyles in receiving societies, migration may also affect saving, investment and consumption habits (Jennissen, 2004:6 from Frey and Mammey, 1996; MaCurdy et al, 1998).

Since international migration has significant short-term as well as long-term social, cultural and economic impacts on receiving as well as sending societies, it is highly relevant to examine the Turkish European migration patterns.

1.5. Terminology

EU-15: Prior to 2004, the number of member states in the European Union was 15. EU-15 comprised Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.

Migration: The "crossing of the boundary of a political or administrative unit for a certain minimum period of time" (UNESCO, 2017).

International (foreign) migration: Territorial relocation of people between nation-states (UNESCO, 2017).

Throughout the dissertation thesis, *migration* portrays international migration unless explicitly noted otherwise.

Migrant: In the narrow sense, a migrant is "any person who lives temporarily or permanently in a country where he or she was not born, and has acquired some significant social ties to this country" (UNESCO, 2017). In the broader sense, the UN Convention on the Rights of Migrants (2003) describes a migrant worker as a "person who is to be engaged, is engaged or has been engaged in a remunerated activity in a State of which he or she is not a national".

"The term 'migrant' (…) should be understood as covering all cases where the decision to migrate is taken freely by the individual concerned, for reasons of 'personal convenience' and without intervention of an external compelling factor." (UNESCO, 2017). Therefore, the term migrant does not include refugees or other people who have been displaced by force.

International migrants are commonly classified according to their motivation as (UNESCO, 2017):

- **Temporary labour migrants (guest workers):** People who migrate in order to work in the destination country and to send money to their country of origin.
- **Highly skilled migrants:** People with high qualifications and scarce skills who "move within the internal labour markets of trans-national corporations and international organisations" or look for employment in international labour markets (UNESCO, 2017).
- **Irregular (undocumented / illegal) migrants:** People who enter a foreign country without having the necessary documents or permission.
- **Forced migrants:** Refugees, asylum seekers and people forced to move by external factors, e.g. environmental disasters.
- **Family members (family reunion / family reunification migrants):** People who migrate in order to join their family members who have previously migrated to the destination country.
- **Return migrants:** People who return to their country of origin after residence in the immigration country for a certain period of time.

Refugee: Article 1(A) of the 1951 Convention Relating to the Status of Refugees defines a refugee as

> "(…) any person who owing to well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence as a result of such events, is unable or, owing to such fear, is unwilling to return to it" (Convention and Protocol Relating to the Status of Refugees, 1951:14).

Determinants of migration: Incentives to migrate; economic determinants may be undesirable conditions in the source country and/or favourable conditions in the destination country.

Gross migration: The total flow of migrants across a border, which means the sum of immigrants and emigrants.

Net migration: The difference between inward and outward migration flows; in other words immigration less emigration from a certain country.

Migration rate: Rate of migration per 1.000 persons over a one-year period, calculated as the difference between the number of immigrants and emigrants divided by the mid-year population and multiplied by 1.000.

Migration interval: The period of time over which migration is measured (Smith, Tayman and Swanson, 2013:104).

Labour force: The employed (persons having a job or business) together with the unemployed (persons who do not have a work, are available for work, and are actively seeking work) constitute the labour force.

Migrant remittances: According to the IMF, migrant remittances are categorized as:

- Compensations of employees, which are gross earnings of migrant workers residing abroad for less than 12 months, including the value of in-kind benefits ("income"),
- Monetary transfers sent home from workers residing abroad longer than 12 months ("current transfers"), and
- Migrants' transfers which represent the net wealth of migrants moving from one country of employment to another ("capital transfers") (OECD, 2006).

Demo-economic models: According to McNicoll (1975) and Willekens and Rogers (1977), demo-economic models are classified in:

- Models of demo-economic growth,
- Demo-economic simulation models, and
- Models of demo-economic policy.

Models of demo-economic growth aim to describe or explain demographic and/or economic growth by treating both demographic and economic variables endogenously. Demometric growth models, neoclassical growth models and dualistic growth models are such models (Willekens and Rogers, 1977:2).

Simulation or descriptive/explanatory models having a growth model as their central element, which aim to simulate and compare *or* to describe and explain the economic effects of alternative policies, of changes in demographic parameters or of other exogenous variables. Demo-economic simulation models may be simultaneously descriptive and explanatory models examining the sensitivity of the demo-economic system to changes in exogenous variables (Willekens and Rogers, 1977:4).

Models of demo-economic policy, on the other hand, are dynamic models that aim to propose demographic and economic policies that will maximize an objective (Willekens and Rogers, 1977:4). They may be planning-oriented or theoretically-oriented.

Agent-based modelling: Also called 'bottom-up modelling', agent-based modelling is a 'decentralized' analysis tool. Behaviour is modelled on the individual level, and then aggregated. Hence, the global behaviour develops as a result of the behaviour of a number of individuals who live in the same environment, act and communicate (Borshchev and Filippov, 2004).

1.6. International Migration Data

The problem with international migration data is that it is difficult to find an internationally consistent database. There are differences between data provided by source and destination countries for the same migration flow (Willekens, 1994; Jennissen, 2004). One of the reasons for this difference might be differences in the definition, especially the time aspect of migration. Another reason is that countries follow different methods for obtaining migration data – population registers or regular population censuses. Although they sometimes use the other method as well to update their records, inconsistencies exist (Jennissen, 2004).

Another difficulty with international migration data is that some countries such as France do not keep record of migrants after their naturalization, since they are considered 'citizens' according to the constitution. Characteristics of migrants such as sex, age, qualificational or educational background are even more difficult to obtain or for most countries unavailable.

For the history of migration flows between Europe and Turkey, mostly Eurostat and OECD data were used. For the agent-based model at the end of this dissertation, data from the destination country (Statistisches Bundesamt data) were used, as suggested by Kupiszewski and Kupiszewska (1999).

1.7. Structure of the Thesis

Chapter 2 provides a historical overview of migration flows between Europe and Turkey. It firstly gives a qualitative description of international migration flows to the EU by phases – as defined by Stalker (2002) and Castles, Haas and Miller (2014), respectively. Then, migration patterns towards the EU are described more detailed in decades, followed by the section on migration patterns from Turkey.

Chapter 3 serves as the theoretical base of the thesis. It gives a review of sociological, micro- and macroeconomic, geographical as well as unifying theories on international migration. After comparing the theories in literature, it provides a theoretical framework, which is used as the basis for selecting the determinants of migration in the agent-based model.

The aim of Chapter 4 is to illustrate three different demo-economic models found in literature as examples of deterministic forecasting methods: (i) the Birg model (1982) on the interactions of job creation, migration and natural population increase, (ii) IDEM (Italy Demographic Economic Model) – a multi-regional model for Italy designed for purposes such as regionalizing national macroeconomic forecasts of the Italian Treasury and the evaluation of economic impacts of regional development plans, and (iii) the International BACHUE model investigating relationships between various demographic, economic and income distribution variables over time in a developing economy.

Agent-based models of migration covering different aspects of the phenomenon were reviewed in Chapter 5. Following Klabunde and Willekens' (2016) classification, they were grouped in (i) minimalist models, (ii) microeconomic models, (iii) psycho-social and cognitive models, (iv) models based on heuristics without direct empirical correspondence, (v) models based on decision theory and direct observation, and (vi) models based on purely empirical, observational rules without mention of a theory.

Chapter 6 then provides the first attempt of an agent-based model of migration flows between Turkey and Germany. Using migration data provided by the German Statistical Office (Statistisches Bundesamt), it aims to reproduce the migration patterns from 1991 to 2015, by taking economic and political factors in the source and destination countries and the effects of migrant networks into account. It can be considered as a model based on decision theory and direct observation.

In the final chapter, the findings of the thesis are summarized. It was attempted to model international migration as a result of agent's decision based on a number of social, economic, demographic and political factors: age, earnings, employment opportunities, family and kinship networks, political stability in source and destination countries and immigration policies. Hence, Turkish migration was reviewed from a different angle, with a unified theoretical approach.

Chapter 2 HISTORICAL OVERVIEW

… After all that has been said of the levity and inconstancy of human nature, it appears evidently from experience that a man is of all sorts of luggage the most difficult to be transported. …

[Smith, A., 1776 (1976), Part I, p. 84]

2.1. Aim, Approach and Data

In the 20th century, until the end of the World War II, migration between Europe and Turkey took place mainly on ethnic and religious – 'nation-state formation' grounds[2]. The biggest migration flows were the deportation or forced migration of Armenians living in Anatolia in 1915/1916, and the population exchange between Greece and Turkey in 1922/1923, when the majority of Christians living in Anatolia were exchanged with Muslims in Western Thrace. The Balkan Wars in 1912/1913 also contributed to large flows of Muslim populations from the Balkans towards Anatolia (İçduygu and Biehl, 2013).

After World War II, Turkish large-scale migration to Europe started in the 1950s, gained momentum after the signing of bilateral contracts in the 1960s between European countries and Turkey, slowed down in the 1970s and continued in different forms (e.g. family reunification and asylum seeking) and intensity during the following decades, until coming almost to a standstill in the first half of the 2010s.

The underlying chapter aims to give a historical overview of migration between Turkey and the EU. Part 2.2. qualitatively describes the international migration patterns to the European Union and differentiates between four main phases, and then gives an overview of the migration patterns to and within the European Union in decades. Part 2.3. categorizes the migration patterns from Turkey to the EU-15 in three major periods, which are subsequently analyzed in decades from 1950 to 2010. The chapter ends with a concluding section giving an overview of the four stage-model of development of international migration by Castles and Miller (1993) and accordingly discusses the stages in the Turkish-European migration.

Data are derived from the European Commission (Eurostat), statistical institutes of EU destination countries and the Turkish Ministry of Labor and Social Security.

[2] Migration of religious minorities (Jews and Christians) from Turkey has continued after the foundation of the Turkish Republic in 1923. The establishment of the State of Israel in 1948 and the political conflicts between Turkey and Greece on the Cyprus issue in the 1960s and 1970s have played a major role in the out-migration of non-Muslim minorities living in Turkey (Biehl and İçduygu, 2012:10 f.).

2.2. International Migration Patterns to the European Union – A Qualitative Description

For centuries, European politics was based on conquering, colonizing and settlement on new lands with rich natural and human resources. After World War II, the international migration patterns changed and partly reversed. Due to influences of decolonization, demographic change, rapid economic growth and the establishment of the European Union as a zone of free trade and (labor) movement, Europe became a major destination for migrants (Castles, Haas, Miller; 2014:102).

The migration rates from Europe to the Americas and Oceania seriously declined in the 1960s and 1970s, while Western European countries started to attract increasing numbers of migrants from their older colonies and from EU neighboring countries. As a consequence, in several European countries, immigration rates have reached or even exceeded those of 'classical' immigration countries such as the United States (Castles, Haas, Miller; 2014:102).

In literature, recent international migration patterns to Europe are most commonly classified according to the motives of migration flows – labor migration, family reunification, undocumented (or illegal) migration; and in decades. According to Stalker (2002), the most appropriate starting point to investigate the modern migration pattern is also the end of World War II. He differentiates four phases (Stalker, 2002; Toksöz, 2006):

Phase I: The late 1940s and early 1950s are characterized by mass refugee flows to Europe. After the end of the World War, about 15 million people did (were forced to) migrate between countries, particularly Germany, Poland and former Czechoslovakia.

Phase II: The second phase, early 1950s to 1973, was characterized by the reconstruction of Europe, high economic growth and the recruitment of contract workers. In this period European countries, particularly Germany, France and the UK were in need of additional labor force. They first recruited people displaced during the World War, then invited workers from Southern European countries Italy, Portugal and Spain, which were slower in industrialization. When the latter became wealthier, France and the UK started to import labor from their colonies – from North Africa; and the Caribbean and Indian subcontinent, respectively. Germany due to its lack of colonial reservoir imported short-term contracted labor from the former Yugoslavia and Turkey – the 'Gastarbeiter'. Net migration to Western Europe in this period reached 10 million compared to 4 million between 1914 and 1949 (Stalker, 1994, 2002).

Phase III: The third phase from 1974 to mid-1980s, was characterized by the closing of doors to labor immigration. Although opposition among natives to the growing migrant stocks had already started in the 1960s, it was the oil shock of 1973 that determined a sharp difference in migration policies across

Europe. Labor migration came to a standstill with the decision of destination countries, while the guest workers, who were expected to leave, never did. Instead, most governments allowed family reunification of the existing immigrants, so that migration continued on this motivational ground. Greece, Portugal and Spain after joining the European Community also became destination countries for immigrants.

Phase IV: The last phase in Stalker's classification was from mid-1980s to 2001, characterized by asylum seeking, refuge and illegal immigration. This period was one of political turmoil since Eastern European countries were strongly affected during and after the collapse of communism (Stalker, 2002). On the one hand, Eastern Europeans started to seek asylum in Western Europe. On the other hand, people who would have been candidates of contracted labor migrants before the 'closing of doors' after 1973 also started to seek asylum. This became evident when the number of asylum seekers from Turkey jumped from 809 in 1976 to 57.913 in 1980 (Abadan-Unat, 2002). Between 1989 and 1998, approximately 4 million asylum applications have been received in Europe (Stalker, 2002 from Salt, 2000). With the tightening of asylum prerequisites by Western European governments as a reaction to the growing number of applications, there has been a significant increase in the number of illegal immigrants.

Another classification of migration patterns in Europe after World War II is that of Castles, Haas and Miller (2014). They differentiate between three major phases:

The first phase, which took place between 1945 and 1973, was characterized by the economic strategy of large-scale companies of concentrating investment and expanding production in highly industrialized countries. Consequently, in the industrialized (North-) Western European countries large numbers of migrant workers were needed from less developed Mediterranean countries as well as from Ireland and Finland. The Oil Shock of 1973 brought this phase to an end and resulted in recruitment freeze.

In the first phase, two major types of migration were observed in industrially advanced European countries – migration of labor force from neighboring countries to Western Europe through 'guest-worker systems' and migration of 'colonial migrants' to former colonial powers. Beside these, at the end of World War II European refugees mass-migrated (Germany and Poland being the most significant cases); and former colonists returned to their home countries in consequence to their independence. After 1968, workers within the European Community, which later in 1993 became the European Union, could move freely (Castles, Haas and Miller, 2014:104).

The second phase, which continued from the mid-1970s to the mid-1990s, was marked with an extensive process that restructured the world economy – 'globalization'. In this period, there have been changes in global investment patterns (such as the establishment of manufacturing industries in less developed countries due to increased capital export from developed countries during the 1970s and 1980s; and the

emergence of new centers of economic performance in the Middle East, Asia and Latin America during the 1990s and 2000s). Technological advances facilitated the replacement of manual work in manufacturing by machinery. Moreover, the services sector expanded with the consequence of higher demand for highly as well as low-skilled work force. Increased education as well as higher occupational specialization facilitated the labor market segmentation, on the one hand, and the decrease of domestic supply of low-skilled workers, on the other (Castles, Haas and Miller, 2014:111).

The period was marked with neoliberal policies focusing on economic deregulation, flexibilization of labor markets and privatization of state companies. Industrial production was repositioned to developing countries with lower wages, leading to the end of recruitment of numerous factory and mine workers including migrant workers. Nevertheless, this situation did not lead to large return migration rates since the workers brought their families over to the countries where they were settled. Starting from the mid-1980s, economic growth recovered, and the service sectors kept attracting migrants, whereas labor demand in the agriculture and construction sectors continued.

Globalization generated significant social and economic transformations all over the world, and increased the volume and diversity of migration to and within Europe. In the period from the mid-1970s to the mid-1990s, there has been a decline in government-organized labor migration to West Europe and new temporary foreign recruitment policies in the 1990s; family reunion of foreign and colonial workers; successive formation of new ethnic minorities; transition of many Southern and Central European countries including Turkey from countries of emigration to countries of transit and immigration; increased migration flows from Eastern Europe and non-European countries (Maghreb, Latin America and West Africa) to Western Europe; growing migration of refugees and asylum seekers to Europe; increasing (temporary as well as long-term) international migration of highly skilled workers and students; and an increasing trend of irregular migration as a reaction to stricter entry policies (Castles, Haas and Miller, 2014:112).

The fall of the Berlin Wall in 1989 and the collapse of the Soviet Union caused gradual transition to the Third Phase. In *the third phase*, the main migration patterns changed again. At the beginning of the new millennium, migration trends that had slowed down during the 1990s due to economic stagnation, gained momentum again. Until the global economic crisis which started in 2008, Europe's economy has been growing and the new employment opportunities for highly skilled professionals led to the introduction of preferential entry rules for this group as well as for students. In the mean while, the demand for low skilled migrants was met by temporary or irregular migrants because of governmental policies (Castles, Haas and Miller, 2014:116).

In the majority of European countries, the largest immigration category has been family reunion although the relative importance of this type of migration from earlier guest-worker countries has been

declining. Instead, labor migration has been gaining importance due to the EU enlargement in 2004, with the 'free movement' of labor force from Central and Eastern Europe towards Western and Southern European countries (Castles, Haas and Miller, 2014:117).

Most of the EU member states (EU-15) opted for the restriction of immigration from the ten new member states over a transitional period of seven years, while Sweden, the UK and Ireland did not. A large number of irregular labor migrants from EU-10 countries enjoyed de facto legalization (Castles, Haas and Miller, 2014:117). After the EU accession of two more countries (Bulgaria and Romania), the EU-15 again restricted the labor market access of workers from the new member states during the transitional period (until December 2013) (Castles, Haas and Miller, 2014:117).

The EU-10 countries – Poland, Romania, Ukraine and the Baltic republics – emerged as new labor migrant source countries for Western and Southern Europe, on the one hand, and as transit and destination countries themselves, on the other. Ireland, Italy and Spain, which were formerly source countries, became new destinations for migrants from Eastern Europe, North and West Africa and Latin America. Also during this phase, European integration was strengthened through the border-free Schengen zone and stronger EU external border controls.

It was the global economic crisis of 2008-2009, which at least temporarily stopped the rapid economic growth, EU expansion and high immigration rates. However, similarly to the Oil Crisis in 1973, the impact of the 2008-2009 crisis was not a large fall in immigration or a mass return migration. The largest effect of the crisis is judged to be slower intra-European migration and the becoming of several economically vulnerable countries (Greece, Portugal, Spain and Ireland) net emigration countries once again (Castles, Haas, Miller; 2014:103).

Asylum seeking has been increasing during the 1990s, reaching its peak in 2001 and subsequently decreasing during the 2000s. However, due to growing number of asylum applications from people from Middle Eastern countries (Afghanistan, Libya and Syria), the falling trend reversed in 2011.

The following part will analyze international migration patterns to and within the European Union in decades.

2.2.1. **Migration in the 1960s:** *Labor migration due to high labor demand in West Europe*

International migration in the EU in the 1960s can be mainly characterized as labor migration. During this time, due to the rapid industrial expansion and start of mass production, the demand for labor was higher than the domestic labor force in Western European countries. Consequently, workers from the Southern European countries - Greece, Italy, Portugal, Spain and Yugoslavia - migrated to West Europe (Jennissen, 2002 from King, 1993; King and Rybaczuk, 1993). In addition to the Southern European

countries, Ireland and Finland experienced high net emigration to the UK and Sweden, respectively (Jennissen, 2002 from Mac Laughlin, 1993; Hammar, 1995).

The most popular destination countries West Germany, Luxemburg and Switzerland received the largest net migration rates – 4.400, 4.500 and 6.500, respectively. The other important destination countries for Southern European migrants were Austria, Belgium, France and the Netherlands (Jennissen, 2002). In contrast to other Western European countries, the high net immigration rate in France was not due to labor migration but due to the political upheaval in Algeria in 1962 (Jennissen, 2002 from Garson 1962).

In this decade, communist countries except Yugoslavia faced only low net emigration. Nevertheless, before the construction of the Berlin Wall in 1961, many East Germans - *'Übersiedler'* - migrated to West Germany. Towards the end of the decade, in 1967-1968, Czechoslovakia experienced relatively high net emigration rates due to the Prague Spring (Jennissen, 2002).

The former West German Government started already in the mid-1950s to employ foreign workers through a selective process operated by the recruitment offices of the Federal Labor Office (Bundesanstalt für Arbeit) settled in Mediterranean countries including Turkey. The temporary foreign labor recruitment system, called 'Gastarbeitersystem' or 'guest worker system' was regulated by bilateral agreements between the Federal Republic of Germany (FRG) and the sending countries (Castles and Miller, 2014).

The guest worker system was marked by the belief of temporary stay, restriction of labor market as well as civil rights, recruitment of rather single workers (initially of male, but later also of female laborers in textiles and clothing, electrical goods and other manufacturing sectors), lack of ability of prohibiting family reunion, gradual move to longer sojourn, and inevitable settlement and community formation (Castles and Miller, 2014:107).

2.2.2. **Migration in the 1970s:** *Family and Return Migration*

The guest worker system reached its peak between 1968 and 1973. For Germany, this meant an increase in the number of migrants from 1 million to 2.6 million (Martin, 1981). In the 1970s, the geographical origin of labor migrants increasingly changed from Southern European countries to Maghreb countries and Turkey. During the first years of the 1970s, net emigration from Poland highly increased due to liberalized travel regulations for Poles and emigration of many ethnic Germans living in Poland to West Germany due to the 'Ostpolitik' of the Brandt-Scheel Administration (Jennissen, 2002:15).

The global economic recession following the 1973 Oil crisis dramatically changed the European migration history. As a consequence of the fall in labor demand due to the crisis and the larger labor

supply through the entry of new labor force ('post-war baby-boomers'), most Western and Northern European countries stopped migrant worker or guest worker recruitment (Jennissen, 2002:15).

In contrast to non-European migrant workers (e.g. the Turkish), a high number of Southern European workers and Irish workers returned to their country of origin. In the Irish case, increasing job opportunities in the home country through the settlement of multinational companies in the high-tech industry are thought to be the second major reason of return migration from the United Kingdom.

On the other hand, migration continued in form of family reunification and family formation. Many migrant workers who chose not to return to their home country, such as the Turkish, brought over their families or married people from their country of origin.

In the second half of the decade, the net migration in Europe by and large stabilized, while both labor-importing and labor-exporting countries experienced low net immigration. Migration from former labor-importing countries to former labor-exporting countries was larger than migration in the opposite direction. Nevertheless, due to the high rates of family reunification (of migrants from Turkey and the Maghreb countries), there was net immigration to labor-importing countries.

On the other hand, return migration into (Southern European) labor-exporting countries was greater than emigration from these to labor-importing countries due to family reunification. The intensity of return migration from Latin American and African countries was high, particularly to Portugal (Jennissen, 2002:15 from Barsotti and Lecchini, 1994; Rocha-Trindade, 1998).

Austria, Switzerland and West Germany introduced guest worker policies which were aiming at impeding family reunion as well as long-term stay. Return migration of temporarily hired workers together with the impossibility of family reunion resulted in net emigration in Austria and Switzerland.

Portugal and the Netherlands were two countries which experienced intense postcolonial migration. In sum, the 1970s were a decade where large in- and outflows of migration affected non-communist European countries, while communist countries experienced low rates of net emigration (Jennissen, 2002:16f.).

2.2.3. **Migration in the 1980s:** *High Numbers of Asylum Seekers, Ethnic Migration*

In the first half of the 1980s, due to the impact of the economic crisis of 1973 as well as the decrease in family and return migration in response to the immigration policies by the receiving countries, migration rates were lower than those in the previous decade. Nevertheless, in the second half of the 1980s, the post-industrial migration wave started and immigration rates augmented immensely due to changes in

political, economic and social spheres following the end of the Cold War and the collapse of the communist system.

Non-communist countries in Northern and Western Europe together with Greece became the main destinations for asylum seekers, illegal migrants and high-skilled labor migrants. West Germany received the highest numbers of asylum seekers (Jennissen, 2002:17 from Eurostat, 1997).

In communist countries, more flexible emigration policies caused an increase in emigration rates. Many ethnic Germans called 'Aussiedler' and 'Übersiedler' mass-migrated to West Germany (approximately 633.000 from Poland, 177.000 from the Soviet Union and 151.000 from Romania) (Jennissen, 2002:17 from Fleischer and Proebsting, 1989; Münz et.al., 1997; Brückner, 1998). In addition, around 220.000 ethnic Turks mass-migrated from Bulgaria to Turkey (Jennissen, 2002:17 from Bobeva, 1994).

2.2.4. **Migration in the 1990s:** *Converging Migration Patterns*

The 1990s were characterized by post-industrial migration as well. In difference to the previous decade, also Southern European countries received net immigration. In West Europe, asylum seeking rates were at high levels in the first half of the decade, the war in former Yugoslavia being one of the reasons of this. Similar to the previous decade, Germany received the highest share of asylum seekers (60%) in the EU (Jennissen, 2002:17f. from Wendt, 1997). Asylum migration to West Europe decreased in the second half of the decade, mainly due to strengthened policies and the end of war in Bosnia-Herzegovina (Jennissen, 2002:18 from UNHCR, 2000a; Van Selm-Thorburn, 1998; OECD, 1999).

Another common form of migration was ethnic migration from Central and Eastern European countries to Germany (as well as to Finland and Greece but at lower levels), originating mainly from the former Soviet Union. The intensity of ethnic migration to Germany has been lower in the second half of the decade than in the first (Jennissen, 2002:18 from Münz et.al, 1997; Brückner, 1998).

Starting from the late 1980s, the emigration rate of former communist countries to the West (not only Europe but also the US) and to Israel rose. After the dissolution of the Soviet Union, a high number of Slavs had to return to their country of origin. Consequently, Russia, Ukraine and Belarus received net immigration from other former Soviet countries. They also had net emigration rates to non-Soviet countries.

Summing up the migration patterns in this decade, most Western European states became net immigration countries, while ethnic migration in Eastern European countries decreased. Thus, differences in net migration rates among European countries have been converging (Jennissen, 2002:18).

2.2.5. **Migration in the 2000s:** *Eastern European Enlargements (2004 and 2007), Global Economic Crisis (2008-2009)*

The most important episodes after 2000 were the Eastern enlargements of the European Union in 2004 and 2007, and the global economic crisis that started in 2008. The Eastern EU enlargement resulted in large East-West migration flows. On 1 May 2004, the largest single expansion of the EU took place when 10 Central and Eastern European countries joined the EU-15 (Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia). On 1 January 2007, two other countries (Bulgaria and Romania, also known as EU-2) joined the EU-25[3].

The population of these 12 accession countries, which accounted for approximately 21 percent of the total EU population, together with the gap in income per capita relative to that in the EU-15 at the time of expansion led to concerns of mass migration within the EU. Because of these concerns, the majority of the former member states imposed transitional restrictions to the free movement of people[4] (Rica, Glitz, Ortega; 2013:9). Temporary restrictions for Bulgarian and Romanian workers remained in several EU-15 countries until December 2013. Although migrants from EU10 countries who were employed irregularly in EU15 countries before 1 May 2004 could enjoy de facto legalization, the accession of the EU2 did not have a similar legalization effect (Castles, Haas and Miller, 2014:117).

During the decade between 2000 and 2010, significant numbers of migrants moved from Central and Eastern European countries towards Western Europe. For Polish migrants, Ireland, Germany and the UK were the main destinations while Romanian migrants predominantly chose Spain and Italy. At the beginning of the decade (2001), there were about 1 million Eastern European migrants constituting 6.3 percent of the overall foreign population in the receiving countries. In 2011, the number of Eastern Europeans had reached 5.3 million and accounted for 19 percent of the foreign population in the EU-15 (Rica, Glitz, Ortega; 2013:10).

Among Eastern European migrants, the Poles constituted the majority, with approximately 1 million people emigrating between 1 May 2004 and April 2007. Migration flows from Poland were accompanied by growing concerns in traditional immigration countries, on the one hand, and by employer concerns about labor shortages in Poland itself, on the other. In the late 2000s, the Polish government as well as policy makers of the other Central and Eastern European countries have

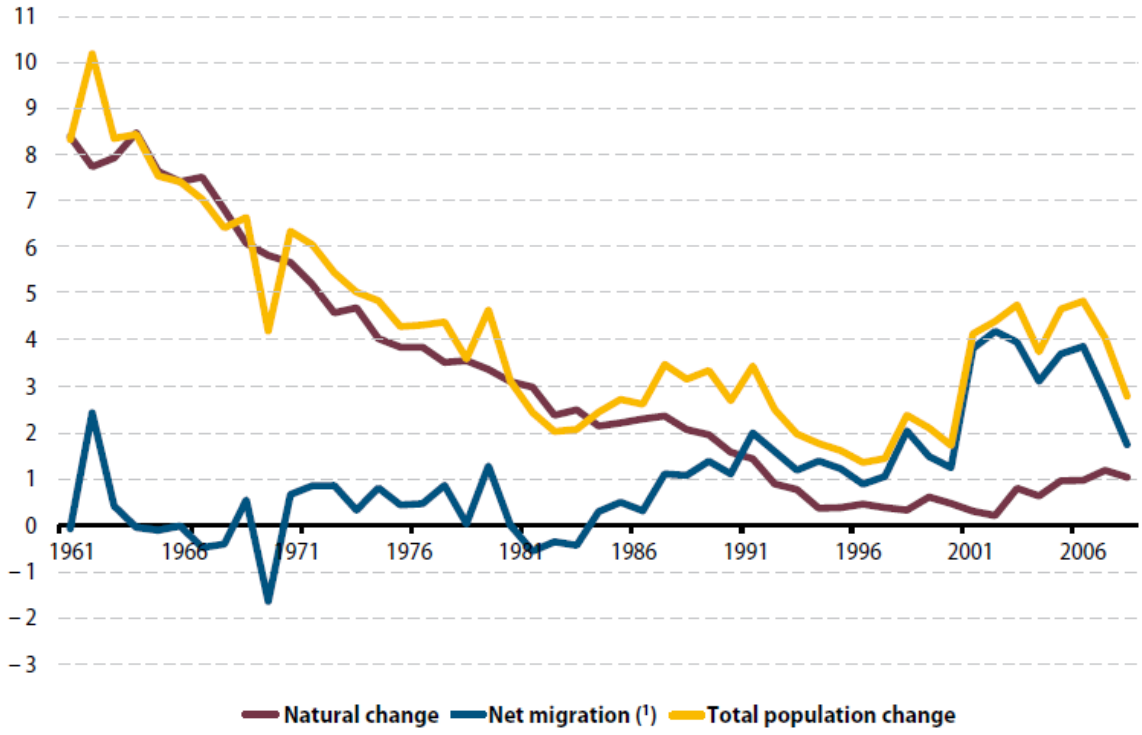
[3] The latest expansion of the EU took place in July 2013 with Croatia.

[4] The restrictions applied only to the right to work in another EU country and not to the freedom of travel. Member states were allowed to impose restrictions for 2 years, extendable by further 3 years and under certain conditions by another 2 years. Except for Ireland, Sweden and the UK all EU-15 member states applied restrictions, mostly until 2006 or 2008. Austria and Germany which share borders with several new accession countries imposed restrictions for the maximum period of 7 years.

recognized themselves as future immigration countries, and were planning to formulate their own legal and institutional procedures[5] (Castles, Haas and Miller, 2014:117).

The economic recession following the 2008/2009 global crisis caused a reduction in immigration to Europe, but there have been increasing intra-European migration flows from countries mostly hit from the crisis towards those with stronger economies.

Figure 2.1. Population Change by Component, EU27, 1961-2009



(1) Including statistical adjustment

Source: 'Migrants in Europe', Eurostat Statistical Books, 2011:13; from Eurostat (online data code: demo_gind)

Figure 2.1. illustrates the population change in the larger European area between 1961 and 2009. It is observed that the natural change has had a declining trend over the long term, while net migration inflows have reduced the negative effect of the natural change on the total population change.

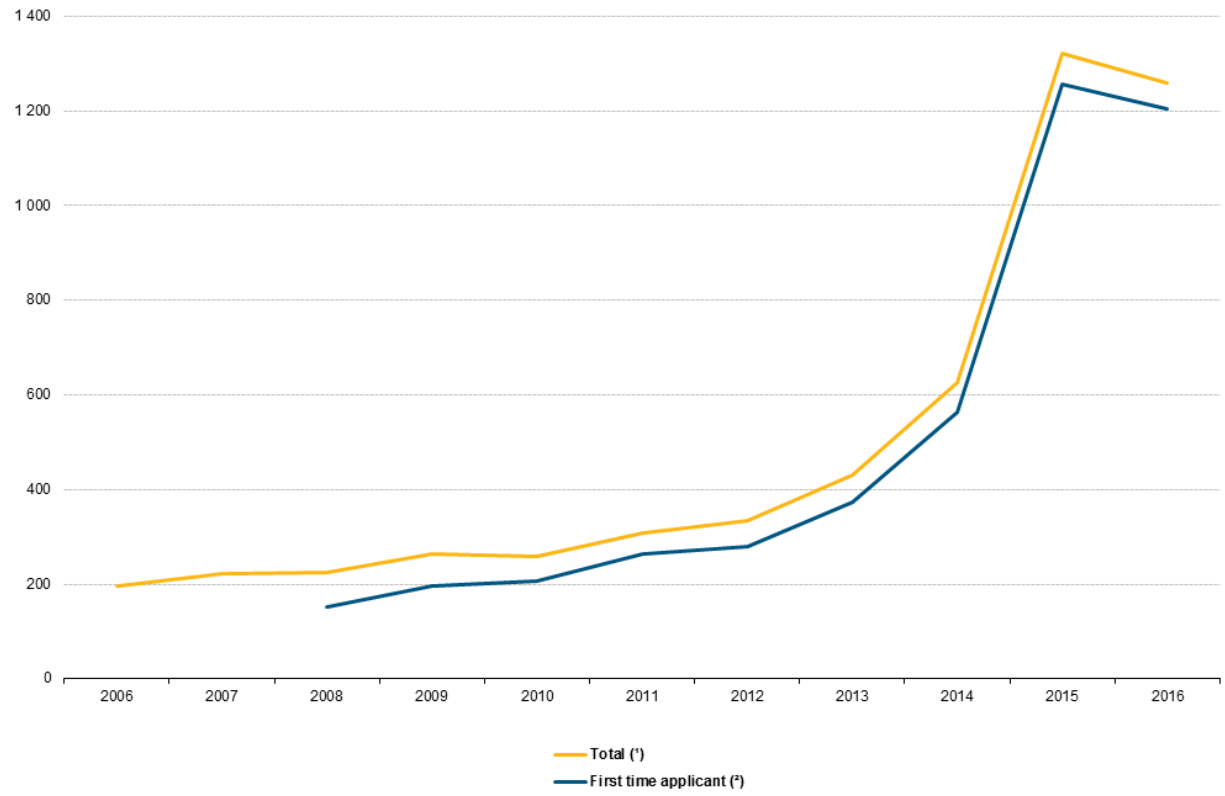
Table 2.1. gives an overview of the stocks of foreign born population living in EU 15 countries. In many countries for which data exist, the stock of foreign born population has been increasing over the 13-year period. While the stock of foreign born persons has more than tripled in Spain, it has more than doubled in Finland and nearly doubled in Austria in the mentioned period. Belgium, Denmark, Sweden and the

[5] Poland, for instance, lifted restrictions on short-term workers from Belarus, Georgia, Moldova, Russia and Ukraine (Castles, Haas and Miller, 2014:117).

United Kingdom are other EU member states which received a large number of migrants in the same period. On the other hand, according to the data the stock of foreign born population in Germany, which hosts the highest number of foreign born population, has remained relatively stable over the period.

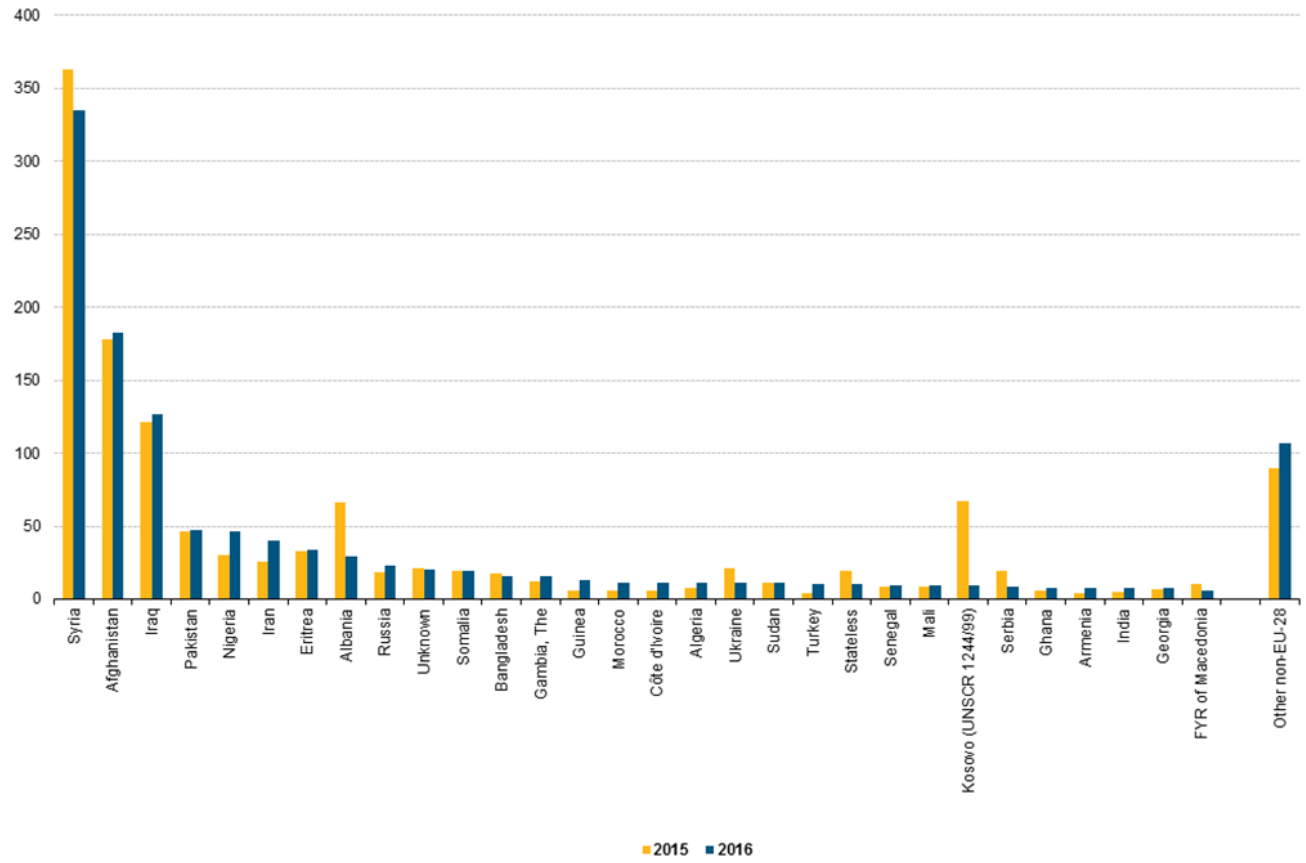
In the mid of 2010s, more precisely in 2015 and 2016, Europe received the largest number of refugees and migrants since the Second World War, while the Syrian civil war played an important role (EC, 2017). In 2015, 2.7 million immigrants from non-member countries moved to EU-28 member states. Figure 2.2. illustrates the increase in asylum applications of non-EU nationals to EU-28 countries from 2006 to 2016, while Figure 2.3. represents the countries of origin of non-EU nationals seeking asylum from EU-28 countries in 2015 and 2016.

Figure 2.2. Asylum Applications of non-EU Citizens in the EU-28 between 2006 and 2018



(¹) 2006 and 2007: EU-27 and extra-EU-27.
(²) 2006 and 2007: not available.
Source: Eurostat (online data codes: migr_asyctz and migr_asyappctza)

Figure 2.3. Countries of origin of non-EU Asylum Seekers in the EU-28 in 2015 and 2016



Source: Eurostat (online data code: migr_asyappctza)

Moreover, 1.9 million people previously residing in one EU Member State migrated to another one. In the same year, Germany reported the largest total number of immigrants (1.543.800), followed by the United Kingdom (631.500), France (363.900), Spain (342.100) and Italy (280.100). Germany also reported the highest number of emigrants in 2015 (347.2 thousand), followed by Spain (343.900), the United Kingdom (299.200), France (298.000) and Poland (258.800). While 17 EU Member States reported positive net migration in 2015, the other Members (Bulgaria, Ireland, Greece, Spain, Croatia, Cyprus, Poland, Portugal, Romania, Latvia and Lithuania) had more emigrants than immigrants (Eurostat, 2018).

Table 2.1. Total Stocks of Foreign Born Population in EU 15 Countries (in Thousands), 2000-2013

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Austria	843.0	1112.1	1137.4	1141.2	1154.8	1195.2	1215.7	1235.7	1260.3	1275.5	1294.7	1323.1	1364.8	1415.0
Belgium	1058.8	1112.2	1151.8	1185.5	1220.1	1268.9	1319.3	1380.3	1443.9	1503.8	1628.8	1643.6	1689.5	NA
Denmark	308.7	321.8	331.5	337.8	343.4	350.4	360.9	378.7	401.8	414.4	428.9	441.5	NA	NA
Finland	136.2	145.1	152.1	158.9	166.4	176.6	187.9	202.5	218.6	233.2	248.1	266.1	285.5	304.0
France	NA	NA	NA	NA	NA	6910.1	7017.2	7129.3	7202.1	7287.8	7358.2	7462.0	7538.0	NA
Germany	NA	NA	NA	NA	NA	10399.0	10431.0	10529.0	10623.0	10601.0	10591.0	10689.0	10918.0	NA
Greece	NA	1122.9	NA	NA	NA	NA	NA	NA	NA	NA	828.4	750.7	729.9	NA
Ireland	NA	NA	390.0	NA	NA	NA	601.7	NA	NA	NA	NA	752.5	NA	NA
Italy	NA	NA	NA	NA	NA	NA	NA	NA	4375.2	4798.7	5350.4	5457.8	5695.9	NA
Luxemburg	NA	144.8	NA	NA	NA	NA	NA	NA	NA	NA	205.2	NA	NA	NA
Netherlands	1615.4	1674.6	1714.2	1731.8	1736.1	1734.7	1732.4	1751.0	1793.7	1832.5	1868.7	1906.3	1927.7	NA
Portugal	NA	651.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	871.8	NA	NA
Spain	1969.3	2594.1	3302.4	3693.8	4391.5	4837.6	5250.0	6044.5	6466.3	6604.2	6677.8	6759.8	6618.2	NA
Sweden	1003.8	1028.0	1053.5	1078.1	1100.3	1125.8	1175.2	1227.8	1281.6	1338.0	1384.9	1427.3	1473.3	NA
United Kingdom	NA	NA	NA	NA	NA	NA	5757.0	6192.0	6633.0	6899.0	7056.0	7430.0	7588.0	NA

Source: OECD, available at <https://data.oecd.org/migration/stocks-of-foreign-born-population-in-oecd-countries.htm#indicator=chart>, 5.5.2015.

2.3. Migration Patterns from Turkey to the EU 15

İçduygu and Biehl (2006) categorize Turkey's migration patterns in the 20th century in three major periods: 1923 to 1960, 1960 to 1980 and 1980 to 2000s. The first period starts with the foundation of the Turkish Republic in 1923. In this period, migration was an important political tool used to transform the 'heterogeneous' Ottoman population into a 'culturally, religiously and linguistically homogeneous' society. As mentioned before, this policy had strong impacts on religious minorities, particularly on Armenians, Greeks, Catholics and Jews who chose or were forced to leave Anatolia (Aktar, 2000; Yıldız, 2001 from İçduygu and Biehl, 2006). Similarly, Turkish and Muslim minorities living in the former Ottoman soil - Balkans and Caucasus - migrated to Turkey.

The 1960-1980 period is described as a phase when rural-to-urban migration was increasingly witnessed in Turkey[6] (Karpat, 1976 from İçduygu and Biehl, 2006). In addition to the internal migration, international migration was triggered by the bilateral agreement between West Germany and Turkey signed in 1961. Thus, the 1960s are associated with large-scale labor migration from Turkey to Europe. In the 1970s, however, when labor demand in European countries suddenly decreased due to the slowdown of economic growth resulting from the Arab oil embargo in 1973, Turkish labor migration was directed to the Middle East and Australia. This decade is associated with migration through family reunification.

Table 2.2. Overview of the International Migration Transition in Turkey

Period	Dominant Types of International Migration	Dominant State Ideology Related to Migration
1923-1960	Emigration of non-Muslims Immigration of Muslims and/or Turks	Nationalism / Statism
1960-1980/90	Labor Emigration (Muslims and/or Turks)	Developmentalism / Liberalism
1990-2010	Immigration of foreigners (non-Muslims and/or non-Turks)	Neo-liberal Institutionalism

Source: İçduygu (2014:10).

[6] Emigration of ethnic and religious minorities from Turkey and immigration of Turkish and Muslim minorities from Europe to Turkey was still taking place in the 1960-1980 period but at a decreased rate.

Globalization together with political and economic transformations in Turkey's neighboring countries significantly changed the migration pattern of Turkey (İçduygu and Biehl, 2006). The liberalization of the Turkish economy and the start of international flow of capital and goods in the beginning of the 1980s revived the economy and led to investment incentive plans. In this period, Turkey transformed from a migrant sending country towards a receiving and transit country. The political upheavals in Turkey's neighboring countries and international military interventions to the oppressive regimes in these resulted in an increase in large (illegal, transit) migration and refuge flows to Turkey. Migration from Turkey to the EU in this period happened in form of asylum seeking.

In the following part, the migration patterns between Turkey and Europe from 1950 to 2010 will be described in decades.

2.3.1. **Migration in the 1950s:** *Personal Initiatives and Private Agencies*

The mobility of Turkish citizens in the 1950s was characterized by the effects of a rapid urbanization of the country (Sirkeci, Cohen, Yazgan, 2012, p. 35). Rural to urban migration as well as temporary international migration in form of personal initiatives started in this period.

West Germany, in need of additional labor force after World War II due to its rapid economic growth, initially employed natives from East Germany, and later from other industrializing European countries – (South) Italy, which was a Common Market member, Spain, Greece and Turkey, respectively. While the labor migration from other Mediterranean countries happened on basis of bilateral agreements from the beginning on, Turkish workers and artisans were invited within the context of 'improving their professional skills' (Abadan-Unat, 2002).

Workers and artisans were nominally recruited by the 'Zentralverband des deutschen Handwerks' and later by the Research Institute for German-Turkish Economic Relations ('Forschungsinstitut für Deutsch-Türkische Wirtschaftsbeziehungen'). At the beginning of 1960, the exchange of German and Turkish artisans was assigned to an inter-ministerial commission. Turkish emigration took another character, when, following the 1960 military coup, in the 1961 Constitution certain restrictions on the right to travel abroad were removed.

2.3.2. **Period from the Early 1960s to 1973:** *Labor Migration on Basis of Bilateral Agreements between Governments*

After the removal of restrictions to travel abroad by the new Turkish Constitution in 1961, due to unemployment rates and lower wages in Turkey, together with the labor force need in industrialized European countries, the number of Turkish labor migrants tripled in a year. In September 1961, a bilateral labor force agreement was signed between West Germany and Turkey. In 1964, similar bilateral

agreements were signed between Turkey and Austria, Belgium and the Netherlands, in 1965 with France and in 1967 with Sweden. Applications of candidates have been anonymously evaluated by the Turkish Labor Placement Office and recorded on waiting lists. However, 'nominal recruitment' of workers continued until 1973 (Abadan-Unat, 2002).

Table 2.3. Bilateral Labor Force and Social Security Agreements between Turkey and Some EU15 Countries

Countries	Labor Force Agreements	Social Security Agreements
West Germany	30 September 1961	30 April 1964
Austria	15 May 1964	12 October 1966
Belgium	15 July 1964	4 July 1966
Netherlands	19 August 1964	5 April 1966
France	8 April 1965	20 January 1972
Sweden	10 March 1967	2 September 1977
Denmark		13 November 1970

Source: Abadan-Unat (2002).

There was a major structural change in the Turkish migration to Europe during this decade. On the one hand, the construction of the Berlin Wall started to hinder migration from East Germany to West Germany. However, additional labor force was needed. On the other hand, in the first Five-Year Development Plan of Turkey, 'the export of the increasing labor force' was determined as a policy goal. Thus, in the 1960s migration took place within the framework of a cooperative model of concerning governments (Abadan-Unat, 2002:43f.; Sirkeci, Cohen, Yazgan, 2012:35).

Most of the guest workers selected were either farmers aged between 18 and 35, or construction workers, miners and schoolteachers (Martin, 2002). Between 30 and 40 per cent of the Turks employed in Germany were skilled workers in Turkey; however, they started to work as manual laborers in their host country. At the end the 1960s, 40 per cent of Turkish carpenters and stonemasons were recruited in Germany (Martin, 1980, 2002).

International migration was planned on the 'rotation principle'. It was assumed that the workers would return to their home country after one year. For this reason, in Germany, they were called guest workers – 'Gastarbeiter'. However, the employers did not want to change their employees, while the employees wanted to stay longer in order to earn enough to start their own businesses when they returned to their home country.

In 1966-1967, when there was an economic crisis in the German car industry, thousands of Turkish employees lost their job. For the first time, the policy of 'importing' labor force was being criticized through discussions if the foreign workforce was a 'Konjunkturpuffer' or a natural part of a highly industrialized country. The majority of the Turkish migrants who lost their job started to look for job opportunities in other European countries such as the Netherlands, Belgium and Denmark. However, the crisis did not last for a long time and the workers were reemployed. Also during this decade, Turkish workers started to syndicate, while European syndicates started to open special departments for them (Abadan-Unat, 2002:45f.).

2.3.3. Period from 1973 until the End of the 1970s : *Economic Crisis and Recession, End of European Demand for Temporary Labor Force, Family Reunification*

Starting from 1972, Turks have been the largest ethnic group among all guestworkers in Germany (Hunn, 2011). It was the 1970s when receiving European countries became aware of the fact that the migrant workers were not only guest workers, as it was intended. The German, Austrian, Belgian and Netherlands governments had already signed Social Security Agreements with Turkey during the course of the 1960s. Similar agreements were signed between Turkey and Denmark, France and Sweden during the 1970s so that Turkish workers were covered by the social security systems in those countries, as shown in Table 2.3.

The oil embargo of 1973, which quadrupled the oil prices and led to a global economic crisis, completely changed the governmental policies towards recruitment of foreign labor force. On the one hand, new labor migrants were not accepted any more. On the other hand, although the existent labor migrants did not lose their jobs, they were encouraged to return to their home country.

After the economic crisis, there has been a polarization in opinions about migration policies in Germany. The German Association of Employees (Deutscher Unternehmer Verband) as well as local governors were for the implementation of migration policies based on the rotation principle so that the infrastructural services would not be overloaded. The German Syndicates (DGB), concerned of the competition of cheap labor force and a potential increase in illegal migration flows, was criticizing the 1965 Law of Foreigners and emphasizing the importance of 'integration'.

As a consequence of the policy change, the number of Turkish newcomers to Germany fell tremendously. Despite that, the Turkish immigrant stock continued to rise due to family unifications. While the number of Turks living in EU countries in 1973/1974 was 711.302, it rose to 1.765.788 after family reunification during the 1970s (Rist, 1978:113). Thus, migration did not come to a halt but took other forms, family reunification being one of them.

The implementation of stricter policies also led to an increase in illegal migration flows. A high share of Turkish workers entered Europe with a tourist visa and overstayed. Later, in order to protect native workers from the competitive low wages of illegal migrant workers and the 'tourist' workers from being abused, receiving countries passed amnesty laws and allowed them to work legally. The illegal migrants were requested to return to their home country first and were promised to be given work and stay permit. These laws came into force in Belgium in 1966 and 1974, in Germany's Hessen and Nordrhein-Pfalz in 1972, in France in 1973 and in Netherlands in 1975 (Abadan-Unat, 2002:50).

During this period, the majority of Turkish migrant workers was aiming to return to Turkey and to found their own businesses (once they had earned the necessary capital). Nevertheless, they chose to postpone the return to their retirement age because of the high unemployment rate and the increasing political and social unrest in Turkey. The economic and political conditions of Turkey also caused them to invite their families to the European countries they were living in.

Family reunifications led European countries to make new regulations on family (child) aid and on work permits to spouses of migrant workers. In Germany, from 1975 on migrant workers whose children were living in Germany received a significantly higher child aid than those whose children were back in the home country. This reform, which initially aimed to save on the social welfare payments, led to the exact opposite. Until that time, although the share of Turkish migrant workers in all migrant workers was the highest, the share of Turks which had brought their families was the lowest. After the coming into effect of the law on social aid, Turkish migrant workers started to bring their families to Europe, and there has been a significant increase in their fertility rates[7] (Abadan-Unat, 2002:50f.).

2.3.4. **Migration in the 1980s:** *Increase in Asylum Seeking in Europe, Restrictive Migration and Travel Policies, Laws Encouraging Remigration*

As already mentioned, the suspension of labor immigration to Western European countries in the mid-1970s did not bring overall emigration from Turkey to an end. On the one hand, new destination countries such as Australia and MENA countries were found for labor migration; and on the other, European countries continued to be the long-standing receiving area.

When migration policies as well as travel regulations to European countries became even more restrictive after 1978, there has been a significant increase in the number of asylum seekers. The 1980 military coup in Turkey played a significant role in the increase of asylum seekers. On the other hand, a part of the asylum seekers were economic migrants who were actually aiming to work. While the

[7] Between 1974 and 1980, there has been a 129.8% increase in the number of children living in Germany (Abadan-Unat, N. et. al., 'Göç ve Gelişme', SBF, Ankara, 1975, p. 193, Table 5.2.2.1, from Abadan-Unat, 2002, p.51).

number of Turkish asylum seekers in Germany was only 809 in 1976, it rose to 57.913 in 1980 (Statistisches Bundesamt, Statistisches Jahrbuch, 1995).

In addition to Turkish asylum seekers, due to the war in Bosnia-Herzegovina, a large number of asylum seekers came from the former Yugoslavia. As a policy response in Germany, starting from June 1980, asylum seekers have been placed to special camps and were not given social insurance or work permit. Consequently, the number of asylum seekers decreased sharply.

Also during the 1980s, almost all European countries except Greece and Italy, have started to issue a visa to Turkish citizens. This implementation has restricted the visit of families of Turkish migrant workers.

Different political parties have proposed the implementation of different migrant policies. While the Social Democrats in Germany have taken a series of measures for the second generation migrants to reach better education opportunities and to integrate socially; the Christian Democrats have repeatedly expressed during electoral campaigns that they aimed to terminate international migration, to encourage migrant workers to return to their home countries and to realize the complete economic and social integration of immigrants residing in Germany since a long time (Abadan-Unat, 2002, p. 56ff.).

In November 1983, the Kohl government in Germany indeed brought into force a law which would 'encourage the return of foreigners' to their home country[8]. According to this law, migrants of Turkish, Yugoslavian, Spanish, Portuguese, Tunisian and Moroccan origin who would return between October 1983 and June 1984 would receive financial aid for themselves and their children. This legal measure has led to a 5.4% decrease in the Turkish migrant population in Germany in 1984 (Abadan-Unat, 2002, p. 58f.).

[8] 'Das Gesetz zur Förderung der Rückkehrbereitschaft'

Table 2.4. Turkish Migrant Population in selected European Countries between 1968 and 1980

Country	1968/69	1970/71	1973/74	1980	1980	1980	Total
				Workers	Adults	Children	
Germany	171.016	373.000	605.000	590.623	287.377	584.400	1.462.400
France	4.000	10.000	29.600	38.000	20.695	34.077	92.772
Netherlands	13.243	16.512	46.018	47.326	38.137	36.249	121.712
Belgium	4.217	8.500	10.000	23.000	13.305	30.258	66.563
UK	-	1.387	2.170	3.000	1.000	2.000	6.000
Denmark	-	2.377	7.000	9.327	250	6.264	15.841
Other EEC Countries	-	-	-	395	30	75	500
Total (EEC)	192.476	411.776	711.302	711.671	360.794	693.323	1.765.323
Austria	5.259	12.316	29.764	30.130	17.331	17.539	65.000
Switzerland	5.227	6.502	23.158	20.119	2.143	13.604	35.857
Norway	-	200	449	1.370	163	719	2.252
Non-EEC Countries	12.157	21.805	58.432	58.619	24.661	40.043	119.314
Europe	204.633	435.581	769.734	770.290	385.455	733.366	1.885.102

Source: Abadan-Unat (2002:48)

During the 1980s, Turkish labor migration has shifted towards the Middle East and North Africa (MENA). A large number of male workers migrated to MENA countries, particularly to Saudi Arabia, Libya and Iraq. Turkey's need of new host countries due to restrictive migration policies of the EU corresponded with the high labor force demand in MENA countries owing to the upsurge of oil prices after 1973 and the increase in the incomes of oil-exporting Gulf countries. The volume of Turkish labor migration to MENA was similar to migration to Germany during the 1960s and early 1970s (until the oil crisis)[9], however its nature was different since it was 'exclusively a temporary movement of male workers', the duration of stay being determined by the completion time of the work (İçduygu, 2008:6; 2012:15f.).

[9] Between 1975 and 1980, 75.000 Turkish workers had migrated to oil-exporting countries. In the 1980s, the number reached 500.000. The number of workers who had the experience of working in Gulf countries at some time between the mid-1970s and the mid 1990s was more than 700.000 (İçduygu, 2008:6).

Since the 1980s, Turkey itself has increasingly become a country of immigration and transit migration. At the beginning of the 1980s, the liberalization and revival of the Turkish economy has led to the attraction of foreign investment. International banks and companies started to invest in Turkey, while particularly the tourism sector has been promoted. As a result, there has been a significant increase in the number of tourists received each year; a part of them entering through the borders either to stay permanently in Turkey or to migrate to a third country.

2.3.5. **Migration in the 1990s:** *Lower Migration Rates, Asylum Flows, Law on Foreigners, Increased Resentment against Migrants, Emergence of Ethnic and Religious Associations, Identity and Integration Problems*

Since the mid-1990s, Turkey has been a country of net immigration. Turkish labor migration to the EU-15 has been on a declining trajectory, while the number of migrants from Turkish-speaking CIS countries and transit migrants from North Africa and Middle East have outnumbered that of labor migrants.

Turkish labor migration in the 1990s was still directed towards MENA countries but with decreased numbers of migrants due to the completion of large-scale infrastructural projects in the destination countries and due to the Gulf crisis. As a response to the decline of labor demand in Gulf countries, relatively small numbers of labor migrants went to CIS countries as a last phase of Turkish emigration, when these states started reconstruction programs after the collapse of the Soviet Union. Emigration of Turks to CIS countries was important in terms of displaying the 'continuity of emigration' from Turkey (İçduygu, 2012:16).

Migration from Turkey to Western European countries continued, similar to the previous decade, mainly in form of asylum flows and family unification. A large part of the migration took place in form of asylum seeking of Turkish citizens of Kurdish origin. According to UNHCR data, 340.000 Turkish citizens have been applying for asylum in Western Europe in 1990s (Kirişçi, 2003). Additionally, in this decade, a new type of family-related migration emerged, when the children of families who had migrated in the 1970s and 1980s grew older and started to marry and bring spouses from Turkey (Kaya, 2008).

In 1990, as a reaction to increasing numbers of residing non-nationals, Germany enacted the Aliens Law, which came into force on January 1st, 1991. The law, on the one hand, was making easier for the new generation to acquire German citizenship, but on the other hand, restricting the residence permit in case of prolonged unemployment status and acquisition of social assistance. Also, workers who were residing abroad for longer than 6 months could lose their (permanent or non-permanent) residence permit. The main policy can be summarized as to 'accept' foreigners who were likely to make a more positive net fiscal contribution and to integrate.

Starting from the end of the 1970s, in Germany the term 'guest-worker' was replaced by the terms 'foreign employee' ('ausländischer Arbeitsnehmer') or simply 'migrant' ('Einwanderer') (Abadan-Unat, 2002:66). After 1979, the policies were based on the integration issue. However, in the 1990s, among the German society resentment against migrants was increased mainly due to integration problems. At the same time, Turkish migrants started to build ethnic and religious associations as a response to failed integration and exclusion from the institutional structure of the German society (Tol, 2012:27).

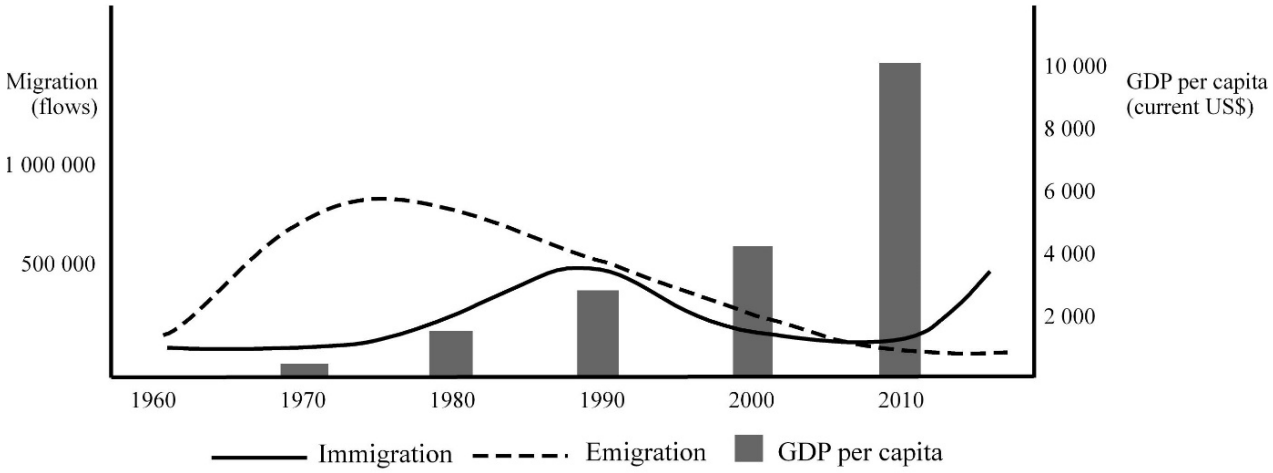
2.3.6. **The New Century:** *Lower migration rates, Immigration and Transit Migration 'through' Turkey, Return Migration, Migration of 'Euro-Turks', European Retiree Migration*

As described in the previous parts, migration dynamics in the Euro-Turkish region have changed several times due to major political and economic developments. In the 2000s, the major factors affecting migratory movements were the two successive EU enlargement waves (in 2004 and 2007), and the global economic crisis of 2008-2009. For the first time in the history of migration between Europe and Turkey, in the late 2000s, migration flows from Europe to Turkey have exceeded the flows in the contracting direction (İçduygu, 2010).

Compared to previous decades, the number of Turks migrating to Western European countries has significantly decreased in the 2000s. In addition, the number of returning Turkish citizens or naturalized Turks has increased. The main reasons for this were the relatively enhanced economic and political conditions in Turkey, restart of negotiations with the EU and prospects of full membership, which existed until the political and technical stalemate in formal accession talks in 2012.

The changes in the labor migration trend in Turkey from 1960 to 2013 can be observed in Figure 2.4. Immigration rates increased from the 1960s on and reached a peak in 1990. After the early 1990s, it had a declining trajectory until 2011 (when the civil war in Syria started). Then it sharply went up again. Emigration from Turkey, on the other hand, increased until the mid 1970s, and from this time on it followed a declining path.

Figure 2.4. Labor Migration Transition in Turkey, 1960-2013



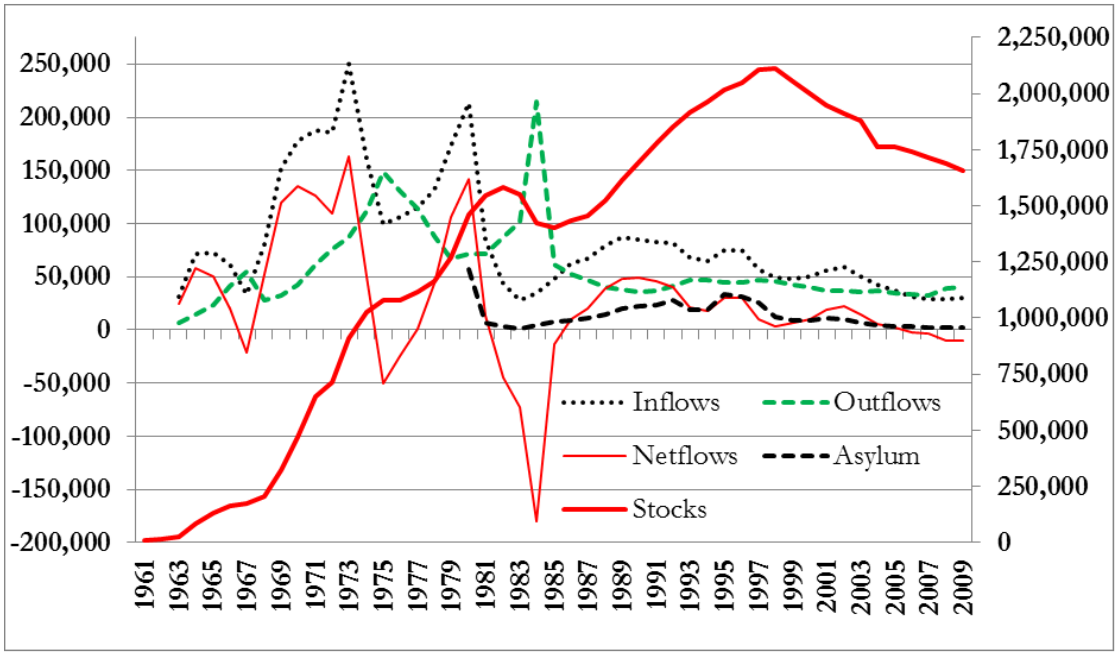
Source: İçduygu (2014:10).

Sizeable Turkish immigrant communities are living in EU-15 countries. The total number of Turks living in the EU is estimated to be approximately 3.750.000[10]. The majority of migrants of Turkish origin are living in Germany, France, the Netherlands and Austria, respectively. By the end of 2013, the number of Turkish citizens living in Germany was 1.549.808[11]. 219.534 Turkish citizens were living in France (in 2011)[12], 378.330 in the Netherlands (in 2009)[13] and 114.740 in Austria (in 2013)[14].

Given the fact that Germany hosts the largest Turkish migrant stock, it is worth looking at the long-term migration flows between Germany and Turkey. The figure below illustrates the inflows, outflows, net flows, asylum rates and the migrant stock in Germany for the period between 1961 and 2009.

[10] Due to the difficulty of finding data for the same year, the migrant stock numbers are given for different years.
[11] Statistisches Bundesamt, https://www.destatis.de/EN/FactsFigures/SocietyState/Population/MigrationIntegration/ForeignPopulation/Tables/DurationOfStay.html, 17.12.2014.
[12] INSEE, Recensement 2011, http://www.insee.fr/fr/themes/tableau.asp?reg_id=0&ref_id=etrangersnat, 17.12.2014.
[13] CBS Netherlands, http://statline.cbs.nl/Statweb/publication/?DM=SLEN&PA=37943eng&D1=0-2,4,7-9,47,89,210,257,299,407,437&D2=318-319,335-336&LA=EN&HDR=G1&STB=T&VW=T, 17.12.2014.
[14] Statistik Austria, Statistik des Bevölkerungsstandes, file:///C:/Users/zeynep.girgin/Downloads/bevoelkerung_zu_jahresbeginn_seit_2002_nach_zusammengefasster_staatsangeho_022498%20(1).pdf, 28.05.2014.

Figure 2.5. Migration Flows from Turkey to Germany, 1961 to 2009



Source: Sirkeci, Cohen, Yazgan (2012).

The migration corridor between Germany and Turkey has two directions. It can be observed that the migration flows from Turkey to Germany (inflows curve) declined sharply right after the oil crisis in 1973 and after the enactment of the law promoting the return of migrants in 1983. Despite fluctuations over time, the rate of inflows has declined during the 1990s and 2000s. Moreover, it is worth noting that in 2006, the flows from Germany to Turkey exceeded those in the opposite direction.

The net annual migration from Turkey to Germany was 4.500 and 4.668 in 2012 and 2013, respectively. Compared to the annual flows from the new EU member states Poland (79.455), Romania (58.800), Hungary (27.645) and Bulgaria (25.776), the flow rates from Turkey are very low. The main motives of Turks for migrating to Germany in 2013 were family reasons (36.18%), higher education (7.61%) and employment (6.79%). The same year, 22.0% of the employed Turkish citizens had non-qualified jobs, while 73.9% had qualified jobs and 3.9% qualified jobs in public interest according to §18 AufenthaltG (BAMF, 2014).

Thus, from the 1960s to the 2010s the volume and type of migratory flows as well as the qualification profile of migrants have drastically changed depending both on economic and political conditions.

2.3.7. Period following the Syrian Civil War

As mentioned before, the number of immigrants heading to Europe and of asylum applications reached a peak after the outbreak of civil war in Syria. A number of legal measures were taken by the EU and Turkey since 2013 to prevent irregular migration. In October 2015, the EU and Turkey agreed on the EU-Turkey Joint Action Plan with the aim to support the Syrians under temporary protection as well as their Turkish hosting communities and to strengthen the cooperation to prevent irregular migration. Turkey declared its intention to "accelerate procedures in order to smoothly readmit irregular migrants who are not in need of international protection and were intercepted coming from the Turkish territory in line with the established bilateral readmission provisions" (EC, 2017).

On March 2016, the European Council and Turkey reached an agreement at stopping irregular migration over Turkey to Europe with the EU-Turkey Statement. According to the Statement, all irregular migrants and asylum seekers who arrived at Greek islands from Turkey, whose applications are declared inadmissible, should be returned to Turkey. Thus, the core aim of the Statement was to prevent migrant smuggling and the fatal risks migrants were taking by crossing the Aegean Sea.

Moreover, the Agreement between the European Union and the Republic of Turkey on the readmission of persons residing without authorisation, signed in December 2013 came into force in June 2016. Complementarily, the EU Facility for Refugees in Turkey, totalling EUR 3 billion for the years 2016 and 2017, was allocated to support the refugees and host communities in Turkey in terms of "humanitarian assistance, education, migration management, health municipal infrastructure and socio-economic support" (EC, COM 2017, 558 final).

The measures taken have been effective in decreasing the number of irregular migrants. Following the EU-Turkey Statement, a sharp decrease in irregular migrants was observed. According to the Progress Report of the EC in September 2016, the average number of daily arrivals of Syrians to Greek islands decreased from 1.740 just before the Statement to an average of 94 after the Statement. Similarly, death occurances diminished significantly after the Treatment. Until September 2016, 1.614 Syrians resettled from Turkey to Europe, while 578 irregular migrants were returned to Turkey in the framework of the Statement (EC, 2016).

2.4. Stages of Migration

Castles and Miller (1993, 1998, and 2014) define four stages in the development of international migration:

> "Stage 1: Temporary labor migration of young workers, remittance of earnings and continued orientation to the homeland;
>
> Stage 2: Prolonging of stay and the development of social networks based on kinship or common area of origin and the need for mutual help in the new environment;
>
> Stage 3: Family reunion, growing consciousness of long-term settlement, increasing orientation towards the receiving country, and emergence of ethnic communities with their own institutions (such as associations, shops, cafes, agencies, professions);
>
> Stage 4: Permanent settlement which, depending on the policies of the government and the behavior of the population of the receiving country, leads either to secure legal status and eventual citizenship, or to political exclusion, socioeconomic marginalization and the formation of permanent ethnic minorities." [Castles, Miller; 1993:25]

Stage 1 started in the 1960s, when Turkish migrants entered the European labor markets in Germany, Austria, Belgium, Netherlands, France, Sweden and Denmark as 'guest workers', with the aim to send remittances to the home country and to return once they had saved enough to start their own business.

Stage 2 already started in the 1960s and continued during the 1970s. Temporary labor contracts with Turkish employees were initially signed for two years and then prolonged several times. Despite the end of demand for temporary work force by European governments after the 1973 oil shock, Turkish migrants stayed in Europe. In the Turkish migration pattern to the EU15, the start of family reunion has been a turning point (Toksöz, 2006:31). While European governments, particularly the German government, were implementing restrictive policies and encouraging the return of the Turkish migrants after the 1973 oil crisis, the latter brought their families to European countries because of the political and economic instability and the lack of positive prospects for Turkey. When family reunion was made legally possible, the workers who had been invited as temporary workers started to become permanent.

Thus, in the 1970s labor migration was to a large extent replaced by family reunion, where Stage 3 came about. With the reunification of families, growing consciousness about the long-term settlement was developed. On the other hand, in the 1980s, a high number of Turkish asylum seekers have emigrated from Turkey, some of which are assumed to be actual economic migrants. Thus, it can be supposed that in the 1980s Stages 1, 2 and 3 were taking place simultaneously.

It can be said that the development of social migrant networks as well as the need for mutual help in the new environment (classified in Stage 2) started concurrently with the first waves of international migration. Due to cultural characteristics, migrants may begin forming networks based on kinship even when there is yet uncertainty whether they will settle permanently. However, it was mainly in the 1990s that ethnic institutions and associations were built. In the same decade, among the host communities growing concerns about Turkish migrants' identity and integration problems were observed.

In case of the Turkish migrants, the permanent settlement in European countries – Stage 4 – 'depending on the policies of the government and the behavior of the population of the receiving country', but also depending on the characteristics of the migrant community, led to the formation of a permanent ethnic minority. Social, economic and political integration takes place with mutual efforts from the native as well as migrant communities. The native community has to socially 'accept' the migrant community, while the latter should be willing to integrate.

The government's perspective towards migrants – for instance whether it differentiates between 'citizens with a migration background' and 'citizens without a migration background' – also plays a significant role in the complicated integration process. In this regard, France and Germany may be mentioned as two differing examples. It is another controversial subject if the sending country should give efforts in integrating the migrants in their host country. In the Turkish case, the integration process has been a matter of socio-political discussion for decades, and has worked better for the 2nd and 3rd generations. However, the integration issue goes far beyond this PhD thesis.

Considering the Turkish European immigration patterns in the 1960-2015 period in this four-stage model, it can be viewed that stages have been taking place simultaneously. While a large Turkish migrant stock was formed in many EU-15 countries already in the 1960s, migration has been continuing in different forms over many decades. Thus, while Stage 3 was already reached, Stage 1 was still continuing. On the other hand, some steps that Castles and Miller expect in the 3rd Stage, such as awareness of long-term settlement, formation of ethnic communities and foundation of their own institutions have occurred long after the family reunion.

Chapter 3 THEORETICAL FRAMEWORK OF INTERNATIONAL MIGRATION

'People vote with their feet.' ***[Tiebout Hypothesis (1956)]***

3.1. Introduction

In order to estimate the potential international migration flows and (potential) economic impacts of immigration, one of the most crucial tasks is to determine the factors which motivate people in source countries to move and which perpetuate migration flows. In addition to a set of factors that initiate or perpetuate migratory flows, migration also tends to develop its own momentum.

International migration theories can be classified as sociological, micro- and macro-economic, socio-economic, geographical, and unifying approaches. Among the most important sociological theories, the Theory of Intervening Opportunities (Stouffer, 1940), the Push-Pull Model (Lee, 1966), the Migrant Networks idea (Taylor, 1986), and the Theory of Transnational Social Spaces (Pries, 1999; Faist, 2000) can be mentioned.

The most significant economic models of international migration are the Neo-classical Theory (which attempts to explain migratory flows at the micro- and macro-levels), the Keynesian Theory, the Dual (Segmented) Labour Markets Theory, the New Economics of Migration (Stark and Bloom, 1985) and the Theory of Relative Deprivation (Stark and Taylor, 1989).

Most economic models have the common premise that migration is driven by spatial differences and distributional differences in net returns to human labour. However, the main incentives of migrants are much more than purely economic. Since the migration decision is affected by a combination of economic, political, cultural, social and psychological factors, a multidisciplinary approach to the migration issue is more realistic. The Cumulative Causation Theory (Massey, 1990), the Institutional Theory (Massey et al., 1993), and the World Systems Theory (Wallerstein, 1974), are interdisciplinary theories which combine the sociological and economic approaches.

Geographical theories, including the Gravity Model (Stewart, 1941; Zipf, 1946; Isard, 1960; Lowry, 1966) and the Mobility Transition Theory (Zelinsky, 1971), focus on the role of distance in explaining migration patterns. They interpret distance as a factor moderating 'spatial interactions' between regions (Bijak, 2011:45). On the other hand, the Migration Systems Theory (Kritz and Zlotnik, 1992) and the Multidisciplinary Approach and Mobility Transition (Massey, 2002) pursue a unifying systems approach.

This part of the dissertation thesis is devoted to a brief discussion of selected international migration theories and the identification of the determinants, which have a key role in the migration process from Turkey to EU 15 countries. Firstly, selected sociological, socio-economic, economic, and unifying international migration models and theories will be described. Then, the relevant economic and non-economic determinants will be selected and a theoretical framework for the migration patterns between Turkey and the EU 15 will be drawn. The subsequent demo-economic model will be built on the determinants of the Turkish-EU migration determined in this Chapter.

Table 3.1. Theories of Migration

<table>
<tr><th>Sociological</th><th colspan="2">Economic</th><th>Geographical</th><th>Unifying</th></tr>
<tr><td></td><td>Macroeconomic</td><td>Microeconomic</td><td>Spatial Interactions</td><td></td></tr>
<tr><td>Intervening Opportunities (Stouffer, 1940)

Push-pull Factors (Lee, 1966)

Migrant Networks (Taylor, 1986)

Transnational Social Spaces (Pries, 1999; Faist, 2000)</td><td>Neo-classical Theory (Lewis, 1954; Harris and Todaro, 1970)

Keynesian Theory (Hart, 1975)

Dual Labour Market Theory (Piore, 1979)</td><td>Neo-classical Theory (Sjaastad, 1962; Todaro, 1970; Borjas, 1980)

New Economics of Migration (Stark and Bloom, 1985)

Relative Deprivation (Stark and Taylor, 1989)</td><td>Gravity Theory (Stewart, 1941; Zipf, 1946; Isard, 1960; Lowry, 1966)

Entropy (Wilson, 1967)

Catastrophe Theory and Bifurcations (Wilson, 1981)

Mobility Transition (Zelinsky, 1971)</td><td>Migration Systems Theory (Kritz and Zlotnik, 1992)

Multidisciplinary Approach and Mobility Transition (Massey, 2002)</td></tr>
<tr><td colspan="2">Cumulative Causation (Massey, 1990)</td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td colspan="2">Institutional Theory (Massey et al., 1993)</td></tr>
<tr><td colspan="2">World Systems Theory (Wallerstein, 1974)</td></tr>
</table>

Source: Bijak, 2011:48 from Zlotnik (1998) and Kupizewski (2002).

3.2. The Push-Pull Model of International Migration

Lee (1966) proposed an analytical framework based on Ravenstein's laws on migration, which became to be known as the 'push-pull' model. This individual choice and equilibrium model became a dominant migration model in education (Haas, 2008:8f.). According to this model, the migration decision depends on factors related to the area of origin, factors related to the area of destination, 'intervening obstacles' (e.g. geographic distance, immigration policies, etc.), and personal factors[15].

The most common determinants of migration can be listed as higher income, better career opportunities, greater freedom to innovate, better schooling opportunities for children, lower degree of discrimination, lower tax levels, civil rights, political rights, religious freedom, law and order, social mobility, personal safety, climate, and peace (Bodvarsson and Van den Berg, 2013). Economic incentives of migration can be a function of undesirable conditions in the source country or that of desirable conditions in the destination country.

Bodvarsson and Van den Berg (2013) have classified the incentives affecting the migration decision in a push-pull framework as illustrated in Figure 3.1. These consist of negative factors which *'push'* people to emigrate, positive factors which *'pull'* immigrants to the destination country, positive factors that encourage to *'stay'* at home, and negative factors that motivate to *'stay away'* from the destination country. If the stay and stay away factors are stronger than the push and pull factors, immigration does not occur in a large scale. On the contrary, if the push and pull factors are relatively stronger, immigration rates will grow as it was witnessed in the second half of the 20th century (Bodvarsson and Van den Berg:6). Beside these push and pull, stay and stay away factors exist costs of moving and formal exit / entry barriers.

Generally, economists distinguish two forces that create the push and pull effects – firstly the rural population growth which causes a Malthusian pressure on natural and agricultural resources, and pushes people towards urban areas, and secondly, better economic conditions that attract people towards urban areas and industrialized countries (Haas, 2008:9 from Skeldon, 1997:20; cf. King and Schneider, 1991:62f.; Schwartz and Notini, 1994).

The push-pull model is able to incorporate different theoretical insights. Although it is successful in incorporating all factors that play a part in migration decisions, it has some major weaknesses. One of the major weaknesses is that it does neither allow the assignment of relative weights to the determinants nor empirical testing on the role of factors that have been included or excluded in the model. Another weakness is that push and pull factors are usually 'mirrored', illustrating the two sides of the same coin,

[15] Migration is selective in the sense that potential migrants respond differently to factors in origin and destination areas and to intervening obstacles.

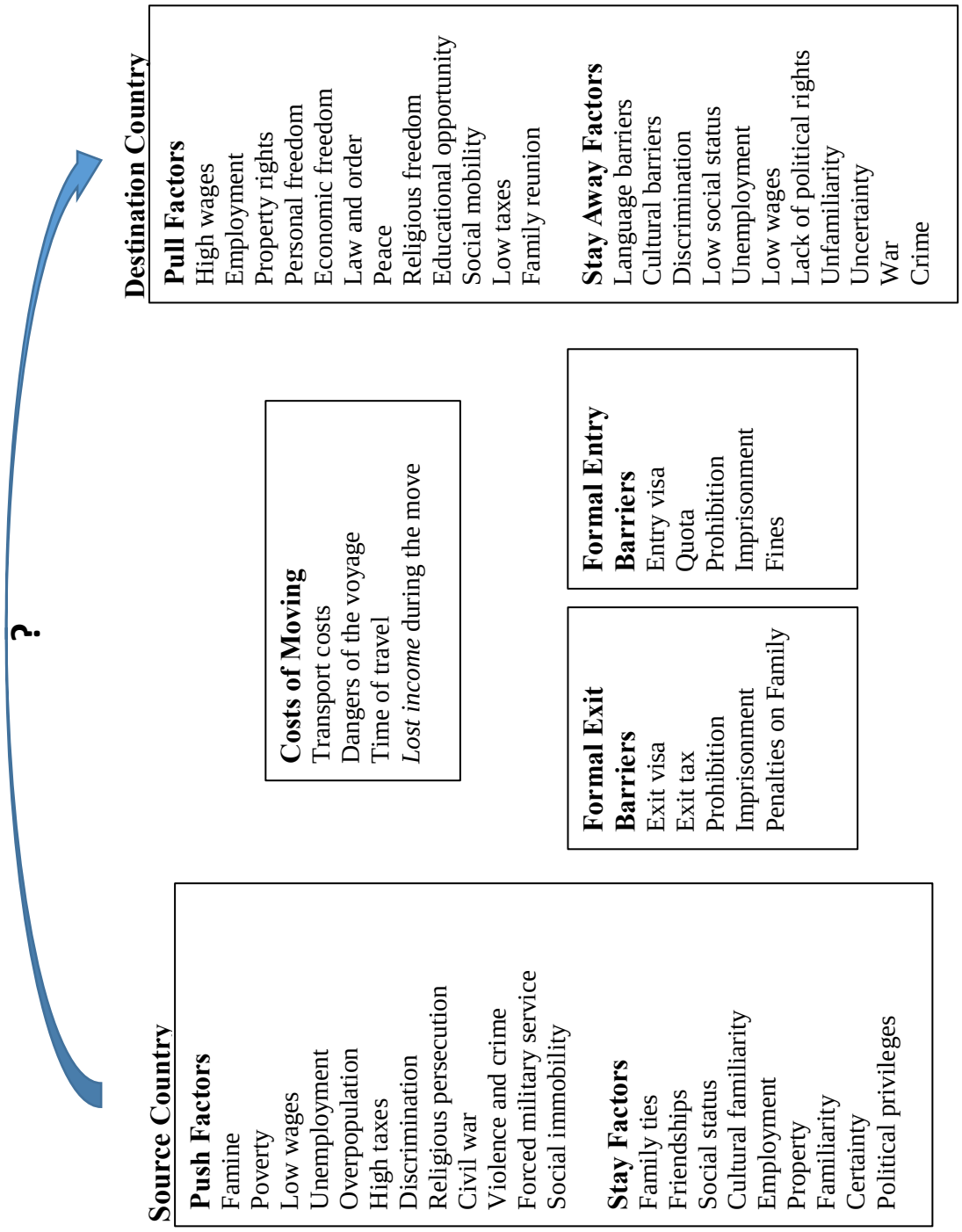
while it remains open to subjective judgement whether the push or pull factor is dominant (Haas, 2013:9f.).

Moreover, the push-pull model (and other neo-Malthusian explanations) have the tendency to pick out population pressure as ‘causes’ of migration, whereas these should be considered in relation to other (political, economic, social, cultural) factors that play a role in the inequality of access to resources. The needed framework to bring the factors of migration together in an explanatory framework is missing (Skeldon, 1990:125-126). Similarly, population growth is only a component of a more complex chain of processes and should not be seen as a ‘cause’ of migration by itself (Haas, 2013:10f.).

As is the case with neoclassical economic models, the push-pull model tends to view the migration decision as an individual cost-benefit analysis mostly ignoring the structural constraints that individuals have incomplete and unequal access to information. Additionally, the push-pull model does not explain return migration, or the simultaneous incidence of emigration and immigration from and to the same area. It also does not investigate the impacts of migration (Haas, 2013:11).

To conclude, the push-pull model is a static one which does not view migration as an integral part of transformation processes. Therefore, its analytical usefulness is limited.

Figure 3.1. Incentives Affecting the Migration Decision



Source: Bodvarsson, Van den Berg, (2013:6).

3.3. A Review of Selected Theoretical Models of International Migration

Migration theories can be broadly grouped as *'functionalist'* and *'historical-structural'* theories. The functionalist theory views the society as a system or collection of interdependent actors, which has an essential tendency towards equilibrium. According to functionalists, migration is generally a positive phenomenon that serves to the interests of all parties and leads to greater equality within as well as between societies (Castles, Haas and Miller, 2014:27). The push-pull model discussed in the previous part, the human capital theory and the neoclassical theory are functionalist theories.

In contrast, historical-structural theories, having their roots in neo-Marxist political economy, accentuate the ways in which social, economic, cultural and political structures constrain the behaviour of individuals and lead to disequilibrium. According to these, economic and political power are not equally distributed. Cultural and social attributes and practices reinforce structural inequalities. Migration, by providing 'cheap and exploitable labour force' serves to the interests of wealthy nations and leads to 'brain drain' from less developed nations. Thus, it leads to more inequalities and increases the gap between developed and developing countries (Castles, Haas and Miller, 2014:27-28). The dependency theory, the world systems theory, the globalization theory and the segmented labour market theory are some of the historical-structural theories.

Theoretical models of international migration can also be classified as theories explaining the initiation of international migration and theories explaining its perpetuation (Massey et.al., 1993). They use different key assumptions as well as references, and analyse international migration movements on different (the individual, household, national and international; and micro, meso, macro) levels. Despite the fact that the assumptions, propositions and hypotheses of the theories are not contradictory, they can have very different implications for policy formation.

Theories Explaining the Initiation of International Migration

Theories on the initiation of international migration are the neoclassical (macro and micro) theory, the dual labour market theory, and the world systems theory. According to the *neoclassical economic theory*, migration stems from differentials in wages and employment opportunities between countries. Migration costs are taken into account. The migration movement is an individual rational decision for income maximization. Workers move from the labour-abundant (low-wage) country towards the labour-scarce (high-wage) country[16]. The explanation of international migration according to the macro theory

[16] This movement has to be differentiated from the movement of human capital which has to be dealt with like capital. In all macro-level models, heterogeneity of immigrants due to their skills levels have to be taken into account.

of neoclassical economics has largely shaped public thinking and has built the basis of most immigration policies (Massey et.al., 1993:433).

Different from the neoclassical economics, in the *'new economics of migration'* the migration decision is interpreted as a household decision in order to minimize or diversify risks on household income or to overcome capital constraints. The new economics of migration examines also conditions in other markets than the labour markets.

Micro-level decisions are disregarded by the *dual labour market theory* and the *world systems theory*, which have their focus on forces on higher levels. The dual labour market theory views immigration necessary for the fulfilment of structural requirements in industrial economies, whereas the world systems theory views it as a natural consequence of (economic) globalization and market penetration across frontiers (Massey et.al., 1993:432).

Theories Explaining the Perpetuation of International Migration

The conditions that perpetuate international migration over time and across space may be the same but also different from those that initiated migration. Conditions such as differentials in wages and employment opportunities, and market penetration may continue to motivate people to migrate. However, new conditions often arise in the course of time and migration flows, such as the formation of migrant networks.

Theories that explain the continuation of international migration are the network theory, the institutional theory, cumulative causation and the migration systems theory. *Migrant networks* increase the likelihood of international migration by lowering the costs and risks of the movement and by increasing the expected net returns to migration. The networks increase the probability of migration and consequently the cumulative number of migrants, so that networks themselves expand over time. They create a form of social capital.

According to the *institutional theory*, after the initiation of international migration, a number of private institutions and voluntary organizations are founded to satisfy demand resulting from imbalances between the large number of potential migrants and the limited number of visas issued by destination countries. As a response to the formation of a black market in migration, voluntary humanitarian organizations are also founded to hinder exploitation and victimization of people. Thus, over time, companies and organizations become known and institutionally stable so that they form another form of social capital for migrants.

In addition to the networks and institutions, several other determinants contribute to the perpetuation of migration which were called *cumulative causation* by Myrdal (1957) (Massey 1990b; Massey et.al.,

1993). Causation is cumulative since due to each one of the socioeconomic factors the social context, in which the migration decision is taken, changes and the probability of additional migration flows increases. Eight socioeconomic factors have been recognized: the distribution of income, the distribution of land, the organization of agriculture, culture, the regional distribution of human capital, and the social meaning of work (Massey et.al., 1993).

3.3.1. Neoclassical Economic Theory

The first contributions to immigration economics date back to the late-19th century. In his two articles, Ravenstein (1885, 1889) wrote that the main causes of migration were economic, and defined several 'laws of migration'. Later, migration movements were associated with the factors of distance and population densities (Skeldon, 1997:19; Haas, 2008:4). This perspective explaining people's migratory movements from lower income towards higher income areas, and from densely populated towards less populated regions, has remained in much of the economic and demographic work (Haas, 2008:4; Castles and Miller, 2003:22; Castles, Haas and Miller, 2014:28).

At the macro-level, the neoclassical theory attempts to explain migration patterns through geographic differences in labour supply and demand. Differentials in wages motivate people to move from regions with low wages and a labour surplus to regions with high wages and labour-scarcity. Thus, after migration labour will be less scarce in the destination area and scarcer in the source area. Capital, on the other hand, moves in the opposite direction. According to this theory, factor price equalization (the Heckscher-Ohlin model) will cause wages in the source and destination areas to converge (Harris and Todaro 1970; Lewis, 1954; Ranis and Fei, 1961; Schiff, 1994; Todaro and Maruszko, 1987 from Haas, 2008:4f). In the long term, the factor price equalization process would bring the system to an equilibrium and eliminate the incentives to migrate (Haas, 2008:4f; Castles, Haas and Miller, 2014:30).

At the micro level, individuals are seen as rational actors who decide to migrate based on a cost-benefit analysis. Under the assumptions of free choice and full access to information, actors are expected to migrate to areas where they will be most productive in the sense of earning the highest wages. The process will depend on the individual's specific skills as well as the specific structure of the labour market (Haas, 2008:5).

In neoclassical theory, rural-urban migration is viewed as part of the development process, where labour surplus in rural regions provides the needed workforce in the urban (and industrialized) regions (Lewis, 1954; Haas, 2008:5). Todaro (1969) and Harris and Todaro (1970) expanded the basic two-sector model of rural-urban labour migration to the 'Harris-Todaro model' which forms the basis of the neoclassical migration theory.

The original model aimed at explaining the continuation of rural-urban migration in developing countries in spite of rising unemployment rates in big cities. Harris and Todaro emphasized that the simple wage differential approach had to be extended to the rural-urban 'expected' income differential, which is the income differential adjusted for the probability of finding an urban job (Todaro, 1969:138). As long as the income differences between rural and urban regions remain high enough to compensate the risk of being unemployed, a steady number of rural workers will be attracted by prospects of the relatively higher permanent incomes (Todaro, 1969:147; Haas, 2008:5).

Bauer and Zimmermann (1998) modified the Harris-Todaro model by including other factors than unemployment affecting the expected income in the destination area. These were opportunity costs of migration, costs of travel, temporary unemployment during the voyage and settlement at the destination as well as psychological costs of migration (Haas, 2008:5).

Borjas (1989, 1990) developed an international migration model where potential migrants decide on the basis of cost-benefit calculations. Another model was developed by Todaro and Maruszko (1987) for undocumented international migration on the basis of the Harris-Todaro model where they took into consideration the probability of being captured and deported, and the 'illegality tax' (Haas, 2008:6).

A complementary approach was that of Sjaastad (1962) where migration was seen as an investment increasing the productivity of human capital. Human capital theory explains the 'selectivity' of migration, and takes into account the labour market structures, skills and income distributions in source and destination countries (Castles, Haas and Miller, 2014:30). Migrants come from different sub-sections of populations and have differences in skills, abilities and personal characteristics. Thus, they will have different expected 'returns on investments'. This can theoretically explain the decreasing probability of migration with increasing age, and the increasing probability of migration with higher education of potential migrants (Castles, Haas and Miller, 2014:30).

The neoclassical migration theory has been criticized for mechanically reducing the determinants of migration, homogenizing migrants as well as societies, and being ahistorical and static (Kurekova, 2011:7). It would be inadequate to explain migration patterns solely in the neoclassical framework since factor markets in most developing countries are imperfect, and migration takes place in a complicated social, political, cultural and institutional framework as well. Governmental restrictions that play a restraining role in migration are also left out in the neoclassical theory.

3.3.2. The New Economics of Migration

According to the new economics of migration, migration decisions are taken not only by individuals but by larger groups of interrelated people, such as families, households or entire communities, where people act together with the intention to maximize expected income, to minimize risks to their income,

to maximize status within an embedded hierarchy and to overcome local market failures (Stark, 1991; Taylor, 1986, 1987; Massey, 1999:36). Thus, this theory 'shifts the focus of international migration theory from the individual independence to mutual interdependence' viewing migration as a 'calculated strategy' (Stark and Bloom, 1985:174f.).

In comparison to individuals, households can better handle risks to economic well-being through diversifying the allocation of productive resources. In case of migration, if economic conditions in the source area deteriorate so that productive activities do not generate sufficient income, households are able to receive remittances from migrants (Massey, 1999:36). Remittances can be viewed as an intertemporal contractual arrangement between migrant and family, while the latter has a dynamic comparative advantage (Stark and Bloom, 1985:174).

The nature of intragroup interaction is used to explain the economic performance of migrants: 'Heavy reliance on network and kinship capital' may explain migrants' higher performance than natives in the context of a prisoner's dilemma game (Stark and Bloom, 1985:175). Earlier migrants assist new migrants since their arrival confers benefits to them.

Another difference of the new economics of migration to neoclassical economic theory is that it does not assume that income is a homogenous good. The source of income is important, whereas households have incentives to invest in activities which will lead to new income resources (Massey, 1999:36).

Persons or households often engage in income comparisons within their reference groups, which has psychic costs or benefits – feelings of relative deprivation or relative satisfaction. Thus, a person can move to another location either in order to change his relative position in the same reference group, or to change his reference group. Even if their absolute income will be lower, people can prefer membership in a low relative deprivation reference group to membership in a high relative deprivation reference group (Stark and Bloom, 1985:173). On the other hand, an increase in other (affluent) households' incomes can increase the likelihood of migration of people from poor households, if income of the latter remains unchanged, because their relative deprivation will have increased. Also, market failures constraining the local income opportunities of the poor may increase the likelihood of migration (Massey, 1999:37).

Despite its ability to analyse the determinants and effects of migration at the same time, the new economics of migration has been critiqued for having sending-side bias and a limited applicability because of the difficulties of eliminating the effects of market imperfections and risks from other income and employment variables. Another criticism is that it does not concern the dynamics within households such as gender roles (Kurekova, 2011:8).

3.3.3. Theory of Labour Market Segmentation (Dual Labour Markets)

In contrast to the neoclassical and new economics of migration theories, which are (functionalist) micro-level decision models, the theory of labour market segmentation gives less importance to (but does not deny) the rational choice of individuals, and emphasizes the inherent labour demands of modern industrialized countries as the moving force of migration. According to Piore (1979), the most eloquent proponent of this theory, international migration is not caused by push factors in source countries but by pull factors in destination countries.

The continuous, inexpensive and flexible labour demand in industrial economies stems from structural inflation, social constraints on motivation embedded within occupational hierarchies, and the inherent duality of labour and capital (Massey, 1999:37f.). Wages cannot be determined only by supply and demand conditions. 'A variety of informal social expectations and formal institutional mechanisms, e.g. union contracts, ensure that wages correspond to the hierarchies of prestige and status workers receive and expect' (Massey, 1999:37). Thus, wages of only low-level workers cannot be increased. Instead, wages have to be increased proportionally throughout the job hierarchy, so that social expectations can be fulfilled, which is a phenomenon called 'structural inflation'.

Social constraints on motivation are another factor increasing demand of cheap and flexible labour. It is a well-known fact that people work not only to generate income, but also to acquire social status. Those at the bottom of the hierarchy, however, have no social status and mostly cannot move upwards in the hierarchy. Thus, at this level motivational problems exist. Immigrants, in difference to natives, can satisfy the need of labour force that will view employment merely as a source of income and not of social status or prestige. Mostly, migrants view themselves rather as part of their home communities, where they get a better social status through employment and earnings abroad, and not as part of the receiving society (Massey, 1999:38).

The demand for cheap and flexible (immigrant) labour is also augmented by the inherent duality of labour and capital. Capital is a fixed factor of production, while labour is variable. Thus, the stable and permanent part of demand is reserved for the employment of equipment, whereas the variable part of demand can be net by employing additional labour. Capital-intensive methods are used for the basic demand, and labour-intensive methods for the fluctuating demand. This duality between capital and labour leads to a segmented labour market structure, which consists of a capital-intensive primary sector and a labour-intensive secondary sector (Massey, 1999:38).

The capital-intensive primary sector is characterized by skilled and highly paid jobs requiring knowledge and experience. In this sector, firm-specific human capital is accumulated. Employers have to bear the economic burden of the layoff of primary sector workers in form of severance pay among others. On the other hand, the labour-intensive secondary sector is associated with unskilled and unstable jobs that can be laid off without (or with a small) burden to the employer. Thus, it is the employees who

have to bear the burden of unemployment that occurs during down cycles. Since the secondary sector with its unstable conditions, low wages and lack of mobility prospects does not attract native workers, employers hire immigrant workers (Massey, 1999:38).

In the past, women, teenagers and people from rural areas have fed the demand for cheap labour force in developed economies. Nevertheless, these human sources have decreased over time due to significant socio-demographic changes – the rise in female labour-force participation, the rise in divorce rates, the decline in birth rates and the urbanization in industrialized countries. The existing difference between low level workers and the limited domestic supply of workforce has led to a long-term demand for immigrant labour (Massey, 1999:40).

The theory effectively explains the coexistence of chronic labour demand from abroad and the structural unemployment in receiving countries (Kurekova, 2011:10 cf Arango, 2000). On the other hand, it is criticized for having a receiving country bias and for emphasizing too much formal recruitment practices. In addition, it is difficult to make the distinction between primary and secondary sectors which is arbitrary. Moreover, the dual labour market theory has another weakness in explaining differential immigration rates for various developed countries with similar economic structures (Kurekova, 2011:9).

3.3.4. Theory of Relative Deprivation

The Theory of Relative Deprivation[17] was firstly conceptualized in *The American Soldier: Adjustment during Army Life* (Stouffer et al., 1949) and was applied to model social behaviour (Crosby, 1979; Stark and Taylor, 1989). Stark and Taylor (1989) give theoretical reasoning (and empirical evidence) that international migration occurs as a result of absolute and relative income considerations.

The relative deprivation hypothesis of international migration is that, controlling for households' expected income gains from migration, households' decision to send family members to foreign labour markets is affected by their initial perceived relative deprivation within their reference group. The theory assumes that international migrants and their households take the village of origin as the reference group. "Given a household's initial absolute income and its expected net income from migration, more relatively deprived households are more likely to send migrants to foreign labour markets than are less relatively deprived households" (Stark and Taylor, 1989).

[17] Relative deprivation, as defined by Runciman (1966:10), is the case if a person (I) does not have X, (II) sees one or more persons as having X, (III) wants X, and (IV) thinks that it is feasible that he has X. A person or household feels relatively deprived if they engage in an income comparison with members of their reference group, and have a lower income in the income distribution.

3.3.5. World Systems Theory

In response to functionalist theories of social change, which assert that countries economically develop by evolutionary stages ending up in modernization and industrialization; a historical-structural theory emerged during the 1950s and reached its peak during the subsequent two decades. According to the historical-structural theorist Frank (1969), the forces of global capitalism led to 'develop underdevelopment' in the Third World. The first line of thoughts became to be known as the 'dependency theory'.

A second wave of historical-structural theory built upon the dependency theory and the historiography of Braudel (1981, 1982). The world systems approach of Wallerstein (1974) has reoriented the theoretical models of international migration. Wallerstein reconstructed the historical processes that led to unequal political and economic conditions throughout the world and classified countries according to their degree of dependency on dominant capitalist powers – the core nations: nations in the periphery, semi-periphery and external area (Massey, 1999:40).

A number of macro-structural analyses of the global expansion of capitalism, the internationalization of markets, the spread of multi-national companies, the effects of the transfer of capital, technology and profits on international migration flows have been made. The analyses agree on that there are multiple and interconnected system consequences for employment and income in migrant sending and receiving countries (Simmons, 1989).

In developing countries, the labour of peasants is replaced by international export oriented agriculture, while peasant farmers are employed at seasonal jobs as well as less skilled or unskilled service jobs in developed countries. Manufacturing jobs are replaced from industrialized to newly industrializing countries with lower wages. Skilled (managerial, administrative and scientific) jobs, on the other hand, remain in developed nations which are characterized by high minimum wages and social welfare systems, and thus attract illegal international migration (Simmons, 1989).

Micro-level analyses of household or family migration, on the other hand, indicate the emergence of '*trans-national families as part of survival and mobility strategies'*, where families in Third World countries characterized by declining economic opportunity want to 'secure' themselves by sending (one or more) family members to a First World country with relatively greater opportunity (Simmons, 1989).

Wallerstein's World Systems model has been criticized for being one-dimensional and incomplete. As an economic model, it naturally neglects many social, cultural and political variables such as ethnic and racial conflicts, political struggles, national laws and policies playing a significant role in international migration (Simmons, 1989). In this sense, it neglects the fact that individuals migrate in response to broader structural processes. Simmons' contribution to the world systems approach originated from the cultural and ideological forces acting independently from economic forces. As a matter of fact, these

forces might be triggered as a response to the 'undesirable' social consequences of the productive system (Simmons, 1989).

The World System-Linkages model of Simmons takes into consideration two facts: First, international migrants consist not only of workers with economic incentives, but rather of refugees and 'sponsored kin', which make up the majority of all migrants and are motivated by political and humanitarian reasons and not merely economic reasons. Second, the cultural background of 'core' capitalist countries plays a major role in their immigration policies as well as in migrants' decisions. While 'frontier countries' (Australia, Canada and the USA) are more 'open' to immigration due to their 'historically conditioned cultural patterns', in particular their multi-ethnic structures, the more ethnically homogenous European nations and Japan are less so. Moreover, immigration policies in most destination countries facilitate the movement of potential migrants with specific cultural attributes such as language skills, and permit the reunion of families. These policies reflect the political pressure of certain groups that support or are against the entrance of 'others' to their community (Simmons, 1989).

In the model, linkages are defined at the intersections of 'spheres of concern' (e.g. productive organization, cultural similarity, international humanitarian values and geo-political ties) and social actors (e.g. family, ethnic or religious community leaders, sectoral leaders, state officials or political leaders). Most linkages operate both on micro and macro levels. International migration is determined by previous system linkages. However, migration flows shape cultural linkages, national value systems as well as economic structures of source and receiving countries, and thus affect future migratory flows (Simmons, 1989).

3.3.6. Network Theory (Social Capital Theory) and Institutional Theory

Although migrant networks caught the attention of sociologists already in the 1920s, they were referred to as the 'auspices of migration' (Tilly and Brown, 1967), 'migration chains' (MacDonald and MacDonald, 1974), and 'family and friends effect' (Levy and Wadycki, 1973) decades later. Taylor (1986, 1987) identified migrant networks as a form of economic 'migration capital', whereas Massey et.al. (1987:170) for the first time referred to them as a form of 'social capital'[18] (Massey, 1999:44).

International migration becomes an attractive strategy for risk diversification or utility maximization through the networks. When in a destination country migrant networks exist and are developed, members of the migrant community have easier access to employment. Thus, family or friendship ties are transformed into an economic resource, and emigration is viewed as a reliable source of income for

[18] Social capital is defined as 'the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition' (Massey, 1999:43 from Bourdieu and Wacquant, 1992:119).

potential migrants. The growth of migrant networks can be viewed as a result of the progressive reduction of costs as well as of the reduction of risks (Massey, 1999:44).

Hence, the network theory or social capital theory has again a different view from micro-level decision models. It does accept that migration is an individual or household decision. However, it emphasizes that each migratory movement systematically affects future migratory decisions, and increases the probability that other decision-makers will migrate (Massey, 1999:45).

Several hypotheses developed – the affinity hypothesis, information hypothesis and facilitating hypothesis developed by Ritchey (1976), the conflict hypothesis and the encouraging hypothesis by Hugo (1981) aim to explain how social networks affect migration decisions (Haug, 2008). The affinity hypothesis states that existence of family and friends in the origin reduces the propensity to migrate. The information hypothesis indicates that migration can be increased through information provided (to potential migrants) by return migrants or family members or friends living abroad. The facilitating hypothesis, on the other hand, explains how by social networks can promote migration by facilitating adjustment to the destination place, e.g. by providing financial support (Haug, 2008; Koser, 1997). The conflict hypothesis (Hugo, 1981) points to the role of intra-familial conflicts in promoting migration, while the encouraging hypothesis (Hugo, 1981) indicates that families can motivate their members to migrate in order to ensure additional income (Haug, 2008).

Similar to the network theory, the institutional theory aims to explain the perpetuation of international migration. Institutions in form of legal (profit and non-profit) as well as illegal organizations, which are 'often embedded in migrant networks', affect the social environment where potential migrants make their choices (Jennissen, 2004:55). Migrant institutions are viewed as a structural complement to migrant networks by Goss and Lindquist (1995; Massey, 1999:44f.).

Private institutions and voluntary organizations are founded to satisfy the demand that arises through the difference between the high number of people seeking to migrate and the limited number of migrant visas issued by destination countries. On the one hand, this difference together with the entry barriers set by destination countries create a black market in migration. On the other hand, to prevent exploitation and victimization of people by the for-profit underground market, voluntary humanitarian organizations arise in developed countries (Massey et al, 1993:450).

Institutions can play a role in lowering mobility costs, thus lowering the threshold discouraging potential migrants from the migration decision. With regard to earlier migrants, institutions can play a role in strengthening the cultural links between source and host countries, thereby lowering the psychological costs of migration.

Hypotheses of the institutional theory are also different from micro-level decision models. When institutions supporting and promoting international migration are developed, migration flows gradually

become institutionalized and independent of the factors that have initiated them. Moreover, migration becomes more difficult to control for governments as institutionalization is difficult to regulate. Police efforts and stricter immigration policies often result in the formation of a black market and resistance by humanitarian organization (Massey et al, 1993:450f.).

3.3.7. Cumulative Causation Theory

The theory of cumulative causation states that over time international migration is likely to perpetuate itself in ways which encourage additional migratory movements. The process was initially described by Myrdal (1957) and reintroduced later by Massey (1990; Massey, 1999:45). According to this theory, causation of migration is cumulative, thus each migratory movement alters the social context such that it makes subsequent migration more likely.

Eight causes affecting migration decisions were identified within this framework: the expansion of networks, the distribution of income, the distribution of land, the organization of agriculture, culture, the regional distribution of human capital, the social meaning of work, and the structure of production (Massey, 1999:45).

As described previously, the network theory states that when the number of migrant networks in a country reaches a critical threshold, migration continues by itself. Each new migrant reduces the costs and risks of additional migration for his relatives and friends, of which some may decide to migrate. Their migration further lowers costs and risks, and hence migration becomes self-perpetuating over time (Massey, 1999:45).

According to the theory of relative deprivation, the incentives of a household to migrate increase when their sense of relative deprivation increases. Because of the costs and risks of international migration, households in the middle or upper segments of the local income hierarchy tend to migrate (Massey, Goldring and Durand, 1994). Once one or two household have migrated and participated in foreign labour, their income increases due to remittances. The recognition of the increase in their incomes make households with lower income feel more relatively deprived, motivating them to migrate. Hence, income inequality and relative deprivation among non-migrants further increase, and induce more households to migrate (Stark, 1991; Stark and Taylor, 1989; Taylor, 1992; Massey, 1999:45).

The distribution of land is another factor that cumulatively perpetuates international migration. International migrants often purchase land for either its prestige value or to have a source of retirement income, rather than using it for a productive investment. They tend to lie fallow the farmland they own since foreign labour is more lucrative than agrarian production in the country of origin. This situation decreases the demand for local agrarian labour force and increases the incentives for emigration. The more people emigrate, the more earn the necessary capital to purchase farmland. The more farmland lies

fallow and is not used for production, the more land shortage and price inflation are caused, and emigration continues (Mines, 1984; Reichert, 1981; Rhoades, 1978; Wiest, 1984; Massey, 1999:45).

In case when international migrants choose to farm their land, having the necessary capital, they are more likely to use capital-intensive methods such as machinery and herbicides than non-migrants. Hence, less labour is needed per unit output, leaving more local people unemployed. Migration leads to greater capitalization of agriculture and displacement of agrarian labour force. This situation also increases migration pressures (Massey et. al. 1987; Massey, 1999:45).

International migration also has a cumulative effect on culture. Although migrants may initially move for 'narrow' financial purposes, their tastes for consumption and lifestyle, as well as their motivations change in advanced industrial countries. Once they have migrated, the probability that they will migrate again rises (Piore, 1979; Massey, 1999:46). At (source) country level, the more people migrate, the more knowledge about international migration and jobs as well as 'values, sentiments and behaviours characteristic of the core countries' spreads (Massey, 1999:46 from Alarcon, 1992; Brettel, 1979; Goldring, 1996a; Massey et al, 1987; Rouse, 1989, 1991).

Another important factor affecting the migration decision is the regional distribution of human capital. Migration is a selective process, where highly educated or highly skilled workers have a higher motivation to migrate. As migrant networks are formed, the risks and costs of migration are decreased so that migration becomes less selective (Massey, 1999:46). The preliminary selectivity of migration depends on labour market characteristics (Taylor, 1987).

As a result of continued migration flows, human capital in sending areas gets scarce decreasing the productivity, while that in receiving areas accumulates increasing the productivity. The worsening of economic conditions in sending areas thus leads to the continuation of migration (Massey, 1999:46 from Greenwood, 1981, 1985; Greenwood, Hunt and McDowell, 1987; Myrdal, 1957). The increase of the educational level in rural areas of source countries also increases the potential returns to migration thereby enhancing the conditions for rural-to-urban as well as international migration (Massey, 1999:46).

In receiving countries, several occupations, where a high number of immigrants are recruited, become culturally labelled as 'immigrant jobs and are not preferred by native workers. This situation increases the structural demand for immigrant workers, and perpetuates migration. The social meaning of work changes, while the stigma originates 'from the presence of immigrants and not from the characteristics of the job' (Massey, 1999:46).

Processes of cumulative causation cannot continue infinitely. At some point, migrant networks reach a numerical saturation, where the costs of migration do not fall as much with each new migrant, the stock of potential new migrants becomes smaller, and increasingly composed of women, children and the

elderly. On the other hand, after long migration flows, local labour shortages and increasing wages in the source country contribute to the dampening of migratory flows (Gregory, 1986; Massey, 1999:46f.).

The migration pattern described above may be hard to identify since migration flows to areas with a long migration history may decrease, whereas new receiving areas occur. Consequently, emigration from a source country may be growing. For populations that have witnessed the transformation from emigration to immigration, a characteristic 'migration curve' (Akerman, 1976), or 'migration hump' (Martin and Taylor, 1996) has been acknowledged. According to Hatton and Williamson (1994:9f), the surge of the emigration cycle typically coincides with industrialization and increasing real wages at the source, while demographic forces, industrialization and increasing number of earlier emigrants abroad contribute to the increase of the emigration rate. The weakening of these conditions leads to the reduction of the gap between home and foreign wages, and to the decrease of emigration rates (Massey, 1999:47).

While the cumulative causation theory is effective in explaining the perpetuation of migration, it has its weakness in shedding light to mechanisms which undermine migration and eventually lead to the decline of migration systems (de Haas, 2009).

Table 3.2. gives an overview of the key variables, measurable indicators and hypotheses of the selected theories of international migration.

Table 3.2. An Overview of the Selected Theories of International Migration

Theory	Key variable	Measurable Indicator	Hypothesis
Neo-classical economic theory	Real wage in Country A – Real wage in Country B	Real GDP pc in Country A – Real GDP pc in Country B	GDP pc in A – GDP pc in B has a positive effect on migration from B to A.
New economics of migration	Certainty of sufficient household income in Country B	Total unemployment as a percentage of total labour force in B	Unemployment in B may have a positive effect on migration from B to A.
Theory of labour market segmentation	Shortages in the lower segments of the labour market in A	Average years of education of the labour force in A	Education in A has a positive effect on migration from B to A.
	Unemployment in A	Total unemployment as percentage of the total labour force in A	Unemployment in A has a negative effect on migration from B to A.
Relative deprivation theory	Degree of income inequality in B	Average years of education in B	Education in B has a negative effect on migration from B to A.
World systems theory	Material and cultural linkages between A and B	Migrant population of country B in country A per capita	Migrant stock of B per capita in A has a positive effect on migration from B to A.
Network theory	Size and quality of the migrant network of country B in country A	Migrant population of country B in country A per capita	Migrant stock of B per capita in A has a positive effect on migration from B to A.
Institutional theory	Number and quality of organizations facilitating migration from B to A	Migrant population of country B in country A per capita	Migrant stock of B per capita in A has a positive effect on migration from B to A.
Cumulative causation theory	Size and quality of migrant networks of country B in A	Migrant population of country B in country A per capita	Migrant stock of B per capita in A has a positive effect on migration from B to A.

Income inequality in B	Average years of education in B	Education in B has a positive effect on migration from B to A.
Distribution of land	Average demand for agrarian labour force in B	Purchase of farmland in B by migrants (in A) has a positive effect on migration from B to A.
Organization (capitalization) of agriculture in B	Unemployment in rural areas as a percentage of total unemployment in B	Migration from B to A leads to greater capitalization of agriculture, displacement of local agrarian labour force in B and has a positive effect on migration from B to A.
Cultural change in B	Not measurable (?)	Migration from B to A spreads the cultural values of A in B, and has a positive effect on migration from B to A.
Changes in the regional distribution of human capital in A and B	Unemployment in A – Unemployment in B Average years of education in A – Average years of education in B	Due to migration from B to A human capital and productivity in B decrease, those in A increase. Increase of educational level in B has a positive effect on migration from B to A.
Social labelling of work in country A	Labour force participation of natives – Labour force participation of immigrants in selected jobs in A	Social labelling in A leads to structural demand for immigrant labour force and has a positive effect on migration from B to A.

Source: Jennissen, (2004:57) and self-assessment.

3.3.8. Migration Systems Theory

Kritz and Zlotnik (1992) analyse international migration as a dynamic process that changes over time with new pull- and push- factors developing between countries of origin and destination, with feedback and adjustments originating from the migration process which in turn alter the process, and with new incentives introduced by interactions between countries (Kritz, Zlotnik, 1992:2). This process is described within a systems framework with political, social, economic and demographic contexts.

An international migration system is composed of a core receiving region consisting of a country or a group of countries, and a number of sending countries linked to the core receiving region by relatively large migration flows (Massey et al, 1993:454 from Fawcett, 1989; Zlotnik, 1992; Kritz and Zlotnik; 1992:2). In addition to the spatial dimension, the time dimension has to be taken into account to investigate the immigration and emigration dynamics. Different perspectives can be adopted to draw the frames of a migration system, such as a regional approach or an approach on the basis of colonial ties (Kritz and Zlotnik; 1992:4).

According to the migration systems theory, the genesis of migration flows is mostly related to historical (e.g. colonial) ties, and to governmental or institutional actions such as labour recruitment activities of governments or employers. Once migration flows have started, they are sustained through migrant and institutional networks, as well as by continuing demand for labour in the core receiving countries (Kritz and Zlotnik; 1992:8).

Migration policies are an integral part of migration systems. Nevertheless, in order to investigate the interaction between explicit migration policies and the evolution of actual migratory flows, the regulations adopted by governments together with the effectiveness of the implementation have to be taken into account.

The hypotheses and propositions of the migration systems theory are:

1. Countries within a migration system do not have to be geographically close to each other as political and economic affairs rather than physical proximity play a role in migration decisions.
2. There can be multipolar systems, where multiple core countries receive migrants from a set of source countries.
3. Countries can belong to more than one migration system. In general, sending countries are part of more than one migration system more frequently than core (receiving) countries.
4. Due to social, political, demographic or economic changes, systems do evolve. Thus, countries can enter or leave the migration system as a response to changes (Massey et al, 1993:454).

The migration systems theory can be viewed as a generalization of the world systems theory, network theory, institutional theory, and the theory of cumulative causation rather than a separate theory by itself (Massey et al, 1993:454). It uses the key notions of the previous theoretical models in a systems

framework. The migration systems theory can also be criticized for its inability to explain the decline of migration systems over time.

3.4. New Approaches to Migration Theory

In recent years, new approaches to migration theory have been developed by different theorists. These include interdisciplinary methodologies, combinations of theoretical models and synthetic approaches, which make connections between migration theory and general social theory, and view migration as part of broader social transformations.

Many scholars have emphasized the necessity of interdisciplinary research on migration (Massey et al., 1993; Favell, 2008; Bretell and Hollifield, 2000; Castles, 2008a; Kurekova, 2011). Stark (1991) and de Haas (2008) have suggested a better interconnection between the analysis of the causes and consequences of migration. Freeman and Kessler (2008) and Collinson et al. (2009) take a political economy approach. The former link economic theories (of labour markets, international trade and public finance) to political analyses emphasizing the role of different political actors (states, institutions and interest groups). Collinson (2003, 2009) has pioneered 'relational political economy' research and has analysed in depth the dynamics of migration, livelihoods and commodity chain.

Another significant contribution to the political economy approach has been made by Menz (2009). Menz's work on 'managed migration' addresses the development of labour migration and political asylum policies in Europe over a period of 20 years. It analyses the interaction of economic structures, policies, legacies and institutional determinants at different levels with regard to migration, and provides a comparison of policy making in several EU countries (France, Germany, UK, Ireland, Italy and Poland).

A combination of the theoretical models has been proposed by several authors. Skeldon (1997) suggests the combination of the new economics of migration with the network theory since the migrant strategies to minimize household risks are related to migrant networks at destination countries. Massey (1999:47-50) views the main migration theories described in the previous subsection as complementary, effectively explaining the migration paths at different development levels of a particular country, and proposes a synthetic theoretical account. According to Massey (1999:50),

> 'During the initial phases of emigration from any sending country, the effects of capitalist penetration, market failure, social networks, and cumulative causation dominate in explaining the flows, but as the level of out-migration reaches high levels and the costs and risks of international movement drop, movement is increasingly determined by international wage differentials (neoclassical economics) and labour demand (segmented labour market theory). As economic growth in sending regions occurs, international wage gaps gradually diminish, and well-functioning markets for capital, credit, insurance,

> and futures arise, progressively lowering the incentives for emigration. If these trends continue, the country ultimately becomes integrated into the international economy as a developed, capitalist nation, whereupon it undergoes a migration transition: net out-migration progressively winds down, and the former sending nation itself becomes an importer of labour.'

De Haas (2008) combines the demographic transition with Zelinsky's theory of mobility transition (1971), viewing both as functions of development stages (Castles, 2008a). According to 'transitional models', processes of development are related to certain forms of mobility, which tends to increase with increasing level of development (Skeldon, 1997; Kurekova, 2011:16 cf de Haas, 2007, 2009; Hammar et al., 1997).

Castles (2009) presents an alternative approach to international migration and development, based on a conceptual framework derived from the analysis of social transformation processes. The point of departure for the analysis of the links between human mobility and global change is Polanyi's (2001) concepts of 'social transformation' and 'embeddedness of the economy in society'. Globalization after the end of the Cold War has led to significant social transformation both in developed and developing countries. The social transformations in developed countries are reflected as the 'closure of older industries, the restructuring of labour forces, the erosion of welfare states and the decline of communities', whereas in developing countries these are 'intensification of agriculture, destruction of rural livelihoods, erosion of local social orders, rural-urban migration and formation of vast shanty-towns within new mega cities' (Castles, 2009:16).

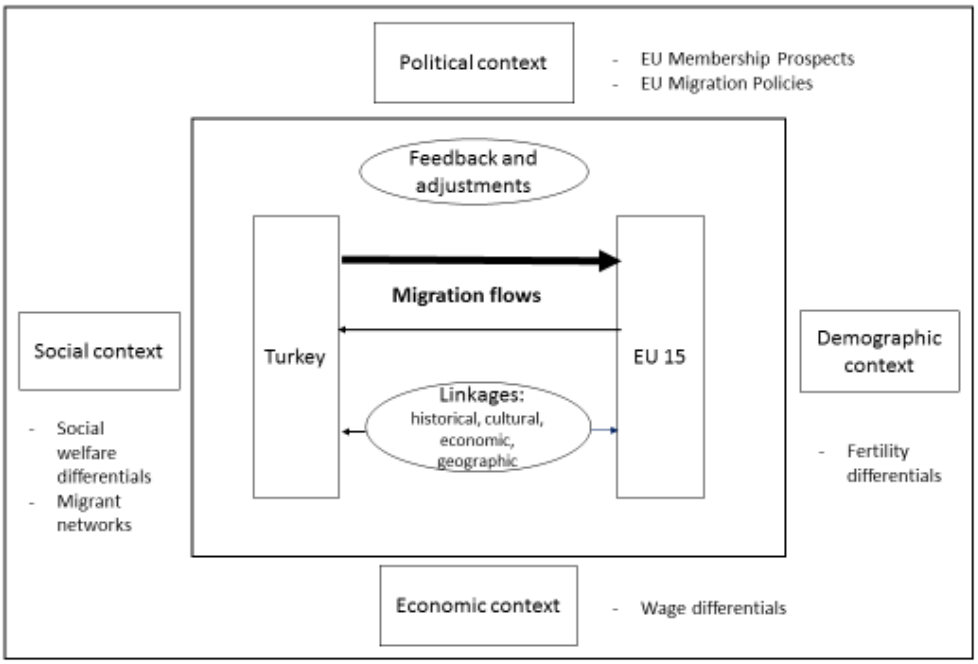
On the one hand, social transformation causes international migration and shapes its forms and directions; and on the other, migration is an essential part of social transformation in restructuring societies and communities (Castles, 2008:11). In order to understand mobility-transformation relationships, it is necessary to understand the links between different (global, local, national, regional) socio-spatial levels. To achieve this, an interdisciplinary approach is crucial since different disciplines address different socio-spatial levels.

3.5. A Theoretical Framework of Migration between Turkey and the EU Based on the Migration Systems Approach

A migration system includes at least two countries, but ideally all countries linked by large migration flows should be comprised (Kritz and Zlotnik, 1992:3). Figure 3.2. represents an international migration system consisting of a group of receiving countries (in this case EU15) and a sending country (in this case Turkey). Countries in the migration system are linked by relatively large (bilateral) migration flows

as well as other types of linkages – historical, cultural, economic and geographic linkages[19]. Analogous to Kritz and Zlotnik's international migration system approach, they are situated within a social, economic, demographic and political context.

Figure 3.2. EU 15 and Turkey in a Systems Framework of International Migration



The contexts in which the migration system is situated as well as the linkages between countries in the system do not only change but can be changed by international migration flows. Large stocks of migrants do alter the social, economic, demographic and political contexts as well as the linkages between sending and receiving countries. The network and institutional theories are examples attempting to explain how international migration flows may change the context(s) or linkages in a migration system (Jennissen, 2004:35-36).

Castles (2008a, 2008b), de Haas (2007, 2008, 2009a and 2009b), and Collinson (2009) have discussed the necessary elements of conceptual framework of migration. Migration research should be interdisciplinary and holistic, 'linking specific research to broader aspects of (social) transformation and its embeddedness in social relations' (Castles, 2008/01:13). It should be capable of contextualizing specific migration experiences, incorporate structure and agency, and be both historical and dynamic

[19] In their migration systems framework, Kritz and Zlotnik distinguish between historical, cultural, colonial and technological linkages (Kritz and Zlotnik, 1992:3).

(Kurekova, 2011:17). Collinson puts forward a combination of the livelihoods approach with a relational political economy approach in order to

> 'capture the interaction of local-level factors immediately influencing people's migration decisions and strategies (linked to livelihoods) with a range of political, economic and social factors and processes affecting the agency of migrants (and non-migrants) that ultimately shape migration outcomes within specific contexts' (Kurekova, 2011:17).

For theoretical models of migration, Massey concludes that

> 'a satisfactory theoretical account of international migration must contain at least four elements: a treatment of the structural forces that promote emigration from developing countries; a characterization of the structural forces that attract immigrants into developed nations; a consideration of the motivations, goals, and aspirations of the people who respond to these structural forces by becoming international migrants; and a treatment of the social and economic structures that arise to connect areas of out- and in-migration' (Massey, 1999:50).

Thus, a theoretical framework of the migration patterns between Turkey and the EU should comprise:

(1) Structural forces promoting emigration from Turkey,

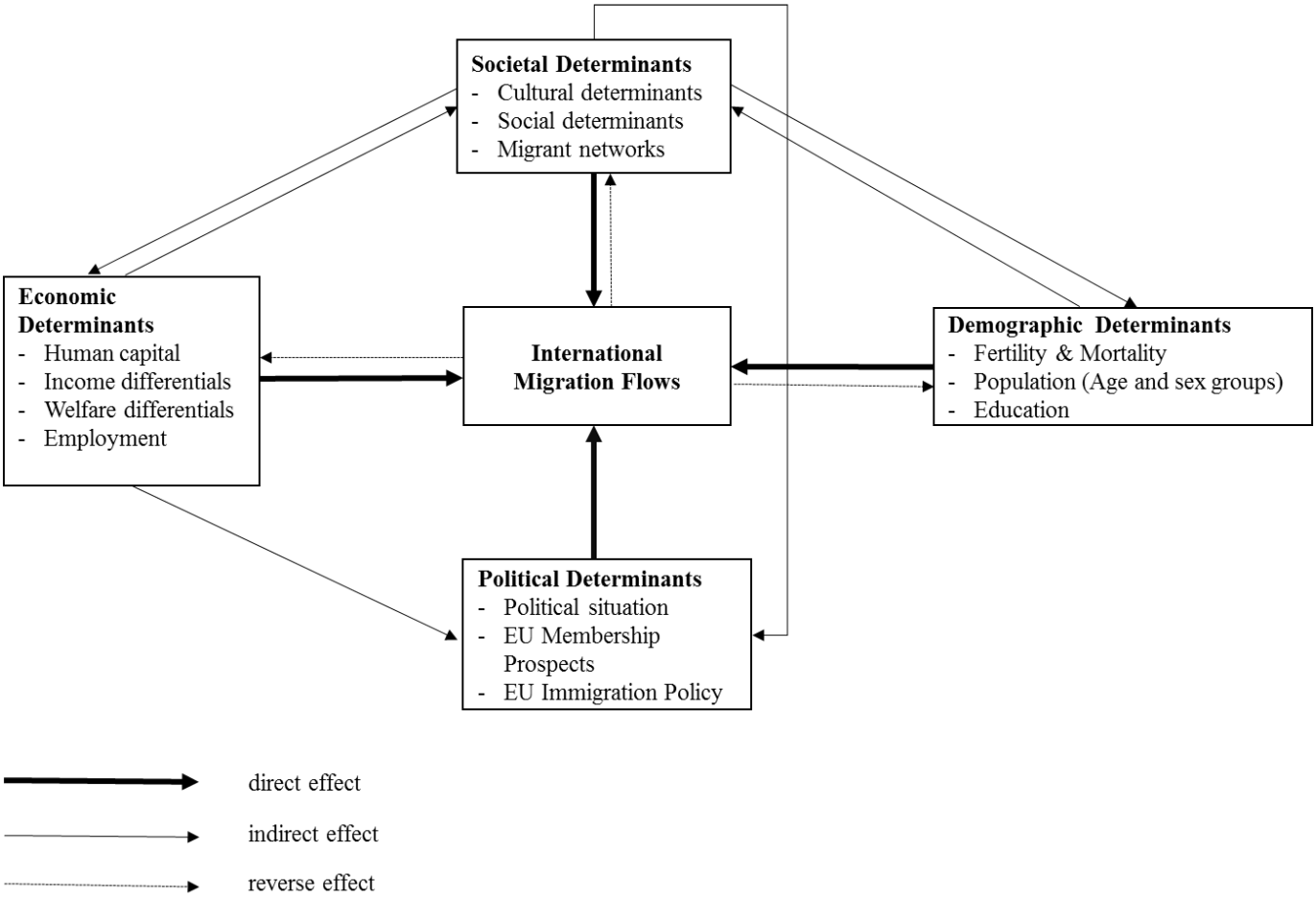
(2) Structural forces that attract Turkish migrants to European countries,

(3) Main incentives of Turkish migrants, and

(4) Political and economic structures that connect Turkey and the EU.

The systems framework of international migration does not describe causalities. Based on the systems framework of Kritz and Zlotnik, Figure 3.3. illustrates a new theoretical framework of migratory flows between Turkey and the EU comprising causalities between migration flows and its determinants (Kritz and Zlotnik, 1992:3; Jennissen, 2004:36-37). International migration flows have direct and indirect economic, demographic, political and social determinants. The economic and demographic determinants can be viewed as parts of more complicated economic and demographic subsystems which interact with each other. Direct effects shown by bold arrows are those which have straightforward effects on migration flows, whereas indirect effects are those between subsystems that have subsequent impacts on migration flows.

Figure 3.3. Theoretical Framework: International migration and its Determinants



The **economy** category is comprised of four components: human capital, income differentials, welfare differentials and employment. Labour economics views human capital as 'a set of skills or characteristics which increase a worker's productivity'. Thus, human capital determines the labour market position of workers. Workers' employment status and income depend on the amount of human capital available on the labour market. The most common investments to human capital include schooling, on-the-job training, investments to improve psychological and physical health, and obtaining information on the economic, political and social system (Jennissen, 2004:38 from Becker, 1962). According to Sjaastad (1962), migration is another form of investment in human capital[20].

As the neoclassical economic theory states, labour and supply differentials between countries is a major cause of international migration. Labour flows from labour-rich towards capital-rich countries. Under the assumption of full employment, neoclassical theory predicts a linear relationship between wage differentials and migration flows (Kurekova, 2011:5; Bauer and Zimmermann, 1999; Massey et al.,

[20] Borjas (1989:463) defined an index function investigating if migration is a sufficient investment in human capital to motivate potential migrants to move. Massey et al. (1993:435) calculated the expected net return to migration by taking into account the probability of avoiding deportation from the destination, the employment probability at the areas of origin and destination, and a time component.

1993; Borjas, 2008). The reduction of wage differentials is expected to decrease the volume of migration flows. In the extended neoclassical models, however, migration depends on the *expected* (rather than actual) income, while the key variable is the earnings weighted by the probability of employment (Kurekova, 2011:5; Bauer and Zimmermann, 1999; Massey et al.; 1993)[21]. The income and employment levels (in both source and receiving areas) in turn are changed due to migration flows.

Concerning welfare and migration, causality runs in both directions. Welfare benefit differentials play an important role in migrants' decisions to move. Welfare systems including social protection and labour market policies, healthcare, education and pension systems, affect migration as a mediating mechanism by shaping opportunities and risks related to labour market difficulties (Kurekova, 2013:722). Potential migrants may be affected to higher welfare areas since they may view these as areas offering higher income and/or long-term unemployment benefits. Migration flows in turn affect welfare benefit levels. On the one hand, welfare benefit levels may increase since migrants increase the number of welfare recipients forming a growing electorate that put political pressure for higher welfare benefit levels (Cebula, 1977:692). On the other hand, the increasing number of welfare recipients increases the fiscal burden and may lead to stricter migration policies since 'voters will prefer selective migration policies favouring skilled migrants who tend to be net contributors to the fiscal system' (Razin and Wahba, 2015:369).

The **demography** category consists of fertility and mortality rates, population (with age groups and sex distribution), and educational level. It can be assumed that the higher the (working age) population of a potential source country, the higher the emigration rate will be. The age distribution of the sending country has an effect on retirement migration. In addition, the age distribution of the migrant stock can be deterministic for return migration. On the other hand, the sex distribution of migrants in both sending and receiving countries is important because it can affect the rates of family formation and family reunification.

International migration flows in turn change the demographic composition as well as the fertility and mortality rates in both sending and receiving areas. The education component affects the fertility and mortality rates, and hence the total population, as well as the female labour force participation rates. The educational level of potential migrants and the mean level of education play a decisive role in migration since migrants' incentives will also depend on the potential returns to education in the destination.

The **society** category comprises cultural and social determinants as well as migrant (kinship) networks. Cultural determinants such as cultural norms and lifestyles in receiving countries, have an effect on

[21] In the course of economic development, migration patterns are empirically observed to be curved in a way that Martin and Taylor (1996) have called a 'migration hump'. Migration rates increase with the source country's wealth since more individuals or families can afford the costs associated with emigration. When the source country economy continues to develop, the incentives to migrate and emigration rates decrease. Over the long term, many emigration countries become immigration countries.

migration flows. Due to cultural determinants (e.g. xenophobia), despite the positive effect of a large migrant stock in form of social capital, emigration of a certain ethnic group can have a negative effect on the expected net returns of migration (Jennissen, 2004:41, Jandl, 1994). Another negative effect of a large migrant stock from the same ethnic origin can be language difficulties since migrants with the same origin tend to live in linguistic enclaves (Jennissen, 2004:41; Chiswick and Miller, 1996).

The social determinants include the degree of inequality and cohesion in societies. Since relative deprivation increases the incentives for migration, it can be expected that societies where there is larger income inequality will have higher emigration rates than those with less income inequality. Another important social determinant is cohesion. A potential sending country that experiences social unrest and thus has little cohesion, will have a higher emigration rate than a country with high cohesion. The assimilation of a labour migrant to the host society or 'ties to home' of a migrant can be viewed as cohesion. According to Waldorf (1994, 1996), the level of assimilation of a migrant to the host country has a negative effect on the migrant's incentives for return migration. On the contrary, stronger ties to home will have a positive effect on the migrant's incentives for return migration (Jennissen, 2004:41).

Existing migrant and kinship networks have a positive relationship with migration flows since they lower the risks (e.g. of unemployment) and the (economic as well as psychological) costs of moving, and increase the probability of finding a job. The expected net returns of migration to a receiving country with a relatively large migrant stock are relatively higher (Jennissen, 2004:40; Massey et al., 1993; Boyd, 1989; Bauer and Zimmermann, 1995). Migration flows in turn affect cultural linkages and migrant networks.

The **policy** category consists of the political situation in Turkey, the Common EU Immigration Policy, and the EU-Turkey relations with regard to the Turkish EU candidacy. Economic migration models excluding political dimensions and political models devoid of economic dimensions take the risk of being incomplete (Freeman and Kessler, 2008:656). Thus, it is ideal to take the main political variables into consideration. The political situation in sending countries is relevant for the amount of emigration since political tensions between interest groups in form of e.g. ethnic struggles, between state and citizens in form of state oppression or revolts against the state, or between states such as wars, can lead to (mass) migration flows. Sending countries can manipulate the amount of emigration explicitly through policy measures and in some cases may request financial support or better trade conditions from destination countries (Jennissen, 2004:43; from Hamilton, 1997).

The immigration policy of the potential receiving countries, in this case the Common EU Immigration Policy, is another political determinant of international migration. Immigration flows decrease as a response to stricter migration policies such as tighter border controls and visa requirements. Immigration flows are affected by not only the policies of a particular destination country but also by those of other potential destination countries. When a particular destination country applies stricter policies, the

immigration amounts of other potential destination countries can rise. Moreover, as another policy measure receiving countries can give international aid or can promote the international trade and investment in sending countries in order to reduce migration flows (Jennissen, 2004:43 from Muus and Van Dam, 1998).

Both political determinants that were discussed – the political situation in sending countries and the immigration policy of receiving countries are to a large extent (indirectly) determined by the society. Cultural determinants – lifestyles as well as the ethnic structure of the society – influence these. Social determinants (e.g. inequality among social groups) affect the political situation in sending countries. The (high) level of income inequality correlates to the (high) level of violence in that country (Jennissen, 2004:43 from Wallerstein, 1983). Potential receiving countries often apply flexible immigration policies when the political situation in a particular sending country worsens endangering peoples' lives.

The components of the four main categories may have a positive or negative effect on international migration or on the components of other categories. As it was mentioned, international migration also may have opposite effects on the components of the categories. Consequently, the direction of the influence is determined by the relative strength of each component.

3.6. Conclusion

Since the theories explaining the initiation and perpetuation of international migration postulate causal mechanisms at different levels of aggregation, their explanations do not need to be contradictory unless it is assumed that causes must operate at one and the same level. It is highly likely that individuals make cost-benefit analysis, that households aim to diversify labour allocations, and that the socioeconomic context in the background of these decisions is determined by structural forces operating at both national and international levels (Massey et al, 1993:455; Papademetriou and Martin, 1991).

Hence, it is preferable to take the more comprehensive view that the causal processes of international migration may operate concurrently at different levels. In order to find out which one(s) of the theories are useful for explaining a particular migratory movement, their principles and verifiable propositions have to be examined and then empirically evaluated.

Depending on the model chosen for investigating the contemporary process of migration, it can be recommended to policy makers to regulate international migration flows by changing wages and employment conditions in receiving countries, by promoting economic development in source countries, by implementing programs of social insurance in source countries, by reducing regional income inequality in origin countries, by improving futures or capital markets in developing countries, or a combination of these advices (Massey et al, 1993:463).

Chapter 4 DEMO-ECONOMIC MIGRATION MODELS

'Man hat Arbeitskräfte gerufen, und es kommen Menschen.'

Translation: 'We sought workers, and people came.' ***[Max Frisch (1965)]***

4.1. Introduction

A large variety of models and methods is used for forecasting migration. Socio-economic predictions can be based both on general laws and theories, as well as on descriptive models designed for specific research questions. Selected forecasting models and methods can be categorized as follows (Bijak, 2011: 53-87):

- Deterministic methods
    - Judgmental migration scenarios
    - The Delphi method and expert surveys
    - 'Migration potential' assessment surveys
    - Macro-level mathematical models in demography
    - ***Demo-economic modelling***
- Probabilistic migration forecasts (assessing uncertainty)
    - Markovian and related models of aggregate population flows
    - Micro-level methods (event-history analysis and ethnosurvey)
    - Attempts to bridge micro and macro perspectives
    - Econometric forecasts of international migration
    - Stochastic forecasts of migration time series
- Bayesian approach in migration studies and demography
    - Bayesian models and forecasts of population flows
    - Bayesian methods in demography
- Model-based forecasting

In order to reconstruct a dynamic occurrence like international migration and to analyze its consequences, a descriptive model will be built in the underlying dissertation thesis. Unlike (migration) theories, which by nature have to be general, models relate to a particular event and have a large degree of flexibility. According to the classification (Bijak, 2011), demo-economic modelling stands in the overlapping area between deterministic and probabilistic methods.

The population development of a region depends both on natural growth rates and to a higher extent on migration rates. Migration flows are connective links between the economic development and the

population development of a region. The high number of studies regressing migration flows on vectors of economic variables shows that the interaction between economic and demographic variables is widely acknowledged (Gordon and Ledent, 1981). The consideration of economic, demographic and regional aspects has led to the formation of a new type of modelling in the 1970s – demo-economic modeling with regional or multiregional differentiation.

Most laborers who are planning to migrate can realize their aims only if there is actually an available job in the destination (unless the distance to the workplace is short enough to ply). Thus, migrations depend to a high extent on labor-creating economic growth determinants of the regions. On the other hand, the growth rates are affected by migration rates, at least in the long run, since the regional stock of human capital, which is of high importance for the regional production and innovation, depends on the skills that are imported or exported through interregional population movements (Birg, 1983).

In a simple dynamic demo-economic model, 4 demo-economic processes are linked with each other in a region:

(1) The growth of production causes changes in the number and type of jobs.
(2) The number of quality of jobs affect migratory flows; inflows as well as outflows.
(3) The migratory flows change the population in number and (demographic) structure.
(4) The population change causes, through feedback on process (1), changes in the production activity (Birg, 1983).

Variables in these 4 processes are directly or indirectly dependent. A regional model can be extended to a multiregional or international model. The underlying chapter will firstly describe several important demo-economic modelling examples in detail.

The first model described in this section is a dynamic, demo-economic model that analyzes the interactions of job creation, migration and natural population increase (Birg, 1982, 1983). The goal of the model is to analyze the roles of job creation and migration for regional development. Dynamic continuous equations are formulated and analytically solved for the regions. Birg then discusses the extension to two or more regions and compares the model with those of Keyfitz and Rogers.

The second model is IDEM (Fachin and Venanzoni, 2002), which combines a multi-regional cohort-component model with economic variables of labor supply and productivity. The analysis is limited to a single country (Italy) and is thus focused on internal migration rather than international. International migration, fertility and mortality rates are exogenous. However, the model can be extended to a multi-national economic model.

The third model to be dealt with is BACHUE-International (Moreland, 1978), a generalized and simplified econometric model for a developing economy. It consists of three subsystems – the

demographic, economic and income distribution subsystems, which are linked through relations of variables.

4.2. Demo-Economic Modelling Examples

4.2.1. A dynamic, demo-economic model on the interactions of job creation, migration and natural population increase (Birg, 1982)

4.2.1.1. The role of migration for economic growth and population change

The starting point of demo-economic models are "hypotheses on the interaction of demographic and economic variables, and their effects on the population growth of a region or on the population distribution of a system of regions" (Birg, 1982). Variables and functions of these models have to be dynamic since the nature of the problems they are solving is also dynamic (Birg, 1982).

Migration provides the main link between regional economic and demographic variables. In many developed countries, the immigration rates have either the same as or more relevance than the birth rates for population change. In Germany, at the time when the model was made (in the period between 1975-1979), the relative weight of the population increasing variables 'immigration' and 'birth' was 1:1 at the national level, and considerably higher at the regional level. The ratio between 'emigration' and 'death' rates was similar (Birg, 1979:91; 1981; 1982).

Since most people who consider migration need a job in the destination, migration is closely related to job creating economic forces of a region. Vice versa, the economic forces (in the long term) depend on migration since the stock of human capital in the region, that produces and innovates, depends on the flow of skills of the migrating labor force.

4.2.1.2. The one-region model

Demo-economic interaction in a region can be summarized in four processes where variables interact simultaneously:

(1) The growth of production causes changes in the number and type of jobs.
(2) The number of quality of jobs affect migratory flows; inflows as well as outflows.
(3) The migratory flows change the population in number and (demographic) structure.
(4) The population change causes, through feedback on process (1), changes in the production activity (Birg, 1982).

For the job creation process, two types of jobs can be differentiated: the number of jobs in the basic sector A_1, and in the nonbasic sector A_2. The total number of jobs in the region at the beginning of period t is given by the sum of A_1 and A_2:

$$A(t) = A_1(t) + A_2(t). \qquad [1]$$

It is assumed that the number of jobs in the basic sector grows at a constant rate a:

$$A_1(t) = A_1(0) \exp (at) \qquad [2]$$

The number of jobs in the nonbasic sector depend on the number of inhabitants P(t) as well as on the number of jobs in the basic sector:

$$A_2(t) = b_1 P(t) + b_2 A_1(t) , \qquad 0 < b_1 , \qquad b_2 < 1 , \qquad [3]$$

where b_1 and b_2 are constants. In order to determine the effects of the number of jobs on immigration, two types of immigration variables are defined: the potential number of immigrants $M_p^{in}(t)$ and the effective number of immigrants $M_e^{in}(t)$. The model assumes that regional conditions (e.g. high accommodation rents) will restrict the number of actual immigration flows. It also assumes that the effect of restrictions can be quantified by a variable R(t) that grows at a constant rate h:

$$R(t) = R(0) \exp (ht) . \qquad [4]$$

The actual number of immigrants can then be calculated by the difference between the potential number of immigrants and the restriction variable R(t):

$$M_e^{in}(t) = M_p^{in}(t) - R(t) . \qquad [5]$$

For any period, the restriction effects have to be lower than the potential immigration:

$$R(t) < M_p^{in} \qquad [5a]$$

and the growth rate h must not be greater than the growth rate of $M_p^{in}(t)$.

There are two groups of potential immigrants; persons who plan to migrate for noneconomic reasons, $M_{p,}^{in}{}_1(t)$; and persons who plan to migrate for economic (occupational) reasons $M_{p,}^{in}{}_2(t)$:

$$M_p^{in} = M_{p,}^{in}{}_1 + M_{p,}^{in}{}_2 . \qquad [6]$$

It is assumed that the number of migrants who do not have economic motivations (e.g. students and retired persons) grows at a constant rate w:

$$M_{p,}^{in}{}_1(t) = M_{p,}^{in}{}_1(0) \exp (wt) . \qquad [7]$$

It is further assumed that the potential number of economically motivated migrants is a function of the number of job opportunities Q(t); and the latter is in turn a function of the stock of jobs:

$$M_{p,}{}^{in}{}_{2}(t) = g.Q(t) , \qquad g > 0 , \qquad [8]$$

g being a constant, and

$$Q(t) = cA(t) , \qquad c > 0 , \qquad [9]$$

where c is also a constant.

The job opportunity variable Q(t) is not given by the difference between the supply and demand of the labor market, but by the number of vacant jobs at time t. Availability of jobs can result from retirement of employees and creation of new jobs, among others. According to empirical studies (Rogers, 1968:90; Birg, 1979:102) the unemployment rate is an inadequate variable for explaining migration flows. In studies made for the USA and FRG, the unemployment rate was highly significant but had the opposite sign of what theory suggests. Even when the demand for jobs in a market exceeds the supply, there is a number of jobs that become vacant due to labor market fluctuations. Therefore, in this model potential migration depends on the number of vacant jobs.

The number of out-migrations (emigration) is a function of the number of inhabitants, and has a coefficient of determination of more than 0.9 in cross-region analysis (Birg, 1979:9):

$$M^{out}(t) = kP(t) , \qquad 0 < k < 1 , \qquad [10]$$

where k is constant. A balance of change equation defines the number of inhabitants at the end of interval [0, t], which is given by the sum of birth surplus (or deficit) and net migration. It is assumed the rate of birth is a constant factor r of the number of inhabitants. Then, population change can be formulated as:

$$dP(t) / dt = rP(t) + M_e^{in}(t) - M^{out}(t) . \qquad [11]$$

The number of inhabitants at the end of the period [0, t] can be calculated by integrating equation [11]:

$$P(t) = P(0) + r\int_0^t P(\tau)\, d\tau + \int_0^t M_e^{in}(\tau)\, d\tau - \int_0^t M^{out}(\tau)\, d\tau . \qquad [12]$$

For empirical analysis, an alternative form of equation [12] can be used:

$$P(t) = P_n(t) + \int_0^t M_e^{in}(\tau)\, d\tau - \int_0^t M^{out}(\tau)\, d\tau . \qquad [12a]$$

The variable $P_n(t)$ in the equation [12a] denotes the number of inhabitants due to the natural increase of inhabitants P(0). If for the population existent in the region at the beginning of the process, a constant growth rate r is assumed, the equation

$$P_n(t) = P(0) \exp(rt) , \qquad [13]$$

gives the number of inhabitants at time t due to natural increase. Moreover, for simplicity reasons the model assumes that for immigrants and emigrants the number of births equals that of deaths.

The use of equation (12a) can be preferred to equation (12) since $P_n(t)$ does not contain migration variables and can be calculated independent from the forecasting model. The expression $\int_0^t P(\tau)$ on the other hand depends on $M_e^{in}(t)$ and $M^{out}(t)$ so that the natural increase cannot be calculated independent from migration.

4.2.1.3. Result of the analytical solution of the model

The model consists of 11 equations with 11 variables. (Equations 12 and 12a were derived from equation 11.) It is solved through reformulation of the eleven equations so that each variable is a function of the time variable only. P(t) is then given by:

$$P(t) = P(0)\exp(\eta + r)t + \frac{Mp,in1(0)}{w-(\eta + r)}[\exp(wt) - \exp(\eta + r)t] +$$

$$+ \frac{gc[A1(0)+b2A1(0)]}{a-(\eta + r)}[\exp(at) - \exp(\eta + r)t]$$

$$- \frac{R(0)}{h-(\eta + r)}[\exp(ht) - \exp(\eta + r)t] , \qquad [14]$$

where $\eta = gcb_1 - k$.

The solution based on equation (12a) instead of (12) is:

$$P(t) = P(0)\left[\frac{r}{r-\eta}\exp(rt) - \frac{r}{r-\eta}\exp(\eta t) + \exp(\eta t)\right] + \frac{Mp,1in(0)}{w-\eta}[\exp(wt) - \exp(\eta t)]$$

$$+ \frac{gc[A1(0)+b2A1(0)]}{a-\eta}[\exp(at) - \exp(\eta t)] - \frac{R(0)}{h-\eta}[\exp(ht) - \exp(\eta t)] . \qquad [15]$$

When r = 0, meaning there is no natural increase, the two solutions are identical.

4.2.1.4. Main results of the Model

Several basic results on population growth and parameters of the model are described in this subsection.

- The population growth given by equations (14) and (15) is not constant with time but depends on time.
- The population growth rate depends on the natural increase parameter r, on parameters included in the immigration and emigration equations as well as on other parameters of the main equations. There are *multiplying factors* (e.g. information-competition coefficient g, matching coefficient c, population related nonbasic coefficient b_1, production related nonbasic coefficient b_2, emigration coefficient k) and *growth rates* (e.g. rate of natural increase r, rate of increase of jobs in basic sectors a, rate of increase of potential non-job oriented immigrations w, rate of increase of immigration restrictions h).

- If the growth rate of the non-job oriented immigrations (w) and the rate of increase of jobs in basic sectors (a) are both greater than or equal to zero, then population will increase (decrease) if η is greater (less) than zero (assuming that the rate of increase of immigration restrictions h holds the restriction (5a)). Thus,

  P(t) will increase if $\eta > 0$, $r > 0$ or $r = 0$, $a, w > 0$ or $a, w = 0$.

  P(t) will decrease if $\eta < 0$, $r < 0$ or $r = 0$, $a, w < 0$ or $a, w = 0$.

  P(t) will increase for $\eta > 0$ even if the rate of natural population increase r, the rate of increase of jobs in basic sectors a and the growth rate of the non-job oriented immigrations w are zero.
- According to sensitivity analysis, the effect of parameters classified as multiplying factors exceeds that of parameters described as growth rates, if the parameter values are chosen realistically.
- The matching coefficient c, that quantifies the number of job opportunities (Q(t)) as a function of the stock of jobs (A(t)) is one of the most sensitive parameters [eq. 9]. The value of the coefficient in Germany at the time the model was built was 25%. Thus, 25% of all employees were changing their job every year.
- If the matching coefficient increases by 50%, the elasticity of P(t) with respect to the information competition coefficient g equals that with respect to the matching coefficient c, since c and g are included in the solution equation as a product. The population related nonbasic coefficient b_1 is incorporated in the product to the extent it is included in η. However, the product (gc) in the term $\frac{gc[A1(0)+b2A1(0)]}{a-\eta}$ does not contain b_1. Consequently, the elasticity of this coefficient is not equal to the ones of c and g.
- Another interesting result is that net migration depends on the birth surplus. An increase in the rate of natural increase r leads to a decline in the cumulated net migrations. However, the effect of the labor market oriented parameters c and g on net migration is bigger, so that an increase in these parameters increases net migration.
- Migration has two effects on population:

  The first one is the direct effect of migration in period [0, t] on the number of inhabitants at time t, in other words 'cumulated net migration':

$$M_c^{net}(t) = \int_0^t M^{net}(\tau)\, d\tau = \int_0^t M_e^{in}(\tau)\, d\tau - \int_0^t M^{out}(\tau)\, d\tau \,. \qquad [16]$$

  The second effect is a sum of indirect consequences of the first effect on the number of births and deaths, denoted as x(t).

  The number of inhabitants at time t is then the sum of the two effects of migration on population added to the number of inhabitants due to natural increase:

$$P(t) = P_n(t) + M_c^{net}(t) + \int_0^t x(\tau)\, d\tau \,. \qquad [16a]$$

Summing up the direct and indirect effects of migration as $M_c^{net,*}(t)$, the equation (16a) can be rewritten as:

$$M_c^{net,*}(t) = M_c^{net}(t) + \int_0^t x(\tau)\, d\tau = P(t) - P_n(t) \,. \qquad [16b]$$

Since the direct effect $M_c^{net}(t)$ can be calculated from the solution equation (14), the indirect effect is given by:

$$\int_0^t x(\tau)\, d\tau = P(t) - P_n(t) - M_c^{net}(t) \,. \qquad [16c]$$

4.2.1.5. Extension of the model to two or more regions

Two-region models can be easily extended to n-region models. The country is divided to two regions, whose population development is modeled. Then, these two regions are divided again to two regions, and so on. For two-region models, the migration function is of crucial importance. They are classified according to the type of the migration function they use: the Keyfitz model, the Rogers model and an alternative model of Birg.

4.2.1.5.1. The Keyfitz Model

The two-region model developed by Keyfitz (1980) has the following form:

$$P_1(t) = P_1(0) + \int_0^t rP_1(\tau)\, d\tau - \int_0^t mP_1(\tau)\, d\tau \,, \qquad [17]$$

where $P_1(t)$ denotes the population in region 1, $P_1(0)$ the initial population stock, r the rate of natural increase, and m the net migration rate from region 1 to region 2 ($m > 0$). The solution of the equation is given by the following equation:

$$P_1(t) = P_1(0) \exp (r - m)t \,. \qquad [18]$$

It is assumed that the natural increase is equal in both regions. The population function for region 2 is given by the difference between the total population in two regions (constantly increasing in the natural rate) and the population of region 1 at time t:

$$P_2(t) = [P_1(0) + P_2(0)] \exp (rt) - P_1(0)) \exp (r - m)t \,. \qquad [19]$$

In the Keyfitz model, the net migration from region 1 to region 2 is a function of the population of only region 1:

$$M_1^{net}(t) = -m\,P_1(t)\,, \qquad m > 0\,. \tag{20}$$

4.2.1.5.2. The Rogers Model

Rogers (1968) has built a two-region components-of-change model that was reformulated by Ledent (1978a; 1978b; 1978c). The model reformulated by Ledent includes specifications of functions for immigration and emigration. Migration from a region to another region is a linear function of the population in the region of origin:

$$M_{12}(t) = m_{12}\,P_1(t)\,, \qquad m_{12} > 0\,, \tag{21}$$

$$M_{21}(t) = m_{21}\,P_2(t)\,, \qquad m_{21} > 0\,, \tag{22}$$

where M_{12} denotes the migration flows from region 1 to region 2.

In the Rogers model, the natural increase rates r_1 and r_2 can be different. If that is the case ($r_1 \neq r_2$), the number of inhabitants in the regions are given by:

$$P_1(t) = P_1(0) + \int_0^t r_1 P_1(\tau)\,d\tau + \int_0^t m_{21} P_2(\tau)\,d\tau - \int_0^t m_{12} P_1(\tau)\,d\tau\,, \tag{23}$$

$$P_2(t) = P_2(0) + \int_0^t r_2 P_2(\tau)\,d\tau + \int_0^t m_{12} P_1(\tau)\,d\tau - \int_0^t m_{21} P_2(\tau)\,d\tau\,. \tag{24}$$

The analytical solution by Ledent (1978:25) is the following:

$$P_1(t) = A\exp(x_1 t) - B\exp(x_2 t)\,, \tag{25}$$

$$P_2(t) = C\exp(x_1 t) - D\exp(x_2 t)\,, \tag{25}$$

where A, B, C, D, x_1 and x_2 are constants.

Using equations (21) and (22), the net migration flows are written as:

$$M_1^{net}(t) = M_{21}(t) - M_{12}(t) = m_{21}\,P_2(t) - m_{12}\,P_1(t)\,, \tag{26}$$

$$M_2^{net}(t) = -M_1^{net}(t) = m_{12}\,P_1(t) - m_{21}\,P_2(t)\,. \tag{27}$$

Thus, different from the net migration function of the Keyfitz model, that of the Rogers model contains the population variables of both regions.

4.2.1.5.3. The Birg Model

An alternative model has been developed by Birg with two additional considerations:

Firstly, potential migrants compare the relative advantages of the two regions i and j before they decide to migrate. The number of comparisons made by migrants (per time period), N_{ij}^{comp}, is thus an upper limit for the number of migrants:

$$M_{ij} \leq N_{ij}^{comp} \ . \qquad [28]$$

Secondly, the number of comparisons per time period is a function of the number of people comparing their present state as well as of the number of alternative opportunities in the destination region. The first variable, that is the number of people comparing their present state, is a function of the population in the region of origin; $f_i(P_i)$. The second variable, which is the number of alternative opportunities in the destination region, is a function of the number of compared jobs in the destination region since most migrants have to perform a job where they are living. The number of compared jobs is a function q_j of the opportunity variable $Q_j(t)$ which denotes the number of jobs that become vacant through job creation, matching process or retirement of employees in the destination region j. Assuming that $Q_j(t)$ is a linear function of the number of total jobs $A_j(t)$,

$$q_j [Q_j(t)] = q_j [c_j \ A_j(t)] \ , \qquad [29a]$$

while c_j is the matching parameter introduced earlier in the model. The activity rate $\xi_j(t)$ is calculated by:

$$\xi_j(t) = A_j(t) / P_j(t)] \ , \qquad \xi_j > 0 \ . \qquad [29b]$$

Equation (29a) can be reformulated using the activity rate as:

$$q_j [Q_j(t)] = q_j [c_j \ \xi_j \ f_i = q_j [\Upsilon_j P_j(t)] \ , \qquad [29c]$$

where ξ_j is a constant; and Υ_j is an abbreviation for the product $(c_j \xi_j)$ that also can be called a matching parameter or job vacancy parameter.

It is assumed that the functions f_i and q_j are exponential functions:

$$f_i [P_i(t)] = P_i(t)^{\beta^*} , \qquad \beta^* > 0 \ , \qquad [29d]$$

$$q_j [\Upsilon_j P_j(t)] = [\Upsilon_j P_j(t)]^{\alpha^*}, \alpha^* > 0 \ . \qquad [29e]$$

Then, the number of comparisons can be formulated as:

$$N_{ij}^{comp} = \psi[\Upsilon_j P_j(t)^{\alpha^*}, P_i(t)^{\beta^*}] \ . \qquad [29f]$$

The function ψ is multiplicative since the number of comparisons made is the number of people comparing multiplied by the number of opportunities with which they compare their present status. Thus,

$$N_{ij}^{comp} = [\Upsilon_j P_j(t)]^{\alpha^*} P_i(t)^{\beta^*} . \quad [30]$$

Rewriting the inequality (28) we obtain

$$M_{ij}(t) \leq [\Upsilon_j P_j(t)]^{\alpha^*} P_i(t)^{\beta^*} . \quad [31]$$

If it is assumed that parameters α* and β* are adjusted so that the inequality sign in equation (31) can be transformed to equality, then the migration function takes the form:

$$M_{ij}(t) = [\Upsilon_j P_j(t)]^{\alpha} P_i(t)^{\beta} , \qquad \alpha, \beta > 0 , \quad [32]$$

and matches up the gravity model function

$$M_{ij}(t) = [P_j(t)^{\pi 1} P_i(t)^{\pi 2}] / (D_{ij})^{\pi 3} , \quad [32a]$$

where D_{ij} denotes the distance between regions i and j. In the two-regions model, the distance can be assumed to be constant. Consequently, the denominator of the gravity model function can be omitted (when $\alpha < \alpha^*$ and $\beta < \beta^*$). The migration function (32) in this case resembles the gravity model function with the difference of the parameter Υ.

Using the migration function, the alternative to the Keyfitz and Rogers models can be written as:

$$P_1(t) = P_1(0) + \int_0^t r_1 P_1(\tau)\, d\tau + \int_0^t [\Upsilon_1 P_1(\tau)]^{\alpha} P_2(\tau)^{\beta}\, d\tau - \int_0^t [\Upsilon_2 P_2(\tau)]^{\alpha} P_1(\tau)^{\beta}\, d\tau , \quad [33]$$

$$P_2(t) = P_2(0) + \int_0^t r_2 P_2(\tau)\, d\tau + \int_0^t [\Upsilon_2 P_2(\tau)]^{\alpha} P_1(\tau)^{\beta}\, d\tau - \int_0^t [\Upsilon_1 P_1(\tau)]^{\alpha} P_2(\tau)^{\beta}\, d\tau . \quad [34]$$

Although the equations cannot easily be solved, it is possible to shed light on the characteristics of the solution if the natural increase rates in the two regions are equal ($r_1 = r_2$). The first issue is which region gains and which one loses population. The second issue is the relative population in the regions if an equilibrium distribution does exist.

In case when there is actually an equilibrium for the population distribution, the relative growth rates of the regions must be equal:

$$(dP_1(t) / dt) / P_1(t) = (dP_2(t) / dt) / P_2(t) . \quad [35]$$

The change in population in equation (35) can be rewritten as the sum of natural increase and net migration:

$$\frac{r1P1(t) + M1net(t)}{P1(t)} = \frac{r2P2(t) + M2net(t)}{P2(t)} . \quad [36]$$

If the natural increase rates are equal ($r_1 = r_2$), then

$$M_1^{net}(t) / P_1(t) = - M_1^{net}(t) / P_2(t) . \quad [37a]$$

The condition (37) is only satisfied when net migration is zero:

$$M_1^{net}(t) = \Upsilon_1^{\alpha} P_1(t)^{\alpha} P_2(t)^{\beta} - \Upsilon_2^{\alpha} P_2(t)^{\alpha} P_1(t)^{\beta} = 0 . \quad [37b]$$

Replacing $P_2(t)$ with the difference between total population and the population in region 1 we obtain:

$$M_1^{net}(t) = \Upsilon_1^{\alpha} [P_0(t) - P_1(t)]^{\alpha} \{ \Upsilon^{\alpha} [P_0(t) - P_1(t)]^{\beta-\alpha} - \Upsilon_2^{\alpha} P_1(t)^{\alpha} P_1(t)^{\beta-\alpha} = 0 . \quad [37c]$$

When net migration in (37c) is equal to zero, there exists a stable equilibrium. The net migration $M_1^{net}(t)$ is zero if $P_1 = P_0$ or the second bracket of the equation is zero. In the second case,

$$P_1(t) = \lambda P_0(t) , \text{ and}$$

$$\lambda = 1 / [(\Upsilon_2 / \Upsilon_1)^{\alpha/(\beta-\alpha)} + 1] = \Upsilon_1^{\alpha/(\beta-\alpha)} / (\Upsilon_1^{\alpha/(\beta-\alpha)} + \Upsilon_2^{\alpha/(\beta-\alpha)}) . \quad [38]$$

According to the condition, as long as the ration of population in region 1 to total population is lower (higher) than λ, there will be positive (negative) net migration. Net migration will be zero at the turning point when $P_1(t) = \lambda P_0(t)$.

Finally, the characteristics of the alternative model of Birg are:

- In the long run, a stable equilibrium population distribution exists for time $t = t^*$ with the shares:
  - $P_1(t^*) / P_0 = \lambda$, and $P_2(t^*) / P_0 = 1 - \lambda$.

  The shares λ and $(1 - \lambda)$ are a function of only the parameters of the migration function.

- The ratio of the equilibrium populations depends on an exponent of the ratio of job vacancy parameters (Υ):
  - $P_1(t^*) / P_2(t^*) = (\Upsilon_1/\Upsilon_2)^{\alpha/(\beta-\alpha)}$. [39]

  Thus, the higher the job vacancy parameter of a region is, the higher will be its relative share of population in the equilibrium state.

- Under the special circumstance when $\alpha = \beta$ and $\Upsilon_1 = \Upsilon_2$, net migration will be zero independent from the population distribution. Only then the population shares of the two regions will remain constant with time, and the equilibrium distribution will be equal to the initial distribution. Otherwise, the population distribution will change until reaching an equilibrium determined by the relative values of the job vacancy parameters.

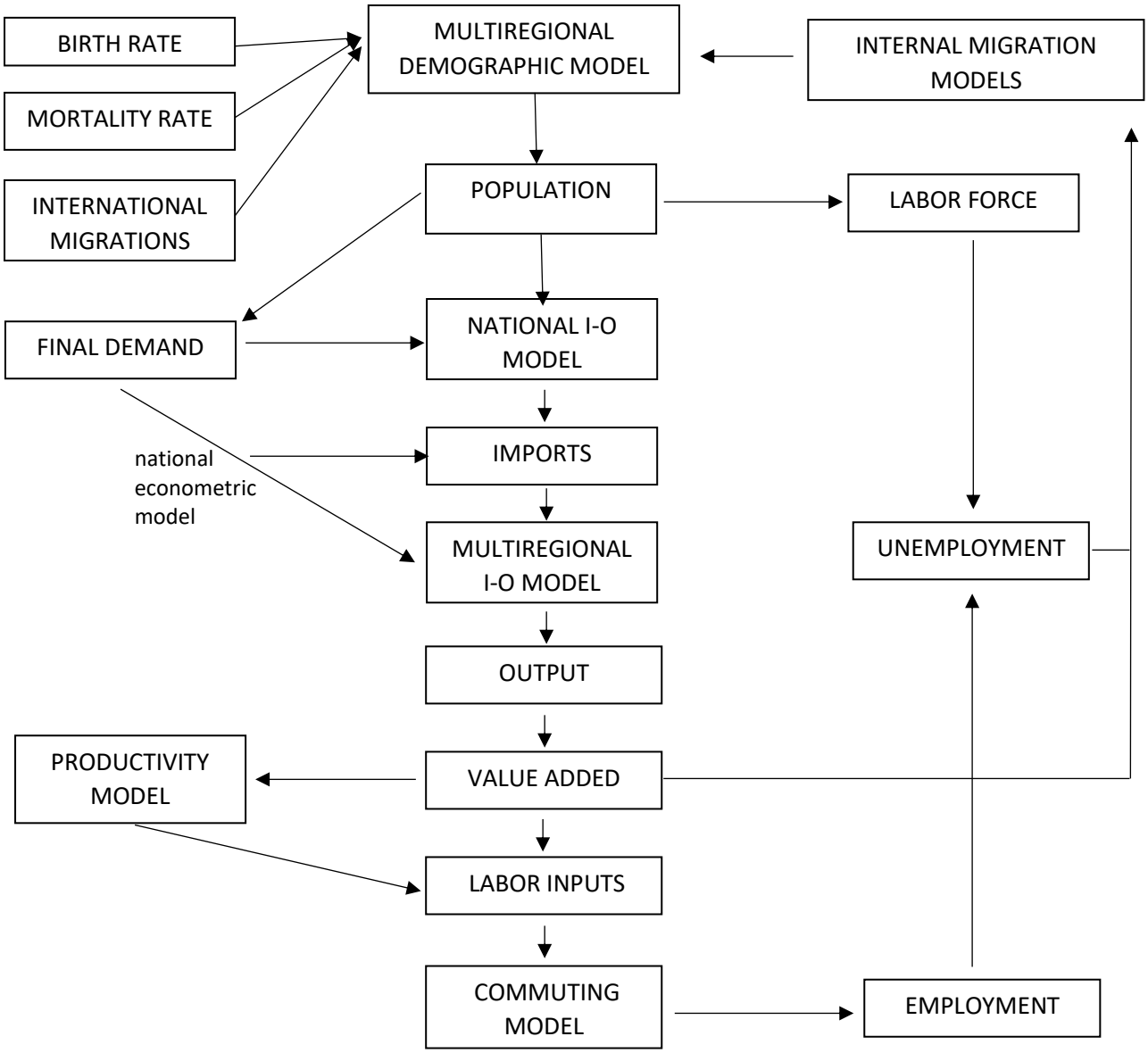
4.2.2. IDEM: an Integrated Demographic and Economic Model of Italy

IDEM (Italy Demographic Economic Model) is a multi-regional model for Italy designed for purposes such as regionalizing national macroeconomic forecasts of the Italian Treasury and the evaluation of economic impacts of regional development plans (Fachin, Venanzoni, 2002). The model arose from the facts that regional economic analysis requires (1) geographical disaggregation of the economy, (2) sectoral disaggregation of the economy (since regions with different economic structures react differently to the same macroeconomic shocks), and (3) endogenous modelling of the demographic variables which affect the labor markets.

The model consists of two main blocks – a demographic model based on the spatial cohort-component approach developed by Willekens and Rogers (1978), and an economic model based on a multi-regional input-output (MRIO) approach. These two blocks are related by a number of modules such as productivity growth, regional labor market participation rates as well as internal migration flows. The exogenous variables used in the equations are given by national economic and demographic variables e.g. investment, per capita consumption and fertility rates.

Figure 4.1. shows the structure of the model. The country is divided into 20 regions (NUTS 2 areas), whereas the economy is disaggregated into 17 sectors (generally due to the NACE classification).

Figure 4.1. The Structure of IDEM



Source: Fachin, Venanzoni, 2002.

The main steps implemented for forecasting are:

(1) **The demographic model** yields yearly forecasts of population by region, yearly age group and gender. These together with regional participation rates by age and gender return forecasts of the labor force by region.

(2) **The economic model** calculates the net final demand by sector and region and estimates the value added, using a set of exogenous hypotheses on national economic aggregates and a set of regional allocation criteria. From the forecasts of the value added and of the labor productivity, regional labor inputs are determined. A final step then links the labor force and labor demand forecasts to determine the unemployment by region.

(3) The value added and the unemployment rate obtained are the main inputs of the interregional migration model, the output of which is added to population forecasts of the demographic model so that the final population forecasts can be made (Fachin, Venanzoni, 2002:3).

The main weakness of the model is its 'open Leontief' type, thus it does not take the labor income multiplier effects into consideration. On the other hand, the model integrates the demographic and economic forecasts; and is able to obtain forecasts under various different hypotheses on future trends of regional differentials of several key variables (Fachin, Venanzoni, 2002:3-14).

4.2.2.1. The demographic model

- Multiregional population change

The demographic model of IDEM is used to forecast yearly population by region, gender and single-year age group. According to the Spatial Population Approach,

"[…] the dynamics of a multiregional population system are governed by its age-specific fertility, mortality and migration rates … [these] determine not only the growth of the population but also its age composition, spatial distribution and crude rates" (Fachin, Venanzoni cf Rogers and Willekens, 2002:4).

In spatial models, populations are disaggregated by age groups and regions. A regional population is determined both by the specific birth-death natural rate, and by the interregional migration flows that redistribute people across regions. The equation

$$\{K_{t+1}\} = G\{K_t\}$$

gives the age and regional distribution of the population at time t+1, while G is the generalized Leslie matrix (multiregional matrix growth operator) containing the birth, death and migration data.

- International Migration

International migration inflows can be endogenously modelled. However, due to scarcity and quality of the data, in the IDEM, total annual inflows and regional shares were set a priori based on recent experiences. Yearly annual outflows were estimated by the demographic model, taking into account the population forecasts and recent regional age- and gender-specific rates.

- Internal Migration

The age structure of migration rates is stable (Fachin, Venanzoni, 1999). The equation

$m_{xijt} = \lambda_{xij} m_{ijt}$, m_{xijt} being the migration rate at age x between region i and j, m_{ijt} the mean migration rate between those regions and λ_{xij} a time-independent coefficient mapping the former to the latter one. Consequently, forecasts of age-specific migration rates can be obtained from forecasts of the mean migration rates, while population changes resulting from migration are modelled. A set of multinomial logit models for group data is used in this model. For each region of origin and gender, seven areas of destination regions exist, and one model is estimated. In all of the areas, flows are allocated to each region on the basis of recent mean shares. The explanatory variables used in the model include per capita value added, unemployment rates in origin and destination regions, employment shares of the agriculture and construction sectors in the regions of origin, and recent correlation between per capita value added in the origin and destination (Fachin, Venanzoni, 2002:5f.).

Regional forecasts of labor participation rates can be made in two steps:

(1) The national mean participation rates for the two genders are forecasted or fixed as scenario parameters,
(2) The regional participation rates for the same age groups are estimated through convergence equations, the coefficients being modified according to the adopted convergence hypothesis (Fachin, Venanzoni, 2002:9f.)..

In IDEM, AR models were used to forecast national participation rates with different scenarios (set by modifying the equations constant term).

4.2.2.2. The economic model

The MRIO (multi-regional input-output) model is of Chenery-Moses type. It is represented as:

$$X = (I - TA)^{-1} [T(C + F + \Delta S + E) - P_T - Imp] \quad [1]$$

X being the output vector (*kxs*) for the k sectors in s regions; A being a block-diagonal matrix including s *kxk* blocks of regional input coefficients; T being the *k.s x k.s* matrix of interregional trade coefficients; C, E, F, ΔS being the domestic consumption, exports, investment and inventory changes vectors of final demand; Imp being the vector of foreign imports and P_T the vector of output transfers between sectors. The components of net national demand are disaggregated by sector and region.

The starting point of forecasting is the trend of net national final demand, such as the medium-term forecasts in the Italian government's Economic and Financial Planning Document. In case of longer-term forecasting, exogenous trends of the different national aggregates have to be formulated. National imports are estimated with a National Input-Output Table, that is an aggregation of the regional A matrix.

As a final step, the vectors of final demand and imports by sectors and regions are computed (while aggregate private consumption is endogenous through population growth).

4.2.2.3. Forecasting the Value Added, Labor Inputs and Employment

The MRIO model gives forecasts of output by sectors and regions as the basis of value added and labor input forecasts. The link between output and value added is given by the (constant) value added input coefficients embedded in the regional A matrix.

Labor productivity grows with value added, thus unit labor inputs fall (Verdoorn, 1949). Assuming that labor input coefficients are constant is therefore not satisfactory. In this case, productivity equations have to be estimated. According to Verdoorn's law, capital should be included in the model, however capital stocks forecasts were not made due to the lack or low quality of existing data on regional capital stocks by sector. Productivity equations only have value added and a time trend as explanatory variables.

Regional labor productivity growth by sector is estimated using a convergence-type equation which expresses the current regional differential (regional productivity level minus the national productivity level) as a function of the one at the beginning of the period. The mean national productivity growth can be either be delivered by forecasts of national models or fixed as a scenario parameter. In the IDEM model (2002), forecasts were derived from cointegrated VARs or the Instrumental Variables equations if the cointegration hypothesis between labor productivity and value added was rejected.

The baseline scenario simulations use empirical estimates. By changing the estimated convergence coefficients, different forecasting options can be obtained such as faster regional convergence or divergence.

4.2.3. BACHUE-International

4.2.3.1. Introduction to the model

The BACHUE-International model (Moreland, 1978) is an econometric model investigating relationships between various demographic, economic and income distribution variables over time in a developing economy. It is part of a family of BACHUE models developed for the Philippines, Brazil, Yugoslavia and Iran. Different from the other models, it is a simplified and generalized model. BACHUE International, as a system of relations between economic and demographic variables, is a framework of a country- or region-specific model, on the one hand, and an empirically estimated working econometric model, on the other.

The model is built on three main subsystems: demographic, economic and income distribution. It is a long-term model predicting on yearly basis. However, simulations can be run for several years. The model is basically a disequilibrium which continually tries to reach equilibrium.

BACHUE International, in a lesser extent than the country-specific models, is disaggregated. Population, for instance, is disaggregated by age, sex as well as urban-rural distribution. Population by age is disaggregated by educational level. Economic activity is disaggregated into ten sectors, which can be rural or urban. Employment in each of the ten sectors is further disaggregated in employees and employers/ self-employed.

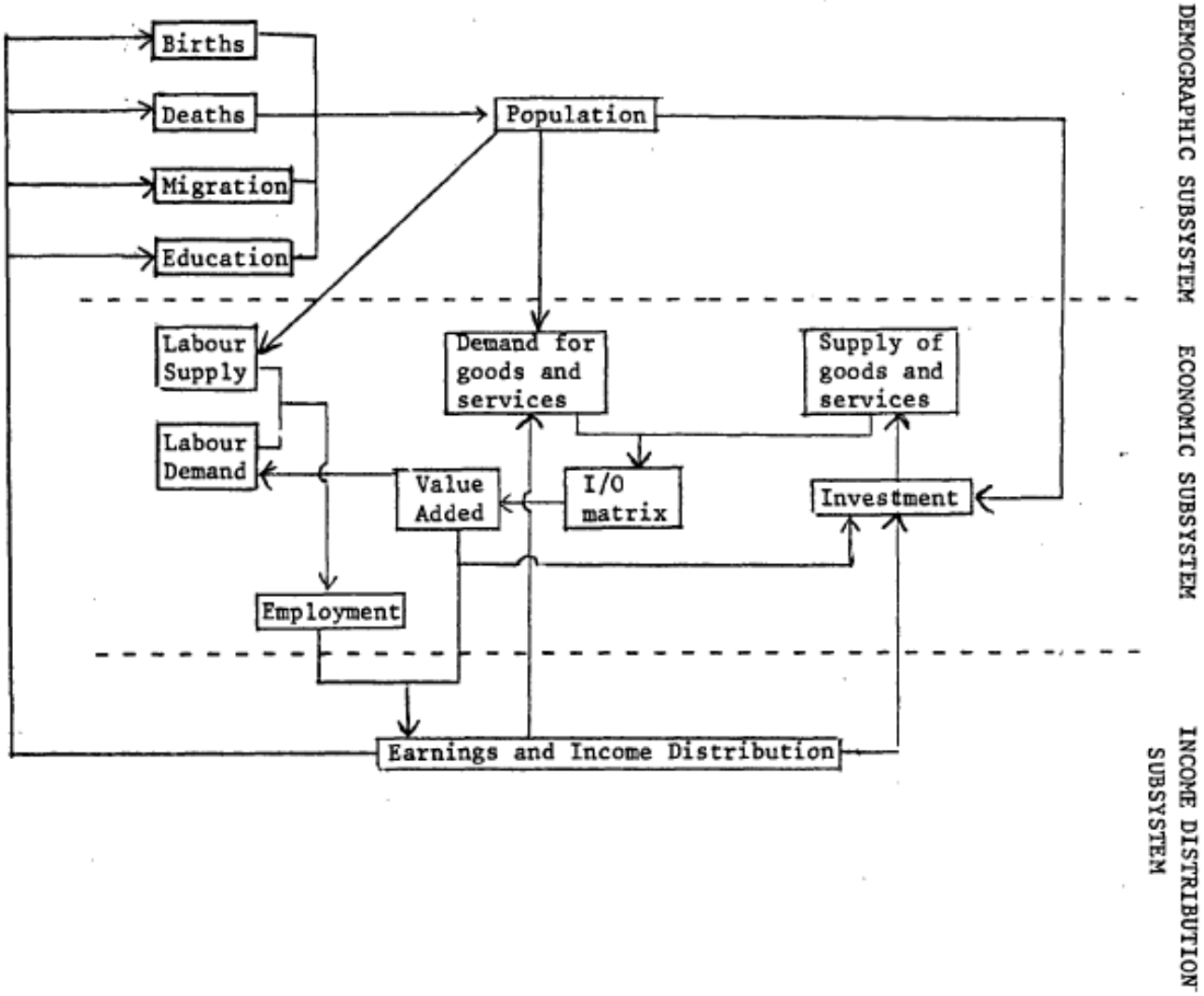
Some of the variables used in the model are exogenous, that are mostly policy variables at government level. The most important exogenous variables are growth rates of exports by sector and technical progress. Others would be tax rates, ceiling on the government deficit, direction and size of government investment and level of unemployment.

Figure 4.2. gives an overview of the model and the interrelations between its subsystems[22]. In a broad manner, the demographic subsystem is concerned with the population by age, sex, location and education. The economic subsystem, including an input-output matrix, considers the value added by sector and employment. The income distribution subsystem aims to predict the distribution of income, and includes the fiscal system although the latter is not illustrated in the figure.

The parameters of the model are empirically estimated, while international cross-section data build the basis for the estimation. Then the model is simulated. In the following, the subsystems will be described more in detail.

[22] Government interaction is omitted in the diagram to prevent overcrowding.

Figure 4.2. Main Subsystems and Relationships in BACHUE-International



Source: Moreland, R. S. (1978). *Demographic-economic model for developing countries: bachue international* (No. 180682). International Labour Organization.

4.2.3.2. Subsystems of the model

4.2.3.2.1. The demographic subsystem

The demographic subsystem is mainly concerned with the population by age, sex, urban-rural location, educational level and labor-force participation in rural and urban areas. Behavioral relations endogenously predict the fertility rates, female life expectancy at birth, (net) rural to urban migration rates, (first and second level) educational completion as well as female labor force participation rates. Figure 4.3. gives an overview of the demographic subsystem.

Fertility is a function of the female labor force participation rate, illiteracy rate, per-capita income and percentage of income earned by the poor. Since child-bearing and –rearing are time-intensive, the female labor force participation rate is related to fertility. Illiteracy is both a proxy for changes in the wage rate and opportunity cost of time as well as a taste variable. Income is relevant since people's financial capabilities affect their fertility, and also tastes change with changing development and income levels. The income of the poor is used in the relations in order to prevent any non-linearity between income and fertility.

It is expected that female life expectancy varies directly with income levels because with higher development and rising incomes in public as well as private level people will allocate more resources to health care and prevention of diseases. Illiteracy affects female life expectancy since better educated people pay more attention to hygiene, immunization and nutrition. Another important factor for life expectancy is the presence of physicians in the society.

Female labor force participation rates are affected by fertility rates as discussed before. Illiteracy has an impact on the labor force participation since more educated females have better skills and thus have more opportunities to obtain employment. Income has a negative impact on female labor force participation, which can be explained by the fact that females with a higher income do not have the 'need' or pressure to work and contribute to household incomes.

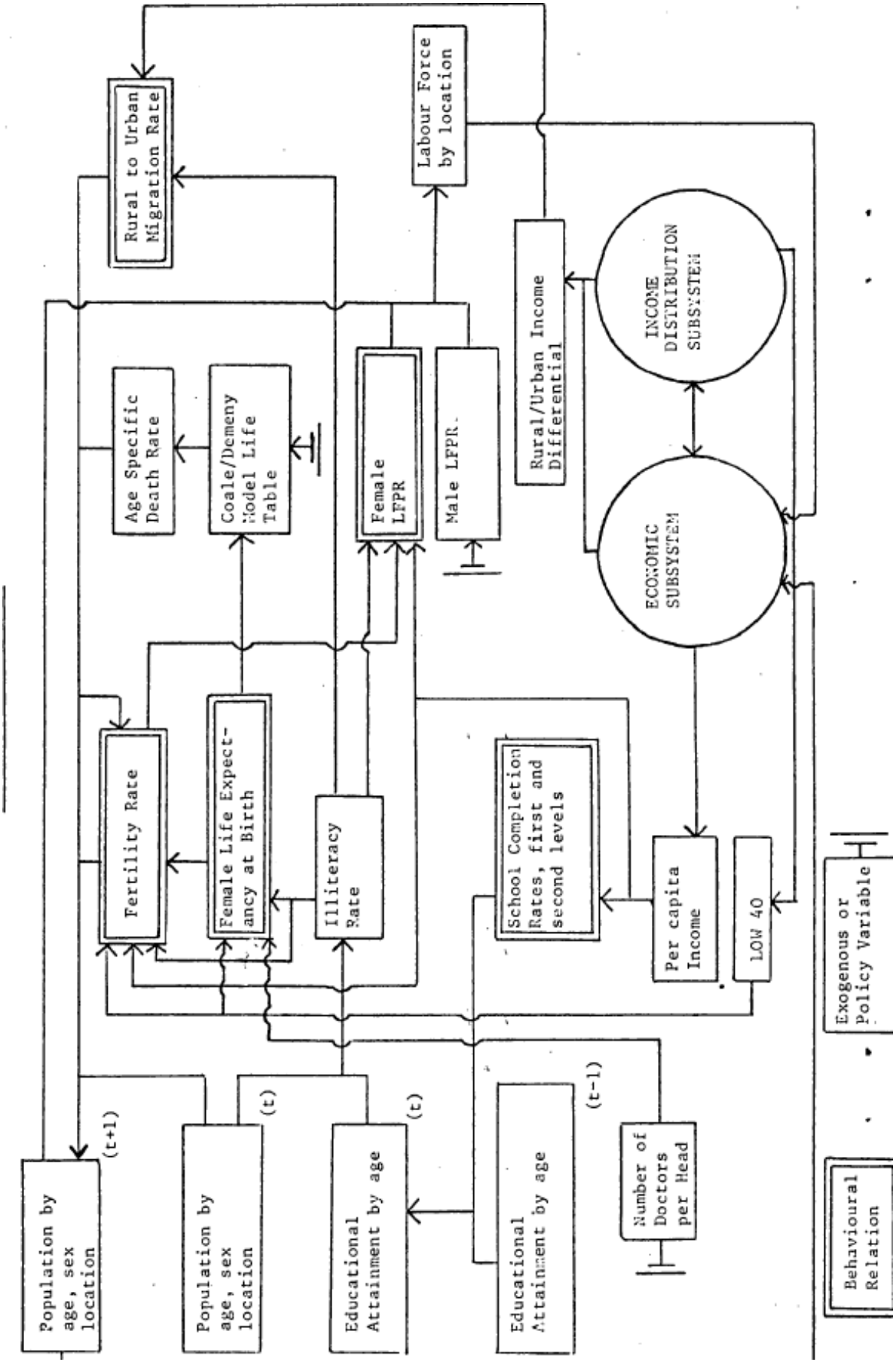
The rural to urban migrations are affected by the relative difference between rural and urban incomes since migrants move with the intention to improve their standard of living. Illiteracy is in negative relation with migration because less educated people have less information on job possibilities and income differences and have less human capital than educated people.

For the prediction of the female life expectancy, the model uses empirically based Coale-Demeny Regional Model Lifetables. Together with the fertility rate, the population by age and sex can be estimated. Migration rates are used to trace the population in periods by rural-urban location. Then, the female and (exogenous) male labor force participation rates are used to estimate the labor force by location. In this model, education has two levels only (primary and secondary). To predict the age profile

of the population's educational level, predicted completion ages are applied to the population. Then, the age profile is aggregated to find a single measure of educational accomplishment.

The main linkages of the demographic subsystem with the economic subsystem are population and labor force. No direct link exists between the demographic and income distribution subsystems.

Figure 4.3. Overview of the Demographic Subsystem



4.2.3.2.2. The economic subsystem

In the core of the economic subsystem stands a general ten by ten input-output table based on technical coefficients of a number of countries. The economic sectors considered in the subsystem are agriculture, mining, food, textiles, chemicals, metal manufacturing, miscellaneous manufacturing, construction, energy and services. Agriculture and mining are rural sectors, while the other eight sectors are urban. Figure 4.4. gives an overview of the economic subsystem.

Final demand by industry is given by private and government consumption, private and government investment, imports and exports. Private consumption and investment are predicted by behavioral equations. Government expenditure is exogenous, although total government spending is affected by taxes and taxable income as well as by the limit on government deficit.

Private consumption by industry is affected by the income of the poorest 40% of the population, per capita income and the age structure of the population. The income of the poor is included in order to capture the non-linearity of the relationship. The age structure reflects the difference in consumption expected between children and adults, and the influence of children on adults' expenditure patterns.

The investment equation is similar to a savings equation, since a savings-investment disparity is lacking. The explanatory variables of the investment equation are similar to those of the consumption equation.

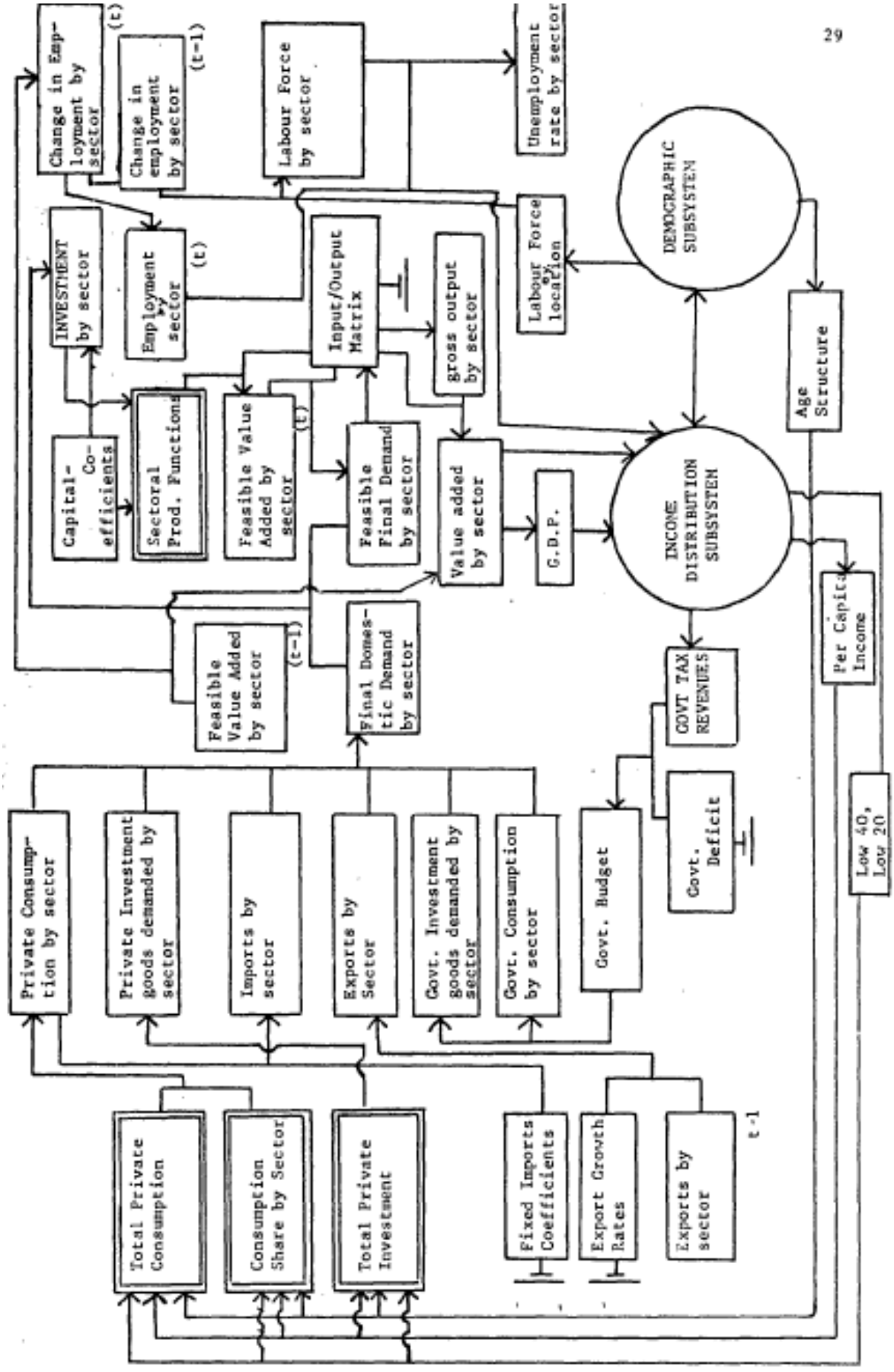
Exports increase at an exogenous rate, whereas imports depend on the difference between domestic demand and supply.

To produce total output and value added by sector, final demand and the input-output matrix are used. The value added is constrained by the capacity of industry determined by industry investment and capital-output ratios. Investment, on the other hand, is proportional to the investment of the previous period and the current gap between unadjusted industry demand and supply. Thereby the effects of market forces responding to excess demand are captured. Demand can be adjusted upward or downward, and excess capacity is allowed, being a proxy for the effects of market forces and reflecting an assumption for prices.

Employment is proportional to the growth in output by sector. The proportionality factor can vary with sector and is a function of the relative growth rate of sectoral value added. Unemployment by sector changes when the labor force and employment at the sectoral level change. Labor force by sector is calculated by allocating rural and urban labor forces across industries. It is assumed that labor force allocates itself across sectors proportionally to employment in those sectors in the previous time period. Adjustment is partial, so that the process is auto-regressive. The model assumes that a 'hard-core' unemployment level exists which is exogenous.

The economic subsystem is linked to the income distribution subsystem. The linkages are value added and GDP, employment and unemployment. The linkages from the economic system to the demographic system are indirect over the income distribution system.

Figure 4.4. Overview of the Economic Subsystem

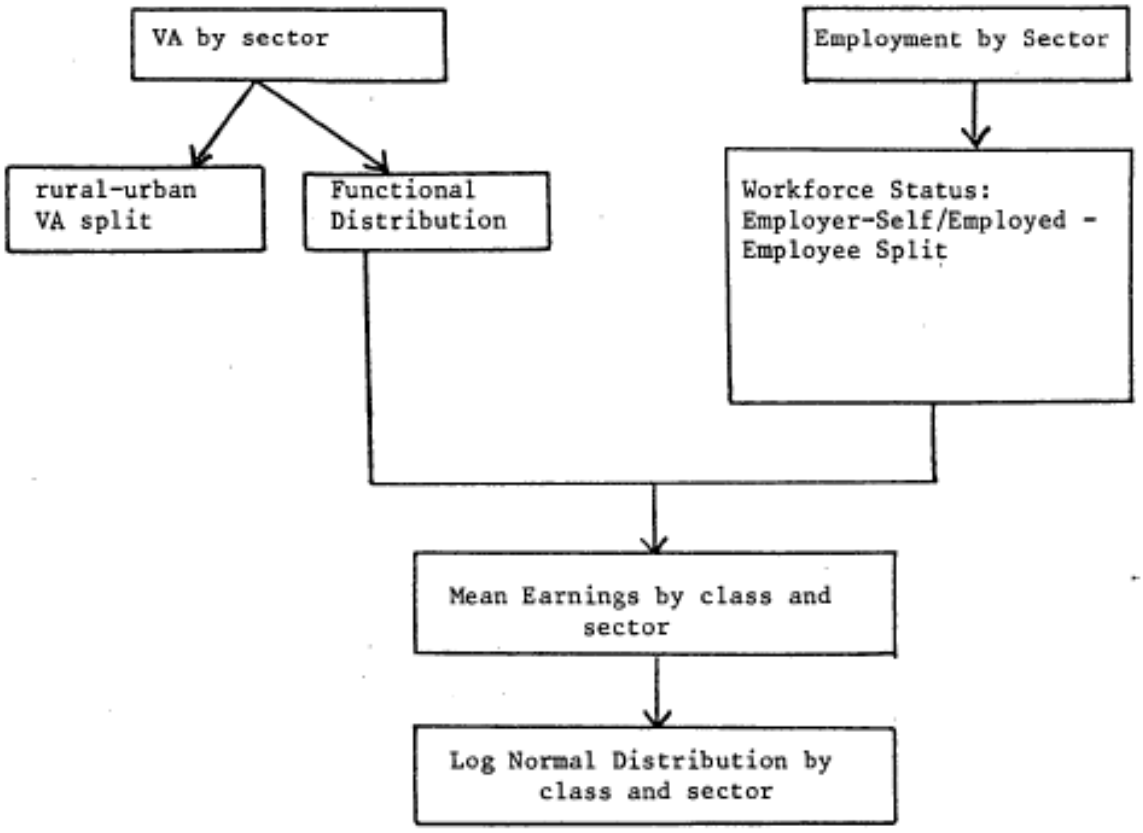


4.2.3.2.3. The income distribution subsystem

The income distribution subsystem predicts the overall as well as rural and urban per capita incomes, divides the labor force and value added by class, and calculates the distribution of earnings by decile. The tax system on earnings is included. In the model the only source of income is value added. Transfer payments from government, investment earnings and other forms of unearned income are not included[23].

Figure 4.5. gives an overview of the income distribution subsystem.

Figure 4.5. Overview of the Income Distribution Subsystem



Source: Moreland, R. S. (1978). *Demographic-economic model for developing countries: bachue international* (No. 180682). International Labour Organization.

The main equations in this subsystem are those which divide value added and employment by class. Value added is divided into profits and wages by a function that includes overall per capita income as an independent variable. This divide is corresponding to the income of employees (wage earners) and

[23] In country-specific application, they can be included.

employers / self-employed persons. The division of the employed to employees and employers / self-employed is each sector is predicted by a constant coefficient.

Then, the mean earnings by 20 classes and sectors are calculated. For each class of earnings by sector, a log normal distribution (with a constant coefficient of variation) is assumed. The overall distribution of earnings in the economy can be found through aggregation of these distributions.

The fiscal system in the model is comprised of taxes on earnings, which finance the government expenditures. The government expenditures can be increased by raising the size of the government deficit. Income tax rates are exogenous and can be represented as a function of income[24].

The income distribution subsystem is linked to both other subsystems. The overall per capita income, which is the main output of this subsystem, and the income of the poorest segments of population link the system into the economic and demographic subsystems. The government revenue generated by the fiscal system in the income distribution subsystem finances the government expenditures on final demand in the economic subsystem.

[24] Import taxes, value added taxes and transfer payments can also be used in country-specific applications of the model.

CHAPTER 5 AGENT-BASED MODELS OF MIGRATION

[Following the spirit of 'post-structuralist' thinking in social sciences, we may note that all individuals and societies face both 'production problems' (...) and 'existential problems' (...). These two broad spheres of problems lead, of course, to interdependent solutions.] ***[Simmons, 1989]***

5.1. Introduction

Computational social simulation modelling started with microsimulation already in the 1960s (Hamill and Gilbert, 2016:4, cf. Gilbert and Troitzsch, 2005:6; Morgan, 2012:301–315). The early computer simulations of economic processes "naturally followed the divide of economics into microeconomics and macroeconomics" (Hanappi, 2017:451). Later, with increasing technical developments attempts were made to combine micro- and macro-economic simulations in parallel with the "more conventional efforts of mainstream economic theory to provide a microfoundation for macroeconomics" (Hanappi, 2017:451). Although in the late 1980s these efforts failed due to implausible restrictions on the micro-level to allow for aggregation, stable equilibria or equilibrium paths became less useful (Hanappi, 2017).

Economic computer simulation gained momentum firstly with an external impulse – from biology, where mathematical modelling and game theory were increasingly used (Hanappi, 2017; Smith, 1982). Nelson and Winter were inspired to use computer simulation to model market dynamics. They used market dynamics simulations to explain how the 'worst routines' were eliminated similarly to the 'survival of the fittest'. These two economists then built the foundations of the evolutionary economics school, which also today makes great use of computer simulation techniques – of agent based simulation (Hanappi, 2017; Nelson and Winter, 1982).

A second external impulse to economic computer simulation came from the analysis of complex systems with network theory. Erdös' random graph theory, which assumes that between variables (nodes) links (dynamic equations) might sequentially emerge through a *random* process that can be described with stochastic processes, was the first of numerous other networks found by researchers (Hanappi, 2017). In the 1990s, Barabasi and his team discovered a 'small world' structure in networks. Also, Barabasi and Albert (1999) designed a 'preferential attachment' model, where heavily linked nodes (called hubs) tend to quickly accumulate even more links, while nodes with only a few links are unlikely to be chosen as the destination for a new link. In other words, in the model new network members prefer making a connection to more popular existing members.

Now in agent-based modeling, a set of data about a given population is taken and rules are applied to reproduce changes, so that the overall impact can be investigated (Hamill and Gilbert, 2016:4, cf. Gilbert

and Troitzsch, 2005:8). Similar to microsimulation models, which they essentially also are, agent-based models capture differences between individuals. Although microsimulation is useful for simulating policy changes, it does not allow interaction. It is only with the development of agent-based modelling that micro-level interactions between heterogeneous agents could be modelled (Hamill and Gilbert, 2016:4).

Different from the methodology of experimental economics and that of other behavioural sciences, which seek to understand *why* humans apply specific rules, agent-based models (ABMs) pre-suppose behavioural rules and verify if these micro-based rules can be used to explain 'macroscopic regularities' (Billari et. al., 2006:2).

> "As outlined in Axelrod (1997), agent-based computational modelling may be compared to the principles of induction and deduction. "Whereas the purpose of induction is to find patterns in data and that of deduction is to find consequences of assumptions, the purpose of agent-based modelling is to aid intuition". As with deduction, agent-based modelling starts with assumptions. However, unlike deduction, it does not prove theorems. The simulated data of agent-based models can be analyzed inductively, even though the data are not from the real world as in case of induction." [Billari et. al., 2006:2]

Behavioural rules determine how agents (e.g. people) interact with other agents, such as their neighbours or other kinds of entities (e.g. firms). The modeller can utilize national statistics, or data provided by studies to explore the underlying mechanisms. It is possible to use standard economic theories as well as theories based on behavioral economics. Then, the simulation model can reproduce certain events or patterns, or generate possible future scenarios to see the effects of economic policies. Thus, the validity of assumptions collected from different sources can be tested (Hamill and Gilbert, 2016:4).

Agents in ABMs can represent different kinds of entities: people or parts of people, but also households, firms or governments. Heterogeneity of agents is an important feature since each agent may have a unique set of characteristics and behaviour rules (Hamill and Gilbert, 2016:4, cf. Epstein, 2006:51). The modeller distributes agents across the two-dimensional space, which represents a geographical landscape, social network, or an 'abstract' space (Hamill and Gilbert, 2016:4, cf. Epstein, 2006:52). Distribution of agents can be done either randomly or following a certain rule. Boundaries in space can be drawn as well.

5.2. Transition from Rational Actor Models to Agent Based Models

Classical economic theory is based on the *rationality paradigm*, which assumes that individual actors, e.g. homo economicus, have certain preferences, represented by a utility function, and on the best possible decision, based on complete information about their environment and the supposed consequences (Billari et. al., 2006:2). Decision theory is about ranking and selection of actors' options according to their preferences. A rational decision-maker maximizes utility under given constraints. In order to find the optimum, a large number of methods has been developed (Billari et. al., 2006:2).

In the real world, however, actors live in complex and uncertain environments, have limits and a bounded rationality. The social environment itself, particularly the unpredictable behaviour of other actors, is one of the factors restraining rationality (Billari et. al., 2006:2). As stated before, in agent-based models agents behave according to certain rules, however utility optimization is only one of the possible rules. Migration models, particularly agent-based models of migration, have become increasingly realistic in the last years by integrating and varying individuals' decision-making processes (Klabunde and Willekens, 2016:74).

In behavioural models, the outcome of the migration decision is mostly uncertain. 'Utility and value are random variables with probability distributions' (Klabunde and Willekens, 2016:74). Migration decision is made by considering the expected utility or expected value. It forms part of the individual's life course, while events in the life cycle, such as marriage and child birth, can change the utility in a location, and affect the migration decision. Migration, on the other hand, also affects the life events. Therefore, it is preferable to model migration and individual's life cycle simultaneously (Klabunde and Willekens, 2016:74).

Moreover, other actors' decisions may also affect the decision, timing and destination of migration. "Agent-based modelling is the only method that allows for the explicit modelling social interaction and the social networks that result from it" (Klabunde and Willekens, 2016:74). Potential migrants exchange information on migration options as well as on job market opportunities through networks. Networks also characterize a form of social capital since migrants can give financial support to other migrants to cover the costs of migration. Networks can ease the job search, provide initial housing, and reduce the risks related with migration. Network ties can change (become weaker) with time and distance as well as through integration or assimilation. They do affect migration decisions, and are important for explaining migratory movements at population-level (e.g. distribution of migrants in a country).

There has been a transition from rational actor models to agent-based modelling, and from top-down macro decision-making to bottom-up microsimulation in recent years (Billari et. al., 2006:3). As van den Bergh and Gowdy state, "in the last quarter century, the microfoundations approach to macroeconomic theory has been dominant" (Billari et. al., 2006:3). "Selection of strategies and decision rules in computer-based simulation models can be based on observation and include real-world actors and stakeholders, offering a wide field of experimental games for educational and research purposes as well as for decision support and policy advice" (Billari et. al., 2006:3).

5.3. Decision-making in Agent-Based Models of Migration

Klabunde and Willekens identify eight criteria which should be fulfilled by migration theories to reflect most aspects of empirical decision-making:

1. In the model '*a gap between desires or intentions and actual behaviour*' should be allowed.

2. *Social influence* should be considered since migrants take others' choices into account and also depend on others (Haug, 2008; Munshi, 2003).
3. The theory should take into account *uncertainty* as the migration decision is taken under uncertain conditions.
4. The migration decision should be considered in the agents' *life cycle* and be related to demographic events.
5. In reality, once people decide to migrate, they have to take time for planning and preparing the move. During this period, demographic events may occur, or the political, economic or social situation in both host and home countries may change. Thus, ideally the *time necessary for planning* migration should be incorporated in the model.
6. The decision rules incorporated in the migration theory should be based on *decision theory* as well as on *empirical evidence*.
7. The migration decision theory has to be "as simple as possible and as complex as necessary".
8. The theory should be *falsifiable*, since at the aggregated level model results may be different from empirical observations so that the *assumed* decision behaviour fails to describe the processes (Klabunde and Willekens, 2016:77f.).

5.4. Review of Agent-based Models of Migration

Agent-based models that are found in literature investigate the migration behaviour through different methodologies. Klabunde and Willekens (2016) classify agent-based models of migration (including models of return migration, excluding models of residential mobility or of mobility with the intention of better housing) in six major groups according to the behavioural theories they use:

- *Minimalist models*, which depart from simple micro-level rules and "grow" macro-outcomes, thus showing the minimal assumptions necessary for generating the observed outcomes;
- *Microeconomic expected utility maximization*, where agents have rational expectations and perform finite horizon and discrete time expected utility maximization;
- *"Psycho-social and cognitive models"*, as called by An (2012), which are based on psycho-social decision models, allow the distinction between desired and actual behaviour, and include social influence, uncertainty and events in agents' lifecycle;
- *Models based on heuristics without direct empirical correspondence,*
- *Models based on decision theory and direct observation,* which aim to combine decision theories with empirical rules; and
- *Models based on purely empirical, observational rules without mention of a theory;* where the choices of behavioural rules are empirically motivated: the determinants of migration are either derived from data or from (expert or stakeholder) interviews.

In the following, relevant agent-based model in literature are reviewed, while the classification is borrowed from Klabunde and Willekens (2016) and models published after 2014 are added.

5.4.1. Minimalist Models

Schweitzer's (1998) stochastic dynamic model of migration and economic agglomeration is an example of minimalist models. Economic agents are active Brownian particles with two internal states: employed agents which are immobile and generate a wage field, and unemployed agents which are mobile and migrate towards wage fields with high productivity. He found that distinct economic centres are established in two stages: "(i) small economic centres are formed based on the positive feedback of mutual stimulation/cooperation among the agents, (ii) some of the small centres grow at the expense of others, which finally leads to the concentration of the labour force in different extended economic regions" (Schweitzer, 1998:11). A stable coexistence between regions is observed, "although they exist in an internal quasistationary non-equilibrium state and still follow a stochastic eigendynamics" (Schweitzer, 1998:11).

A model similar to Schweitzer's (1998) was proposed by Jiang et al. (2010), who investigated labour migration within the framework of active Brownian particles and add the effects of cultural difference. They found that

> "(i) a region with high tax rate always provides better welfare service, which is an important reason for attracting labour migration; (ii) when the cultural distance is small, labourers migrate to the regions with better welfare service; otherwise, (iii) when the cultural distance is high, only labourers in regions with high tax rate can obtain high welfare and make migrations between regions; (iv) although different wage levels have different effects on regions with different tax rates, the main factor which causes labour migration is to obtain better benefits from the welfare service" (Jiang et al., 2010:567).

Another model was built by Silveira et al. (2006) to analyse the rural-urban migration process in a developing economy with a statistical mechanics approach. Rural-urban migration decision was formulated as a discrete choice problem, where like in the Ising model, the influence of neighbours is taken into account. They found aggregate regularities such as continuous growth of urban population, wage equalization in rural and urban sectors (Harris-Todaro equilibrium condition), increasing of urban population and of per capita income, which indicates that "decentralized migration decisions can lead to the emergence of equilibrium macrostates with features observed in developing economies" (Silveira et al., 2006:455). El Saadi et al. (2010) similarly proposed an agent-based model of rural-urban migration, based on the dynamic Harris-Todaro model.

Ichinose et al. (2013), on the other hand, studied the effects of adaptive long-distance migration on the evolution of cooperation with an agent-based model. Agents play the Prisoner's Dilemma game with

agents in their Moore neighbourhood. Agents decide the site to migrate based on the number of defectors nearby. Through the "adaptive long-range migration", they can move to more distant places, if the number of adjacent defectors is larger. Then, in each game, two agents simultaneously decide whether to cooperate or to defect based on their current strategies. When the game is over, the agent imitates the strategy of the agent who has received the highest payoff among all neighbours including itself. The model showed that adaptive long-rage migration strongly enhanced the evolution and maintenance of cooperation (Ichinose et al., 2013:11).

Ruiz, Giret, Alvarado, Perez, Rodriguez and Julian (2014) developed an agent-based model for border crossing. They simulated the process of migration using multi-agent systems (MAS). A behavioural model including the profiles of the agents and the legislation of the source and destination countries defines the interaction between the migrants and border security police at the micro-level. The authors conclude that changes in legislation or in applications of the legislation affect migration trends, such as the migration routes. Migrants did actually deviate from entrance points with stricter border security. Over time, this situation increases owing to the 'pull effect'.

5.4.2. Microeconomic Expected Utility Maximization

Heiland (2003) proposed an agent-based model to simulate state-level East to West German migration patterns since the fall of the Berlin Wall. The model focused on the differences of uncertainty of employment at the source and destination places places. The theoretical approach of the model was that state-contingent expected income (utility) net of moving costs are the main incentive for migration. Thus, agents solve a finite horizon utility maximization problem with the migration decision being the control variable, and the location and employment status being the state variables. They aim to maximize their consumption utility and utility from amenities at their current residence. The optimal decision rules are found by backward induction using a dynamic programming algorithm, while the agents' behaviour is simulated with the adoption of Rust's Method (Heiland, 2013:83). The model was able to capture the main stylized facts of migration patterns from West to East Germany. Heiland found that unemployed agents were more likely to emigrate. The large number of emigrants in the period after the German unification was explained by the initially large number of mobile (e.g. young) people. Geographic proximity and the demand for technically skilled workforce mainly explain the distribution of migrants across the German states (Heiland, 2003:73).

Biondo et al. (2012) considered return migration after brain drain from a microeconomic approach. Instead of utility gained from consumption, they refer to 'social capital' as a composite value capturing the value given by individuals to the three components – job, family and friends. Thus, utility is a function of social capital. Agents' return probability is evaluated as a function of their initial social capital (in the home country and host country), and of two psychological factors – risk aversion and

initial expectation. The authors found that the probability of return migration strongly depends on the ratio between risk aversion and initial expectation. If risk aversion is much higher than initial expectation, return migration will occur with a high probability, and vice versa.

Espindola et al. (2006) developed a Harris-Todaro agent-based model to rural-urban migration. They dealt with the question if the conditions of urban concentration and urban unemployment from the Harris-Todaro model can be produced as properties from the interaction among adaptative agents (Espindola et al., 2006:603). Migration is considered as a process of social learning by imitation. In each time step, only a share of agents becomes potential migrants, while the latter search for the best sectorial location. They calculate their satisfaction level by comparing their wage to that of their nearest neighbours and decide to migrate, if their earnings are lower than most of their nearest neighbours. The authors found that (i) the main Harris-Todaro principle, that there will be rural-urban migration if urban expected wages exceed rural expected wages, was observed as a consequence to interaction among adaptative agents, (ii) the migratory dynamics lead the economy to a long-run equilibrium characterized by urban concentration and urban unemployment, (iii) "the impact of the minimum wage and elasticity in terms of trade in a long run equilibrium (…) are in agreement with the predictions of the Harris-Todaro model with Cobb-Douglas technology" (Espindola et al., 2006:609), and (iv) there is the possibility of reverse migration.

Similarly, Garcia-Diaz and Moreno-Monroy (2012) built up a model that looks at rural-urban migration dynamics. In this model, however, they add the urban informal sector to the setting, which functions as an 'economic buffer'. Migrants are willing to take jobs in the informal sector to earn income while waiting for jobs in the higher paying urban sector. 'Urbanization and the urban informal sector arise endogenously from migration decisions of heterogeneous agents that are subject to social influence through neighbouring effects' (Garcia-Diaz and Moreno-Monroy, 2012:1564). Heterogeneity is introduced in migration decisions, which are modelled 'according to a multinomial logit choice model that allows for agent idiosyncrasy in the decision-making process' (Garcia-Diaz and Moreno-Monroy, 2012:1564), as well as in form of socio-demographic characteristics. Social influence is introduced by migration decisions depending on the agents' social network. Moreover, adaptive agents are able to use past available information (such as rural, urban and informal sector wages, and the immediate past location of neighbouring agents). Agents decide where to migrate by considering the expected earnings differentials and the number of the neighbouring agents. As a result of rural-urban migration, both urban unemployment and the urban informal sector emerge. The authors found that 'moderate levels of social influence and a large proportion of rural inhabitants with preferred socio-demographic characteristics (by modern-sector employers) are conducive to a higher urbanization rate and a larger informal sector' (Garcia-Diaz and Moreno-Monroy, 2012:1563).

In their agent-based model to describe labour migration Makarov, Bakhtizin, Sushko and Ageeva (2017) conducted two experiments: In the first one, they aimed at investigating the effects of the depreciation of the rubble against the yuan on labour migration. Then in the second one, it was assumed that all agents in both Russia and China had perfect information on wages irrespective of their qualification levels.

5.4.3. Psycho-Social and Cognitive Models

Kniveton et al. (2011) proposed an agent-based model of environmental migration within and from Burkina Faso, using the Theory of Planned Behaviour (TPB)[25] for explaining the decision-making process. They investigated the role of the environment in migration decisions using different 'scenarios of future demographic, economic, social, political and climate change in a dryland context' (Kniveton et al., 2011:S34). According to the conceptual model, the environmental impact on migration occurs through the 'drivers of: differential employment opportunities; limited access to natural resources; national policies and incentives; ecological vulnerability, political instability and infrastructure' (Kniveton et al., 2011:35). The individual's decision-making process is shaped by 'their attitude towards adaptation behaviours, their subjective norm (or assessment of the expectations of others), and their perceived behavioural control (or perceived adaptive capacity)' (Kniveton et al., 2011:36). Each agent forms behavioural intentions towards their migration options, and determines behavioural intention values according to which (s)he acts (migrates to one of the possible places or stays). Simulation results indicated that low economic growth, high population growth and exclusive local social, political and economic governance have a decreasing effect on migratory flows in comparison to other combinations of non-climate drivers. Moreover, in both wet and dry climate scenarios, lowest migration flows were observed by a combination of low economic growth, high population growth and exclusive local social, political and economic governance; whereas highest international migration flows were observed in dry climate scenarios (Kniveton et al., 2011:39).

In a similar study investigating the effects of climate and demographic change on migration flows from and within Burkina Faso, Kniveton et al. (2012) conclude that population growth increases the effects of climate change on migration flows. Again, in a similar study Hu, Zhou, Cui and Zhang (2014) looked at the correlation of climate change and migration in Bangladesh. Agents in the model make a migration decision based on climate factors such as sea level, temperature, rain and drought.

[25] The theory of planned behavior implies that a person's intention to engage in a certain behavior at a certain time can be predicted with great accuracy "from attitudes toward the behavior, subjective norms, and perceived behavioral control. (…) Attitudes, subjective norms, and perceived behavioral control are shown to be related to appropriate sets of salient behavioral, normative, and control beliefs about the behavior, but the exact nature of these relations is still uncertain" (Ajzen, 199:179).

Reichlova (2005) proposed an agent-based model using Abraham Maslow's (1954) motivational theory to explain migration flows within Europe[26]. She employed three out of the five types of needs in her model: Migration influences the individual's utility through different wage levels existing in different locations; utility changes with regard to the individual's safety and needs; and changes in social networks. Decision-making occurs in two phases: once the individual has reached a certain threshold level of saturation of physiological needs (a wage threshold), s(he) will try to saturate her/his safety and social needs. Results of the model indicated that

> "(1) If agents include safety and social needs into decision making then wages in all regions either exceed minimal physiological threshold or are equalized in stable state. (2) If agents include safety needs into decision making then wages may remain unequalised in stable state. (3) If agents include social needs into decision making then wages may remain unequalised in stable state. (4) The more important are social and safety needs, the lower convergence of wage levels due to migration occurs" (Reichlova, 2005:21).

Another agent-based migration model that uses psycho-social and cognitive approach based on planned behaviour theory is that of Hébert, Perez and Harati (2018). Drawing on complex systems theory, the model identifies possible pathways of Syrian refugees. Conflict zones are defined according to death tolls. Agents firstly decide whether or not to migrate. Once they decide to migrate, they leave conflict areas for destinations that they choose based on their own characteristics (e.g. wealth). Then, depending on other conditions such as the capacity and existing population of refugee camps, they decide whether to seek asylum.

Li, Jiang, Gu and Yang (2017) investigated the effects of migration speed on the evolution of cooperative behaviour with a 'model based on an adaptive migration mechanism'. In the model, agents migrate or change their strategy asynchronously tuned by the migration frequency. They found that in an 'appropriate' migration speed, cooperators may dominate even in adverse conditions. Another finding was that people cooperate only at a small migration speed if migration frequency is high, while at low migration frequency cooperation occurs at any migration speed.

Li and Ye (2018) built a spatial prisoner's dilemma game model to investigate the relationship between risk preference and evolution of cooperation, where (individual) migration, a risky investment, is considered as a means increasing cooperation. They found that "the migration mechanism based on risk preference provides an effective mechanism for the emergency and promotion of cooperative behavior under certain conditions" (Li and Ye, 2018:630): Under the assumption of homogenous risk preference and smaller values of defection parameter, the cooperation level can be increased if the whole population is risk seeking. If the defection parameter gets higher, a high level of cooperation can be maintained in

[26] Empirical findings were indicating that (between 1991 and 2001) Europeans were 'less sensitive to wage and unemployment levels than predicted by economic theory' (Reichlova, 2005:3).

case of lower risk aversion. Under the assumption of heterogenous risk preference, the cooperation strategy is the winning strategy, while the system approaches an evolutionary stable state. Cooperation decreases with increasing variance of the risk preference. The model gives a realistic view of the evolution of cooperation.

5.4.4. Models based on heuristics without direct empirical correspondence

One example of models without direct empirical correspondence is Janssen's (2010) agent-based model on small-group migration decision-making and resource use in arid environments. He found that climate variability increases the resilience of population levels. Moreover, long-term population is affected by the level of storage of resources and by decision rules on migration and exchange.

Rogers et al. (2011) proposed a demographic mechanism aiming at explaining how stratified societies have come to dominate egalitarian societies as a form of societal organization. They hypothesized that the spread of the stratification may have been the consequence of "cultural change via demic diffusion", that is population growth or migration of populations favouring stratification (Rogers et al., 2011:1). Results of the model indicated that stratified populations faced more demographic instability, crises and extinctions than egalitarian populations. They were not able to stabilize due to the thriving of their upper classes even when the rest of the society was suffering from resource scarcity. Experiments showed that migration occurred, when the population or the resources people could reach fell below a certain threshold, or in case of resource depletion.

Hafızoğlu and Şen (2012) built an agent-based model of migration and behaviour adoption patterns of people living in geographically distributed communities. They assumed that people wish to 'fit in' in their environment in terms of sharing similar opinions, and that environments which support their opinions or preferences attract them. Firstly, agents in the model decide on migration according to the similarity or dissimilarity between their own opinion and the state of their community. If the dissimilarity between these is high, they may migrate to another community better reflecting their opinon. Having decided on the community to live in, agents (tend to) adopt their behaviour. Some (binary) agents can adopt only the opposite opinion, while others (continuous agents) have infinitely many options. Experiments showed that in most of the scenarios of migration and behaviour adoption choices, agents in communities reached consensus.

5.4.5. Models based on Decision Theory and Direct Observation

Massey and Zenteno (1999) developed a dynamic model to reveal the "self-feeding character of international migration" and to "quantify the mechanisms of cumulative causation predicted by social capital theory" (Massey and Zenteno, 1999:5328). They argued that the continuation of migration results

from the processes of human and social capital accumulation. Out-migration and return migration were estimated by using the individuals' age, sex, number of prior trips to and months of prior experience in the destination, number of trips to destination and months of prior experience at the destination of other community members. They simulated changes of a Mexican community population under the scenarios of no international migration, constant international migration and dynamically changing international migration due to accumulation of migratory experience. Massey and Zenteno came to the conclusion that if migration's effect on the accumulation of human and social capital is not taken into account by the projection method, this will lead to an understatement of the (effects of) immigration (Massey and Zenteno, 1999:5334).

Rehm (2012) developed a network model of migration from rural and urban Ecuador to the U.S. It is an overlapping generations model, which simulates life cycle decisions of agents (Ecuadorians) with respect to migration and remittances. Behavioural rules in the model are obtained from economic migration literature. The migration decision is modelled within a multinomial logit framework by various factors: number of family members at the origin and destination, community of migrants, availability of funding, presence of debt, (receipt and sending of) remittances, income differences between the origin and destination, and number of available jobs in urban Ecuador.

At the core of her dissertation thesis, Rehm aimed to differentiate between remittance theories "by determining which behavioural rules produce certain stylised facts on the macrolevel" (Klabunde and Willekens, 2016:82), such as the "population distribution and the distribution of monetary variables, age-wealth profiles and remittances distributions" (Rehm, 2012:116). She came to the conclusion that "no behavioural rule in isolation is able to reproduce all of the stylised facts at the same time" (Klabunde and Willekens, 2016:82).

Klabunde (2014), on the other hand, built an agent-based model of migrant networks with the aim to "identify the determinants of migration and return decisions" (Klabunde, 2014:3). The model assumed that migrants try to maximize their utility function which is implicit in the behavioural rules and that they use heuristics to deal with uncertainty with regard to future income, others' migration choices and future immigration policies. Methodologically, Klabunde combined parameterization with calibration. Similar to Rehm (2012), she chose the behavioural motives for migration and return migration from literature, and tested the hypotheses using data. Moreover, she estimated most of the behavioural parameters (except four free parameters which she calibrated) directly from microdata in difference to Rehm, who systematically calibrated her model. For external validation, empirical data and time series were used. Klabunde found that the determinants of migration are expected earnings, wealth, age, and network ties, while those of return migration are the number and strength of ties to the home country and age. She further came to the conclusion that "the distribution of migrants across US cities in the

data follows a power-law distribution, whereas the distribution of the number of trips across migrants is negative-binomial" (Klabunde and Willekens, 2016:82).

Naqvi and Rehm (2014) built a model of a low income economy in order to study 'the impact of natural disasters on population displacement, income, prices, and consumption'. The natural disaster is simulated as a food production shock in rural areas. The decline in food production leads to a decrease in nominal incomes since output (per person) declines. Because of the decline in output, the food supply falls and consequently prices rise. The decrease in workers' incomes leads to migration from rural to urban areas. Due to the increase in urban population incomes in cities fall, whereas the demand for food rises and contributes to the increase prices. Individuals respond to decreasing income with migration and reduction of savings. "The adaptive decision making of individuals can lead to over- and undershooting, and it generates not only spillover effects in regions not affected by the disaster, but also minor secondary effects like village-to-village and return migration" (Naqvi and Rehm, 2014:303). As a policy experiment, two hypothetical scenarios are set: a cash and a food transfer program.

Lin, Carley and Cheng (2016) proposed a country-level agent-based network model to examine how populations might move. The model incorporates a number of (bilateral) networks between countries: alliance and hostility networks, linguistic similarity networks, proximity networks, sea-level networks, economic similarity networks and migrant networks, for which values are derived from actual data. For the migration decision, a migration probability function as a linear combination of the network indicators is computed. For validation, actual (migration probability, population and age distribution) data were compared to simulated data. One major contribution of the model to the literature is the incorporation of country networks in the agent's migration decision model, and another was the inclusion of age distributions of countries, which changes due to migration and demographic events.

The model of Fu and Hao (2018) analyses rural-urban migration in China and takes migration as a complex system driven by the interactions between individual decision-making, social interactions and local economy. The authors use a hybrid population-scale social network that combines observational data with computational simulation. When migration happens, social network structures change, thereby increasing the migration propensity of some nonmigrants who have connections. The paper concludes that network structural changes play an essential role in explaining increased migration in China between 1995 and 2000.

5.4.6. Models based on Purely Empirical, Observational Rules without Mention of a Theory

With an agent-based model Naivinit, Le Page, Trébuil and Gajaseni (2010) investigated how changing climatic and soil conditions are interrelated with cropping practices and labour migration in Northeast Thailand. Their point of start was the adaptive behaviour of rice producers to climate and economic

changes. The ABM consists of the interacting modules of water, rice and household, while the household agent makes decisions on rice production and migration of household members taking into account the availability of water, rice crop and labour. Simulation results suggested that water availability by itself was not enough to explain labor migration since there was a number of other adaptive ways than labour to avoid the failure of rice crops even at times of water scarcity (Naivinit et al, 2010:1355).

Smajgl and Bohensky (2013) simulated the effects of fuel price changes and cash payments to poor households on poverty and natural resource usage in East Kalimantan – Indonesia with their agent-based model. Local government strategies such as changes in logging activities were simulated. Households in the model adapt to changes they perceive by either changing 'livelihood strategies' or by migrating. Simulation results showed that deforestation in forest-dwelling communities triggers migration into peri-urban areas. Moreover, fuel price reductions do not have a high impact on poverty, thus policy makers should not expect lower poverty due to higher reductions in petrol prices (Smajgl and Bohensky, 2013).

Cai and Oppenheimer (2013) developed an agent-based model to simulate climate-induced agricultural labour migration. For calculating the agents' probability of migration, they used parametrization through logistic regression and calibration. The authors found that a larger crop yield reduction caused by climate change leads to increased migration. Additionally, the network effects cause a larger difference in migration flows between different climate scenarios (Cai and Oppenheimer, 2013).

Entwisle et al. (2016) investigated the effects of climate shocks on migration with an agent-based model. Rules for immigration and emigration as well as parametrization of the model were derived from empirical data. Four different weather scenarios were drawn, while the results showed weak impacts of climate change on migration. Although a large decline in assets led to relatively high levels of migration in regression-based analysis, the outcome of the ABM analysis was different. Possible explanations for this result were selection effects on migration, existing social networks and high pre-existing migration rates during 'normal' weather conditions.

Mo, Duan, Jin, Zheng, Xie and Chen (2017) proposed a model combining agent-based social simulation (ABSS) with a kernel hierarchichal model to simulate and analyse large-scale immigration. Parameters of the model were derived from microdata. The ABSS model consists of a data layer and a model layer, while the latter includes the necessary rules for simulation including behavioural rules. 'Productivity' and 'happiness' are used as metrics to determine the 'success' of society. On the other hand, income, education and equality are the priority factors for which influencing parameters are determined. A three-layer hierarchy is built, where the lower layers influence their respective superiors. Through simulation the authors analyzed the effects of mass migration on specific regions with accuracy (Mo et al., 2017).

Suleimenova, Bell and Groen (2017) proposed a 'generalized simulation development approach (SDA)' to predict refugee destinations in conlict areas. Using empirical data, they simulated possible refugee movements in three African conflict regions – Burundi, Central African Republic and Northern Mali – in selected time periods with an agent-based model including networks. The simulations were able to reproduce the key trends in refugee movements according to UNHCR data.

5.4.7. Models Excluded from the Classification

Excluded from this classification was Liu, Hollister and Andris' (2018) model on U.S. urban migration system. They used the International Revenue Service's (IRS) data on migration between counties to build a network of cities connected to each other weighted by the number of migrants. They built a single allocation (called 'best friend') network from migratory flows, as well as networks of specifically high- and low-income migration. The authors concluded that "migration networks exhibit significant structural temporal persistence", and rules can be established to re-construct those networks. They also found that over time cities' popularity can change. Networks created by low-income flows are different from those created by high-income flows. "The best friend network did not align well with the gravity and radiation models of urban interaction, and was distinguished by urban hubs, spokes and chains" (Liu et al., 2018:84).

Warnke, Reinhardt, Klabunde, Willekens and Uhrmacher (2017) developed an application of the Modelling Language for Linked Lives (ML3) to model decision processes in continuous time. Agents, which are only individuals, are modelled in family and social networks. Behavioural rules are defined for agents. Agents have two incentives to migrate: higher income and reunion with their family. The decision process consists of the stages intention formation, planning, preparation and migration. Agents can drop the process or jump to a further stage (e.g. from intention formation to migration). With the example of migration decision-making, they discussed the features of the language design of ML3, such as the integration of agents into networks.

Klabunde, Zinn, Willekens and Leuchter (2017) proposed an extention of demographic multistate models by behavioural rules that characterize ABMs. By using the theory of planned behaviour for the decision processes, they demonstrated the approach with a migration model from Senegal to France. In the multistate model, there are five states of life: marital status, family status, employment, country of residence and life status, while transitions between them happen according to transition rates. The decision process of agents is affected by external shocks such as policy changes. To a large extent, parameters are empirically determined, but when not available they are calibrated. For validation, age- and period-specific migration rates are used. The authors found that "higher income growth in Senegal leads to higher emigration rates in the medium term", and that a decrease in fertility decreases them (Klabunde et al., 2017:51).

Willekens (2017) simulated the decision to emigrate with a simulation model[27] based on the theory of planned behaviour. He combined the TPB with the process character of decision-making in order to explain the discrepancy between the intention to emigrate and actual emigration (Willekens, 2017:257). Individuals formulate their intention to migrate through their attitudes toward migration (behavioural beliefs), subjective norms for migration (normative beliefs) and perceived control over migration (control beliefs). The intention to migrate can be a good predictor of migration if there is only a small discrepancy between the perceived and actual control over migration. The process model consists of four consecutive stages: (i) a stage where the individual never considered emigration, (ii) formation of behavioural, normative and control beliefs, (iii) planning and preparation for emigration, and (iv) decision process. Individuals in a given stage may continue to the next stage but may also decide to quit and return to the first stage (which is to stay in the country). On the other hand, individual's background factors (e.g. skill level) affect the formation of beliefs, e.g. the time needed for decision-making in each stage. The model was validated through comparison of generated results with stylized facts on international migration based on empirical (Gallup) data. It could reproduce the age profile of emigration as well as the global migration rate well. However, it overestimated the share of the world population that lives in another country than their country of origin, probably due to the omittance of return migration in the model.

[27] Since it does not take the social interactions generating norms and support, it is classified as a simulation model rather than an agent-based model.

Chapter 6 AN AGENT-BASED MODEL OF MIGRATION FLOWS BETWEEN TURKEY AND GERMANY

"A simple way to take measure of a country is to look at how many want in… And how many want out." ***[Tony Blair]***

6.1. Introduction

The aim of this part of dissertation is to simulate international migration flows from Turkey towards Germany in the period between 1991 and 2015. In order to be able to forecast migration, migration patterns and their determinants have to be well understood. If life courses of agents in the model and of agents in real life actually converge, the model can also be useful in forecasting migration flows.

The basic premise of the model is that individuals take a number of factors into consideration to decide whether to migrate. Beside macroeconomic and political developments in the source and destination countries, the existence of migrant networks plays a significant role in migrants' decisions. In alignment with the Migration Systems Theory (Kritz and Zlotnik, 1992), the model has a unifying approach and attempts to combine propositions of the neoclassical economic theory, network theory, and decision theory. Based upon the migration history between Turkey and Europe, the model assumes that migration flows are initiated through governmental or institutional actions such as labour recruitment activities of governments or employers. And once migration flows have started, they are sustained through migrant networks as well as by continuing demand for labour in the core receiving countries.

A number of scholars has conducted research on the history of Turkish migration to Europe. Gökdere (1978), Rist (1978), Abadan-Unat (1976, 2002), Toksöz (2006), İçduygu and Biehl (2006), İçduygu and Kirişci (2009), İçduygu (2014), Sirkeci, Cohen and Yazgan, (2012), and Martin (1980, 1981, 2002) among others have made valuable contributions to the literature of migration history. Also, many attempts have been made to estimate potential migration from Turkey to the EU, particularly to Germany.

There is a high range of migration estimation methods and models from deterministic methods to probabilistic forecasts. The most common methods used for migration estimation are (i) *econometric models:* error correction models (e.g. Togan, 2002; Flam, 2004 following the estimation of Boeri and Brücker, 2000), gravity and other cross-sectional regression models, and dynamic panel models, (ii) *estimations based on opinion pools* (Krieger, 2004; Krieger and Maitre, 2006), and (iii) *extrapolation based on earlier migration experience*. Several studies combine dynamic modelling with extrapolation (e.g. Sinn, Flaig, et al., 2001; Alvarez-Plata, Brücker and Siliverstovs, 2003; Erzan, Kuzubaş and Yildiz, 2006). Elitok (2010) provides a detailed literature survey of models forecasting Turkish migration.

Another approach to modelling international migration is agent-based modelling. Agent-based models in literature investigate the migration behaviour through different methodologies. Klabunde and Willekens (2016)'s classification of agent-based migration models according to the behavioural theories they use was already provided in Chapter 5.

The underlying Chapter provides an example of models based on decision theory and direct observation. Part 6.2. describes the methodology and data used for the model. Part 6.3. gives the stylized facts on Turkish migration to Europe, which the model has to be consistent with in order to be useful. Part 6.4. gives the behavioural motives selected for the model, while Part 6.5. describes the model in detail[28]. In Part 6.6, simulation results are presented. The last section comprises concluding remarks.

6.2. Methodology and Data

The reference pattern for the model is immigration from Turkey to Germany in the simulation period. In order to be useful for policy analysis, the model has to match certain stylized facts, which are determined from empirical findings (described in the next section). Additionally, the model is calibrated and matched against empirical data.

The model assumes that migrants maximize a utility function, which is implicit in their behavioural motives. Migrants use heuristics to cope with uncertainty, e.g. in terms of their future earnings, migration behaviour of others in their network and changes in EU immigration policies. Similar to Rehm (2012) and Klabunde (2014), behavioural theories are chosen from literature on international migration, and are fed as behavioural heuristics in the model.

Fixed parameters used for simulation are derived from the AMECO Database and from World Bank data. The methodology is comparable to Klabunde (2014), Da Fonseca Feitosa (2010), Kniveton (2011) and Entwisle et al. (2008).

As modelling approach, agent-based modelling was chosen, which is a practical analytical method for representing the evolution of structures at the macro level from micro-level decisions. In other words, migration behaviour is defined at the individual level, where each 'agent' has his/her own characteristics (e.g. demographic and educational, which is reflected to the wage) and behaviour rules (e.g. income maximization or escape from war). Then, individual choices are aggregated to observe migration patterns between source and destination countries. For the coding, NetLogo 5.3.1 was used (Wilensky and Rand, 2015).

[28] The NetLogo code of the model can be found in the Appendix.

6.3. Stylized Facts on Turkish Migration to Germany

6.3.1. Period between 1991 and 2004:

Since the mid-1990s, Turkish labour migration to Western European countries has been on a declining trajectory. Migration from Turkey to Germany continued mainly in form of asylum flows and family unification. Similarly to labour migration, there has been a serious decline in asylum flows. In this decade, a new type of family-related migration emerged, when the children of families who had migrated in the 1970s and 1980s grew older and started to marry and bring their spouses from Turkey (Kaya, 2008).

In 1990 Germany enacted the Aliens Law, which came into force on January 1st, 1991. The law made it easier for the new migrant generation to acquire German citizenship, but on the other hand, was restricting the residence permit in case of prolonged unemployment status and acquisition of social assistance. Also, workers residing abroad for longer than 6 months could lose their residence permit. The policy can be summarized as to 'accept' foreigners likely to make a more positive net fiscal contribution and to integrate.

Table 6.1. shows the migration flows between Turkey and Germany between 1991 and 2015.

6.3.2. The New Century/ Period between 2004 and 2007:

In the 2000s, the major factors affecting migratory movements were

- two successive EU enlargement waves (in 2004 and 2007),
- the global economic crisis of 2008-2009, and
- mass migration from Syria following the civil war starting from 2011.

The eastern EU enlargement waves led to the fulfilment of labour demand mainly from Eastern European countries so that labour migration from Turkey became more redundant. From 2003 to 2004, the total number of migrants has dropped approximately by 21.9%.

Table 6.1. Migration Flows between Turkey and Germany 1991-2015

Year	Immigration	Emigration	Net Migration	Immigration of Turkish Citizens	Emigration of Turkish Citizens	Net Migration of Turkish Citizens	Turkish Migrant Stock	% Change in Turkish Migrant Stock	Asylum Applications of Turks	Labour Migrants in Germany	Visa Type Family Unification	(Starting) Students	Sum (Asylum+Labour +Family+Students)	Naturalization
1991	82,818	36,763	46,055	82,635	36,639	45,996	1,779,586	0.050121	23,877	NA	NA	NA		NA
1992	81,404	41,038	40,366	81,303	40,727	40,576	1,854,945	0.042346	28,327	441	NA	NA		NA
1993	68,618	47,115	21,503	68,466	46,642	21,824	1,918,395	0.034206	19,104	1,454	NA	NA		NA
1994	64,811	47,174	17,637	64,725	47,378	17,347	1,965,577	0.024595	19,118	1,575	NA	NA		NA
1995	74,558	44,129	30,429	74,517	44,366	30,151	2,014,311	0.024794	25,514	1,603	NA	NA		31,578
1996	74,344	44,615	29,729	74,144	45,030	29,114	2,049,060	0.017251	23,814	1,591	22,882	NA		46,294
1997	57,148	47,120	10,028	56,992	46,820	10,172	2,107,426	0.028484	16,840	1,429	26,650	NA		42,420
1998	49,091	46,255	2,836	49,178	47,154	2,024	2,110,223	0.001327	11,754	1,103	21,055	NA		59,664
1999	48,383	42,131	6,252	48,129	42,823	5,306	2,053,564	- 0.026850	9,065	1,267	21,056	747	32,135	103,900
2000	50,499	40,369	10,130	50,026	40,263	9,763	1,998,534	- 0.026797	8,968	1,296	21,447	825	32,536	82,861
2001	56,101	37,268	18,833	54,695	36,495	18,200	1,947,938	- 0.025317	10,869	1,420	23,663	976	36,928	76,573
2002	58,648	36,740	21,908	58,128	36,750	21,378	1,912,169	- 0.018362	9,575	1,572	25,068	1,310	37,525	64,631
2003	49,699	35,612	14,087	49,774	36,863	12,911	1,877,661	- 0.018047	6,301	1,402	21,908	1,605	31,216	56,244
2004	42,222	37,058	5,164	42,644	38,005	4,639	1,764,318	- 0.060364	4,148	1,017	17,543	1,666	24,374	44,465
2005	36,341	34,595	1,746	36,019	34,466	1,553	1,764,318	-	2,958	672	15,162	1,943	20,735	32,661
2006	31,449	33,229	- 1,780	30,720	32,424	- 1,704	1,738,831	- 0.014446	1,949	614	10,195	2,070	14,828	33,388
2007	28,926	32,172	- 3,246	27,599	29,879	- 2,280	1,713,551	- 0.014539	1,437	826	9,609	2,146	14,018	28,861
2008	28,742	38,889	- 10,147	26,653	34,873	- 8,220	1,688,370	- 0.014695	1,408	626	8,376	2,062	12,472	24,449
2009	29,544	39,615	- 10,071	27,212	35,410	- 8,198	1,658,083	- 0.017939	1,429	411	7,759	2,208	11,807	24,647
2010	30,171	36,033	- 5,862	27,564	31,754	- 4,190	1,629,480	- 0.017251	1,340	368	8,366	2,351	12,425	26,192
2011	31,021	32,756	- 1,735	28,610	27,922	688	1,607,161	- 0.013697	1,578	399	8,363	2,511	12,851	28,103
2012	28,641	32,788	- 4,147	26,150	27,725	- 1,575	1,575,717	- 0.019565	1,457	482	7,332	2,670	11,941	33,246
2013	26,390	33,644	- 7,254	23,230	27,896	- 4,666	1,549,808	- 0.016443	1,521	442	6,966	2,965	11,894	27,970
2014	27,805	31,941	- 4,136	22,058	25,520	- 3,462	1,527,118	- 0.014641	1,565	311	7,317	2,997	12,190	22,463
2015	32,684	30,540	2,144	23,698	23,985	- 287	1,506,113	- 0.013755	1,500	322	7,720	2,956	12,498	19,695

6.3.3. Period between 2008 and 2010:

Consequent to the global economic recession and due to restrictive immigration policies, the number of Turks immigrating for economic reasons has been declining. Nevertheless, the movements for higher education, language courses and education and humanitarian reasons remained almost constant. Between 2008 and 2010, the number of Turks who immigrated as employees[29] has decreased by 35.6% (from 1417 in 2008 to 912 in 2010) (Migrationsbericht 2010:71). On the contrary, the number of immigrating university students has been increasing (from 1792 in 2008 to 2073 in 2010) (Migrationsbericht 2008, Migrationsbericht 2009, Migrationsbericht 2010). The number of family unifications remained almost constant.

For the first time in the history of migration between Germany and Turkey, in late 2000s, migration flows from Europe to Turkey have exceeded the flows in the contracting direction (İçduygu, 2010). Compared to previous decades, the number of Turks migrating to Germany has significantly decreased in the 2000s. Due to relatively enhanced economic and political conditions in Turkey, restart of negotiations with the EU and prospects of full membership, the number of returning Turkish citizens and that of naturalized Turks has increased.

6.3.4. Period between 2011 and 2015:

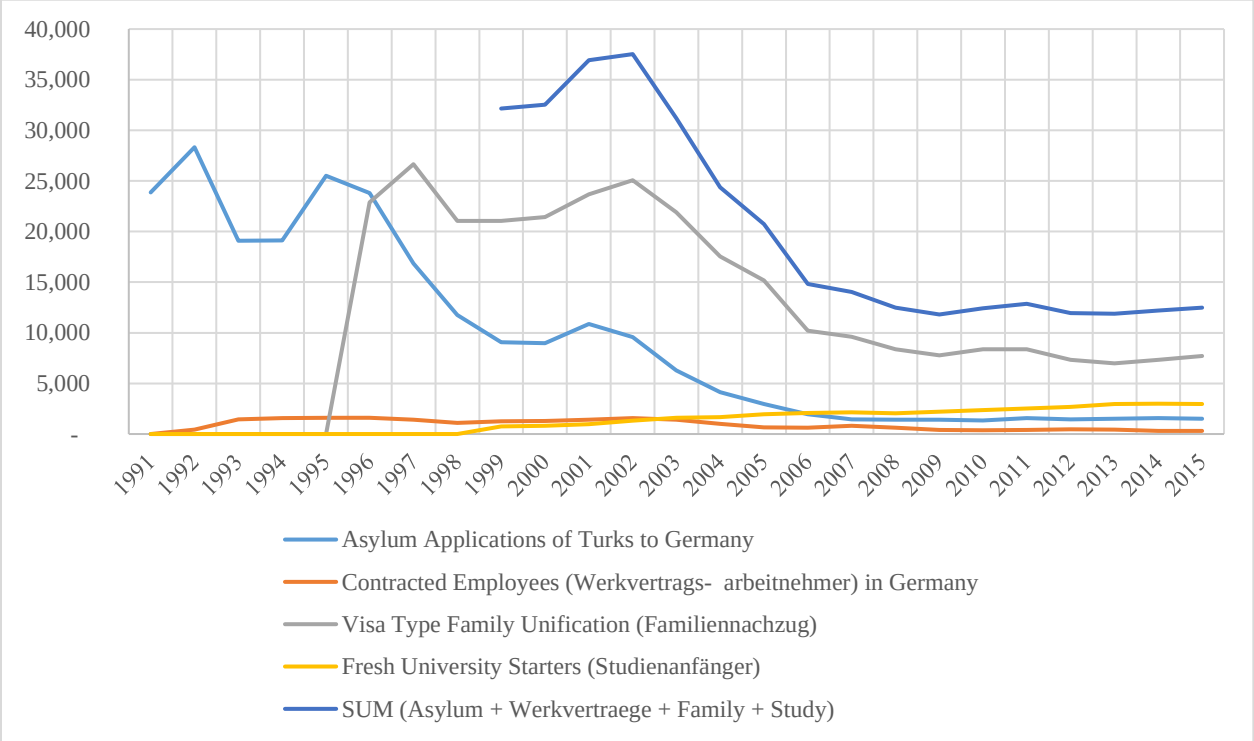
After the outbreak of civil war in Syria in 2011, the form of migration from Turkey changed mainly to illegal transit migration of Syrian asylum seekers. Although exact data of illegal migration are not available, it is estimated that about 1.5 million Syrians passed through Turkey and Greece heading towards Central Europe. After the entry into force of the Readmission Agreement between Turkey and the EU in 2014, however, the number of illegal migrants significantly decreased.

In this period, the percentage change in the Turkish migrant stock was only between 1.3% and 2%. The net migration of Turkish citizens to Germany was negative (except for in 2010), meaning that more Turks have emigrated from Germany than those who immigrated. The majority of Turkish citizens migrating to Germany belonged to two groups – university students and family members of earlier migrants; while the number of Turkish asylum seekers and labour migrants with work contracts (‘Werkvertragsarbeitnehmer’) significantly decreased. In the other direction, European retiree migration took place.

[29] As defined in §18 AufenthG

Table 6.1. reports the number of various types of visa granted between 1991 and 2015, while Figure 6.1. visualizes these flows. Immediately following the EU eastern enlargement waves (in 2004 and 2007), there has been a significant drop in Turkish immigrant influx. The net change in the Turkish migrant stock turned to negative initially in 1999 and remained negative since that year. Between 1991 and 2015, the net decrease in the Turkish population in Germany has been approximately 15.4%.

Figure 6.1. Migration from Turkey to Germany by Type of Visa



Source: Source: Statistisches Bundesamt (2017)

Taking the stylized facts described in this section into consideration, the model has to match following general patterns:

- Direction of migration flows are mainly from Turkey to European countries, while there is some return migration and retiree migration.
- The number of new coming Turkish immigrants per year decreases between 1991 and 2015.
- People tend to go to countries where migrant networks (family or friends) exist.
- Restrictive immigration policies effectively decrease migration flows.

6.4 Behavioural Motives

Following behavioural motives for migration that are consistent with the theoretical and empirical literature are chosen for the model:

6.4.1. Behavioural Motives for Immigration (from Turkey to Germany)

Motive 1: Higher expected earnings attract potential migrants. It is assumed that each agent has perfect information on wages in the destination country and on employment opportunities. Thus, they form an income expectation before deciding.

Motive 2: Existence of migrant networks (family at destination but also a migrant stock) are pull factors since they can facilitate job search, provide initial housing opportunities and reduce (economic, psychological, social) risks.

Motive 3: People live in households. However, migration is an individual decision. With time migrant's household can follow.

Motive 4: Potential migrants are discouraged by stricter immigration policies applied by the destination country. Stricter policies effectively decrease the individual migration probability.

Motive 5: Younger people are more likely to migrate. Migration behaviour reaches a peak between ages of 25-30. Then it declines until increasing again after retirement.

6.4.2. Behavioural Motives for Return Migration (from Germany to Turkey)

Motive 6: Migrants settled in the destination country have a baseline probability to return. This probability only reflects the agent's wish to return home one day but at least another additional factor must be there in order the agent to actually return.

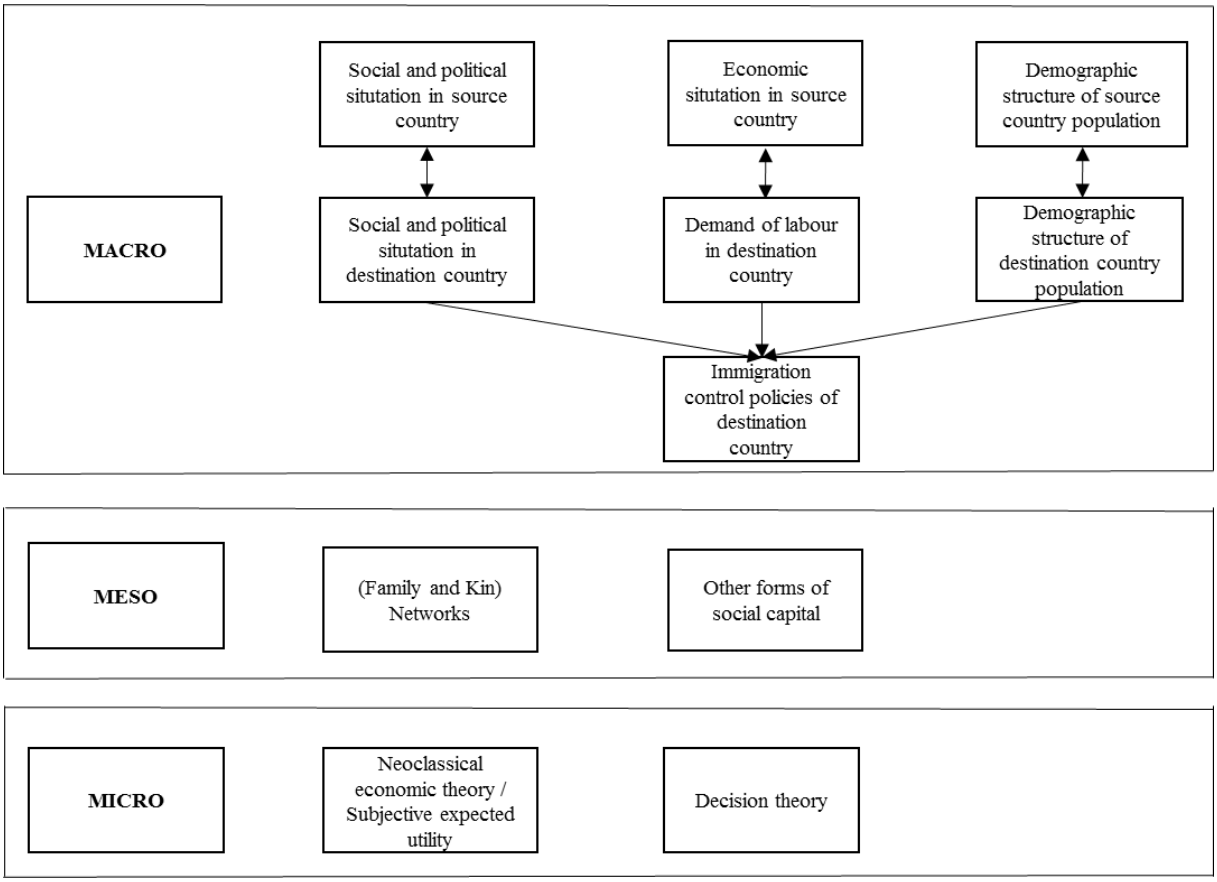
Motive 7: Migrants in retirement age or those whose period of stay is shorter than 6 years are more likely to decide to return.

6.5. Conceptual Framework of the Model

6.5.1. Theoretical Framework

Since migration is a complicated decision, both micro-theoretical and macro-theoretical approaches alone are insufficient to explain it (Luft, 2009). Thus, the model combines micro-, meso- and macro-theoretical approaches, as shown in Figure 6.2.

Figure 6.2. Micro, Meso and Macro Levels of Analysis



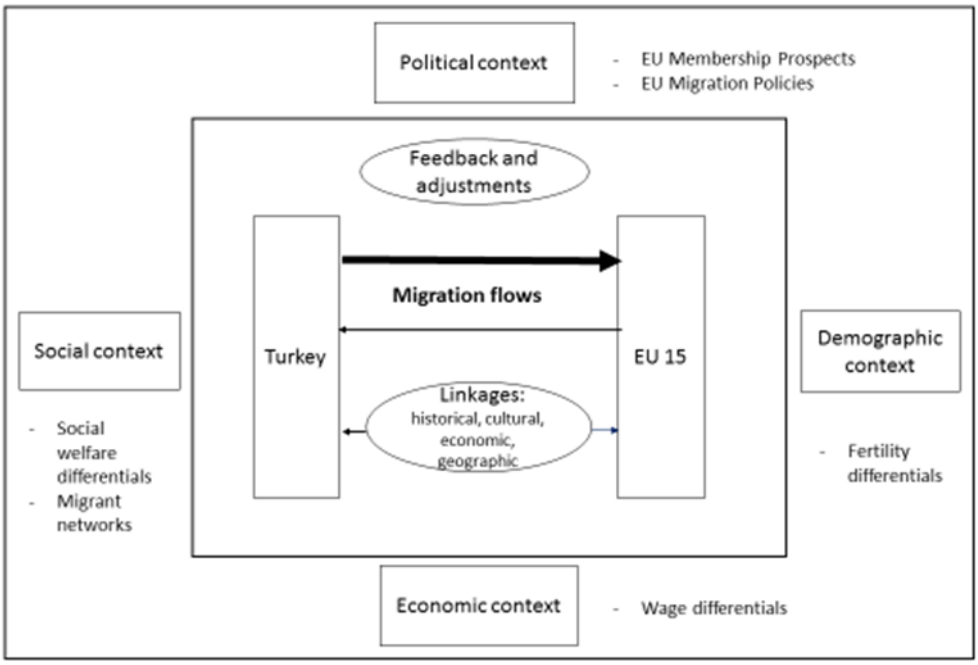
Source: Own elaboration

On the macro-level of analysis stand the social, political and economic situation in source and destination countries, demographic structures and immigration control policies of the destination country. On the micro-level, there are the neoclassical economic theory or subjective expected utility theory and decision theory for explaining individuals' decisions. On the meso-level, there are social networks consisting of family and friends, but also other forms of social capital – benefits that come from trust, reciprocity, information, and cooperation associated with social networks.

The model has a unifying approach and combines the basic premises of the neoclassical economic theory (motive 1), network theory (motives 2 and 3) and decision theory (motives 3, 4, 5, 6 and 7) with

empirical observation. Figure 6.3. visualizes the theoretical framework of the model, which combines political, social, economic and demographic elements.

Figure 6.3. Theoretical Framework



Source: Own elaboration based on the Migration Systems Theory of Kritz and Zlotnik (1992)

6.5.2. Setting of the Model and the Labour Market

For the simulation of each destination country, the environment is divided into 2 sections with equal areas and different population densities: a source country and a destination country. Time is modelled in years. There is one large private firm in each country, which employs the labour force. It is assumed that agents will look for better opportunities, such as higher income and better political environment to settle abroad.

Two types of unemployment are included: frictional and cyclical unemployment. Frictional unemployment is created when employees in the source country look for a better paid job abroad. Secondly, there can be cyclical unemployment. In both countries, due to macroeconomic changes, output can fall, so that there is a general fall in labour demand. This may be either due to an increase in wages or in long-term interest rates.

Parts of the code of the simple (Guildford) labour market model of Hamill and Gilbert (2016) were used for generating personal networks and a normal wage distribution. Extensions to Hamill and Gilbert's model are demographic components, cyclical unemployment, social networks and migration behaviour.

6.5.3. Agents and Agent Networks

Actors in the model are agents in the labour force in host and home countries – potential and actual migrants at working age (minimum age is 20), and the labour market represented by one big private firm in each country. Populations are set proportionally to the labour force in each country. People are heterogeneous – they differ in ethnicity, age and qualification level. In each country, wages are modelled as a (log) normal distribution, while the modeller can set the extent of income inequality. It is assumed that agents' earnings represent their work experience as well as qualification level.

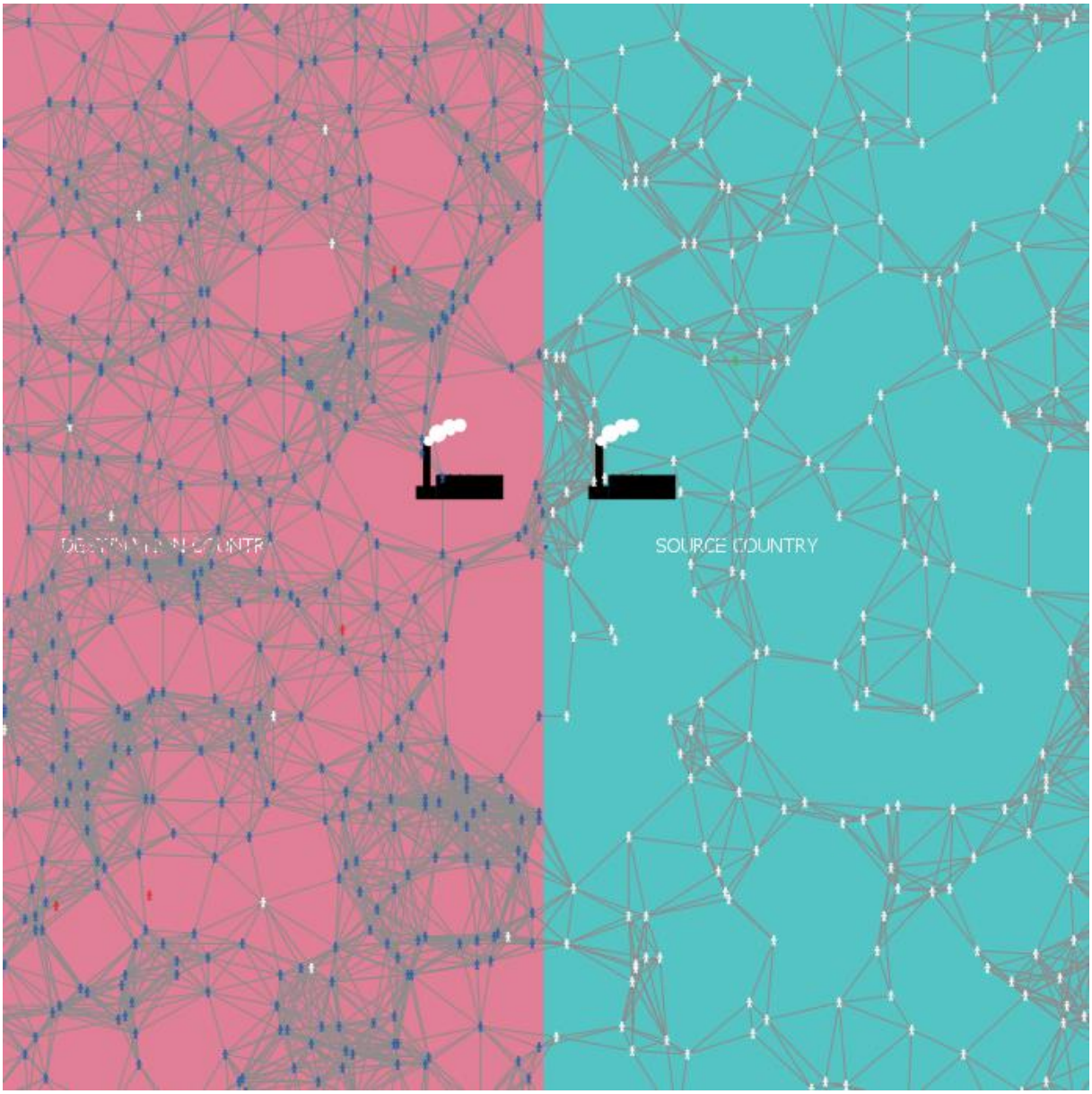
For introducing new agents to the model in each time period, crude birth rates of countries (World Bank data) are used. Retired migrants can stay or return to their home country.

Agents live in households. Nevertheless, the migration decision is given by individuals. Other members of the household may or may not follow, but are influenced by the migration attitude since they now have a network connection in the destination country. Social networks where people live include agents' household members inside a close circle and their friends in a wider circle. If an agent migrates, her/his network links change, so that he/she forms new network links to neighbouring agents. Family links do not disappear, but friendship links are dissolved.

The size of the social circles is chosen in a way that there is a low overall network density. That is, realistically not all agents know each other. The average network size is 30. Network links mean that agents share information and financial resources. Migration decisions are correlated because agents share information and potential migrants receive information and help from actual migrants in their networks.

Figure 6.4. visualizes the social networks at model initiation.

Figure 6.4. Agent Networks at Initial Model Setup



The model was implemented in NetLogo 5.3.1. The destination country is placed on the left, the source country on the right side. Grey lines show network links between people.

6.5.4. Decision Making

Migration is a life-cycle decision, and overlapping generations exist. Events in the life cycle, such as death and birth, are exogenous deterministic events. There are two types of decisions: migration decisions taken by people and employment decisions of firms. The relevant factors taken into account for modelling the migration decision are demographic, economic, political and societal determinants. Their number is kept at a minimum for the usefulness of the model.

6.5.4.1. Migration decisions

Agents try to maximize their utility, which is not necessarily only their wage. The migration decision is more complex and depends on the employment probability and expected income of an agent in the destination country, on the location of his network members, the existence of a migrant community in the destination, on the political stability in the source country, and on the immigration control policy of the destination country. Agents may migrate, and return (if they become unemployed for subsequent years or if they retire). Age plays an important role in the migration decision. Since young people are more likely to migrate, they have a higher baseline probability (α).

The individual probability of a person *i* in working age to migrate at time t is assumed to have the following functional form:

$P_{i,t}(\text{migrate}) = \alpha + \beta \cdot Fam_{(host)} + \gamma \cdot Mig_{(host)} + \delta \cdot EmplProb_{(host)} - \varepsilon \cdot PSI - \zeta \cdot EUPol + \eta \cdot Inc$; while

- $Fam_{(host)}$ denotes the share of family members at the destination in one's total family (network at the destination),
- $Mig_{(host)}$ is the share of migrant population in the destination country,
- $EmplProb_{(host)}$ is the share of available jobs in the total employment,
- PSI (political stability index) is a composite indicator of political stability and absence of terrorism and violence (as a ratio of the value in the destination to that in the source country),
- EUPol is an index measuring the strictness of EU immigration policies (term values close to 0 mean low immigration control, while term values close to 1 point to restrictive immigration policies), and
- Inc is the ratio of income at the destination to the income at the source country.

If the individual probability to migrate is positive, this means that the agent intends to migrate. However, not all agents who decide to migrate can do so. Whether the agent can actually migrate, depends on the immigration control policy of the destination country (implied by an immigration quota in the model).

6.5.4.2. Return migration decisions

People with a migration background consider return migration. This means that migrants as well as their offspring can intend to move to their home country. Here, *return* migration is used for all agents with a migration background regardless of their place of birth.

The decision to return depends on a baseline probability, on the agent's age, length of stay in the host country and current employment status. Agents have a baseline return probability at any time that captures subjective reasons for return migration, e.g. ties to the home country, discrimination experiences, family or partnership reasons. Those who have some of the mentioned subjective reasons,

are older (e.g. at retirement age), or those who have lived less than 6 years in the destination country and are unemployed, are more likely to return.

The individual probability of a person *i* to return at time t is assumed to have the following functional form:

$P_{i,t}$ (return) = $\theta + \iota$. Age + κ . $t_{in\_Germany} + \lambda$. EmplStatus; while

- Θ denotes the baseline return probability,
- Age is the age factor,
- $t_{in\_Germany}$ denotes the duration factor (length of residence in Germany), and
- EmplStatus is the agent's employment status at time t.

6.5.4.3. Employment decisions

As a first step, wages are distributed normally among all agents on the labour market. Wages reflect agents' qualificational and educational levels. Then, firms in each country 'employ' agents, whose number equals the number of employees. In the first iteration, the number of employees is read from data. Afterwards, employment is calculated considering the employment/labour force ratio.

At each iteration, agents who get 65 years old retire. When employees retire, new vacancies are opened. Migrant retirees consider return migration. It is assumed that the firm in the destination country employs a share of migrants as soon as they move, while the rest stays unemployed (e.g. students and spouses). Each year there are also young newcomers to the labour market, whose number is calculated as the crude birth rate multiplied by the population of 25 years ago. Similarly, young agents who enter the labour force for the first time are initially unemployed. Firms have to replace those who migrate or retire, and employ agents of any citizenship with matching qualification levels (wages).

6.5.5. Pseudocode

- Create a world 315 x 315 with 2 countries
- Create agents (representing the labour force) and distribute them to source and destination country
- Create links among people within a pre-defined network area
  For each year;
- Read (at first iteration) or calculate (starting from the 2nd iteration) yearly wage, employment, unemployment and political stability index data from file
- Assign wages (in normal distribution) to the labour force and let the private firms hire employees

- For each agent in the source country, calculate the migration probability. If the probability is higher than 0.5 and the agent is younger than 50 years, and the immigration quota of the destination country is not exceeded, let the agent migrate
- For each agent in the destination country with a migration background, calculate the return migration probability. Let a pre-defined share (e.g. 1/3) of agents with a return probability higher than 0.5 move back to the source country
- Execute demographic changes: Agents get older, retire, new generation enters the labour force
- Collect and display information on the number of employees, unemployed people, migrants and return migrants
- Update the populations in both countries (the employed, unemployed, retired, total populations)

6.5.6. Highly stylized immigration policy

Immigration policy covering visa regulations and processing times and required qualifications have been encapsulated in an externally set immigration quota: The total number of work permits and visa for family unification granted by the destination county has been simplified to an immigration quota affecting the total number of migrants, which is (exogenously) set by the modeller. The costs of migration that depend on the immigration policy, on labour market policies and (the number of) network migrants have been ignored.

There is a second exogenous variable in the model, which captures the effect of political unrest – the political migration parameter. The value of the parameter increases at times when political prospects of the sending country worsen. During the continuation of EU negotiations, e.g. the political migration parameter is low, while it increases as a reaction to the suspension of negotiations.

6.6. Parameterization

Table 6.2. shows the variables used in the model that are derived from data.

Table 6.2. Variables calculated or derived from data

Variable	**Representation**	**Source**
Wages in the source country	nominalTurkishWage	AMECO
Wages in the destination country	nominalGermanWage	AMECO
Number of employees in the source country*	employmentInTurkey	AMECO
Number of employees in the destination country*	employmentInGermany	AMECO
Number of the unemployed in the source country*	unemploymentInTurkey	AMECO
Number of the unemployed in the destination country*	unemploymentInGermany	AMECO
Employment probability	employment-probability	Calculated from AMECO data
Political Stability Index in the source country	PSI_Germany PSI_Turkey	World Bank (Worldwide Governance Indicators)
Number of migrants at destination	migrants-at-dest	Computed during simulation
Family members at destination	family-at-dest	Computed during simulation
EU Immigration Policy	EuPol	Fixed to 1**

* The values for the first simulation year are derived from data, values for all other simulation years are computed endogenously.

** The effect of the immigration policy depends on the policy-parameter ζ. If the latter is is set to 0, the policy doesn't affect the individual migration probability. If it's set to 1, it is a highly restrictive policy and affects migration intentions.

Non-measurable parameters in the individual migration probability function $P_{i,t}$ (migrate) and the individual return probability function $P_{i,t}$ (return), as seen in Table 6.3, were determined by searching the parameter space for the most fitting values that will render the closest match between empirical data and simulation results. At the same time, some of their values were calibrated according to changes in immigration policy.

Table 6.3. Parameters and their Values

Parameter Name	Direction of Effect	Value Range	Initial Value	Value during Simulation
Baseline probability α	+	[0, 1]	-	May increase or decrease
Family-parameter β	+	[0, 0.50]	0.50	Decreases
Network-parameter γ	+	[0, 1]	1	Decreases
Employment-probability parameter δ	+	[0, 1]	1	Constant
Political-stability parameter ε	-	[0, 1]	0.50	Decreases
Policy-parameter ζ	-	[0, 1]	0.80	Decreases
Income-parameter η	+	[0, 1]	0.50	Constant
Baseline return probability θ	+	[0, 0.25]	-	May increase or decrease
Age-parameter ι	+	[0.1, 0.4]	0.01, 0.03 or 0.04	Increases
Duration-parameter κ	-	[0.05, 0.5]	0.5	Decreases
Employment-status-parameter λ	+	[0, 0.5]	0 or 0.5	Varies between 0 and 0.5

The baseline probability means that even in the absence of other factors (such as existing migrant network at the destination or positive income expectations), an agent will have an intention to migrate. It can be low or high depending on factors such as (weak or strong) ties to the home country and family ties at home. In the model, the value for each agent is set to a random number between 0 and 1. Those with a higher baseline probability have a higher probability to migrate and vice versa. At each step, a new value is assigned to each agent, thus it may increase or decrease with time.

The baseline probability, network- and family- parameters as well as the income and employment-probability factors affect the individual probability equation positively. When agents migrate, family links get weaker with time and people lose their connections. Therefore, the family parameter decreases with time. The political stability parameter and policy parameter, on the other hand, affect the individual probability equation negatively. The political stability parameter is multiplied by the ratio of the political stability index in Germany to that in Turkey (which is always negative). Since the worsening of the political stability in Turkey will increase the migration probability, the sign of the coefficient has to be negative. Similarly, restrictive EU immigration policies decrease the migration probability.

A baseline return probability shows that regardless of their age, length of stay in Germany or employment status, due to some subjective reasons migrants or agents with a migration background settled in the destination country will have an intention to 'return'. Similar to the baseline probability α, at each step a new value for the baseline return probability is assigned to agents. The age parameter affects the return probability positively. Moreover, older agents will have a higher return probability. On the other hand, the longer agents stay in the destination country, the smaller their return probability gets. Those who have stayed less than or equal to 6 years, will have a higher probability to return. Another factor, the employment status impacts the return probability positively if the agent is unemployed, but doesn't have an effect if he/she is employed.

6.7. Simulation Results

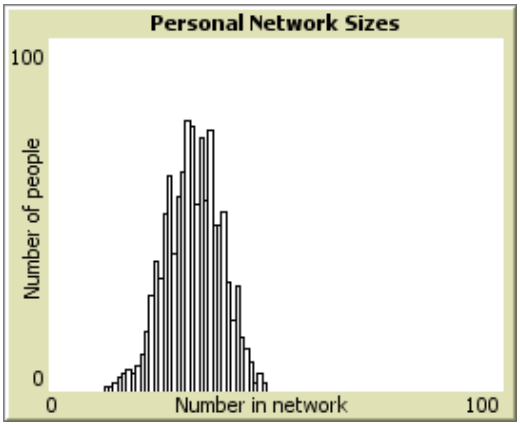
The model is initialized with populations of 410 and 204 agents in Germany and Turkey, respectively. Convenient to empirical data, at the setup there is already a migrant stock living in Germany (10 agents). The simulation is run sequentially for 24 years, while parameters in the model change passing from one period to the other: 1991-2003, 2004-2007, 2008-2010 and 2011-2015. In each period, agents calculate their individual probability to migrate and decide either to move or to stay.

Starting from 2004, e.g. the parameters of indicating the labour migration intention (income and employment probability parameters in the migration decision function) decrease. Similarly, as time passes and immigration policies get stricter, the immigration policy parameter in the migration decision function increases, while the immigration quota decreases. Less people, who intend to migrate, can actually do so.

6.7.1. Agent Networks

Agents live in networks with an average network size of 25.55 (minimum network size: 8.08 and maximum network size: 44.25). Family networks, on the other hand, are smaller. Only the closest family members agents (within a radius of 2) can migrate with an agent for family reasons.

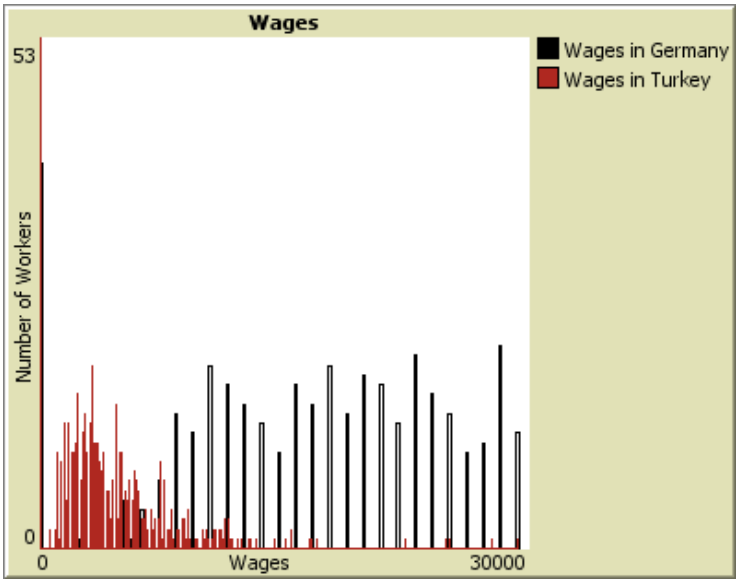
Figure 6.5. Histogram of Agent Network Sizes



6.7.2. Wage Distributions

Wages are distributed normally. Figure 6.6. shows the wage distributions in both countries in 2015.

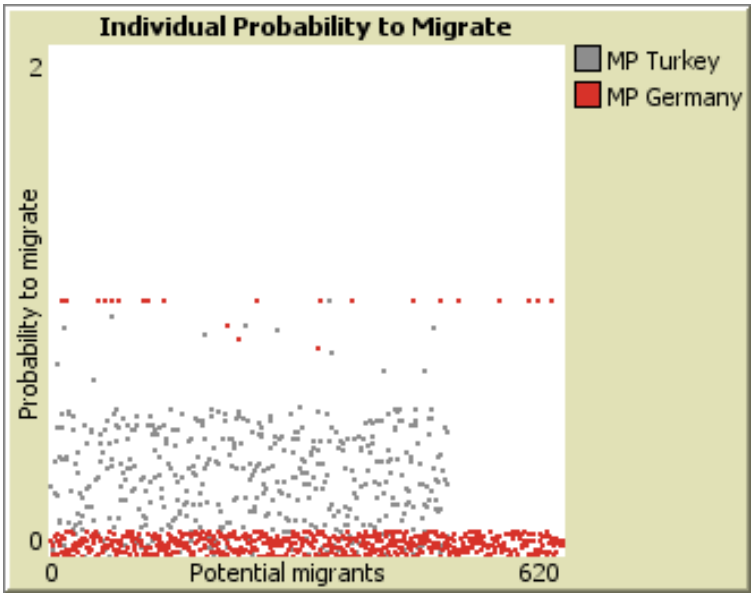
Figure 6.6. Distribution of Yearly Nominal Wages in Germany and Turkey (at iteration 24)



6.7.3. Migration Stocks and Flows

The individual probability to immigrate or emigrate is calculated by the agents themselves. Figure 6.7. illustrates the migration probabilities of agents residing in Germany and in Turkey. Migration probability of Turks is clearly higher than that of agents residing in Germany. Those with the highest return probability are elderly migrants, migrants who have been residing in Germany for less than 5 years and unemployed migrants.

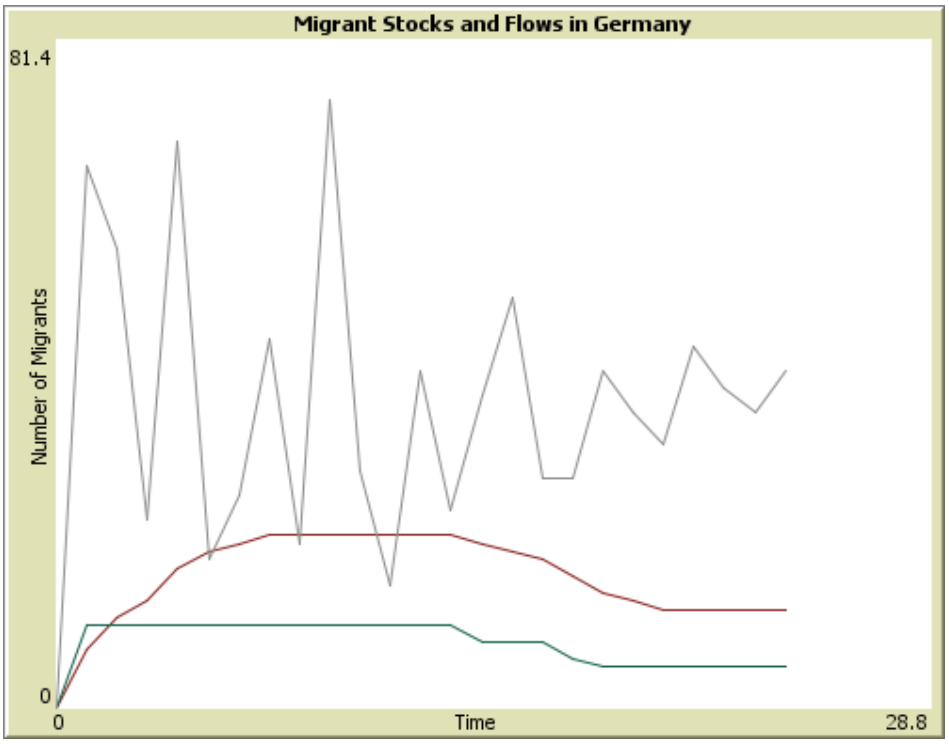
Figure 6.7. Individual (Calculated) Probility to Migrate (at iteration 24)



6.7.3.1. Migration Stocks in and Inflows to Germany

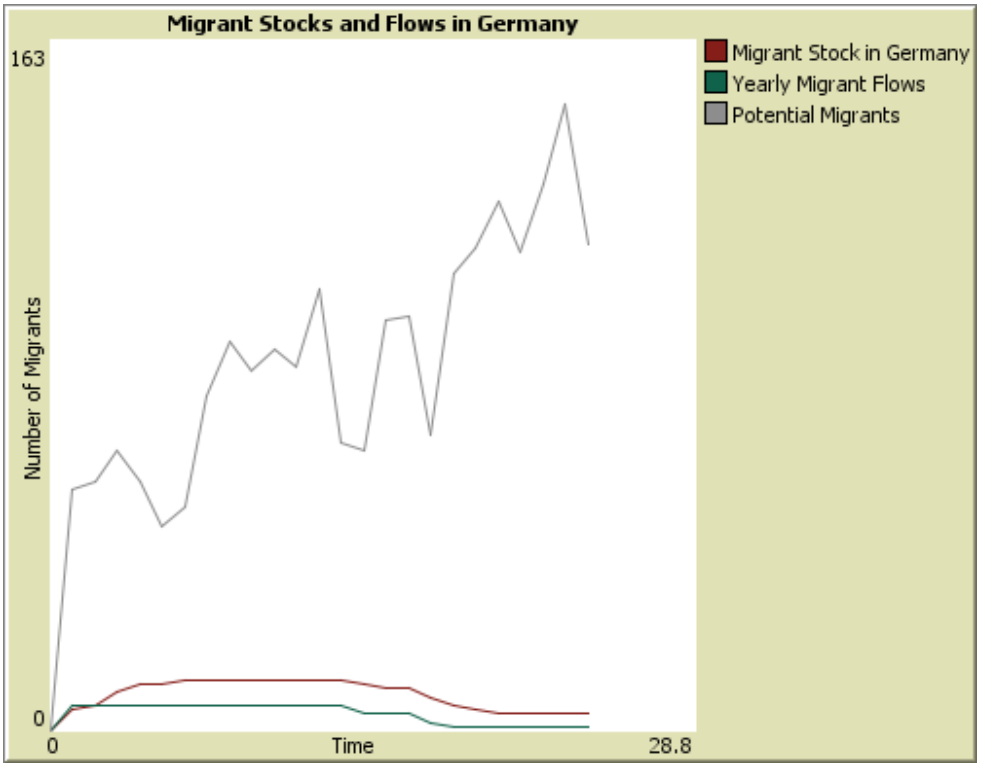
Figure 6.8. illustrates the migration flows (green line) and stocks (red line) in Germany. The flows remain steady for 13 successive years until in 2004 immigration policy becomes stricter and the quota for employees decreases. The flows continue decreasing also due to the global economic crisis in 2008/2009. The grey line on the other hand, shows the number of potential migrants, who have a migration intention. Only a small share of people with migration intention can actually immigrate. The migrant stock firstly increases and then decreases due to retirements and increasing return migration flows.

Figure 6.8. Migration Flows and Stocks in Germany



A stricter immigration policy applied in form of a ‘migration quota’ decreases migration flows, as in Figure 6.9. It is observed that compared to the previous case, a higher number of agents intend to immigrate. Again, only a small share of people with migration intention can actually immigrate.

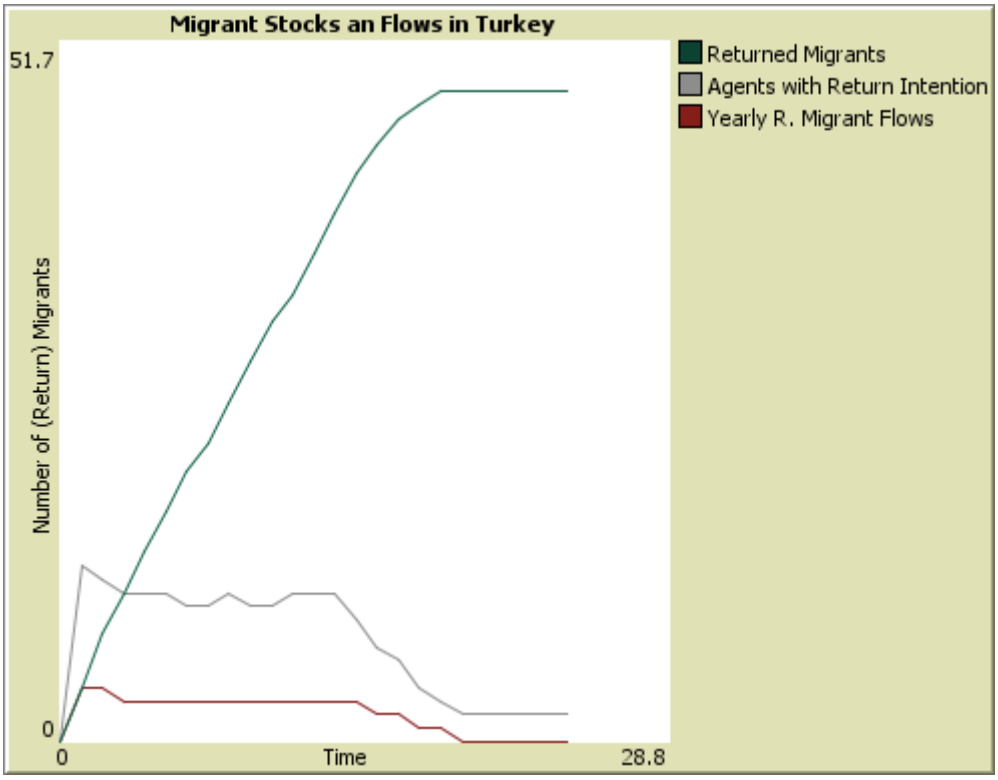
Figure 6.9. (Managed) Migration Flows and Stocks in Germany with a lower Migration Quota



6.7.3.2. Migration Stocks in and Flows to Turkey

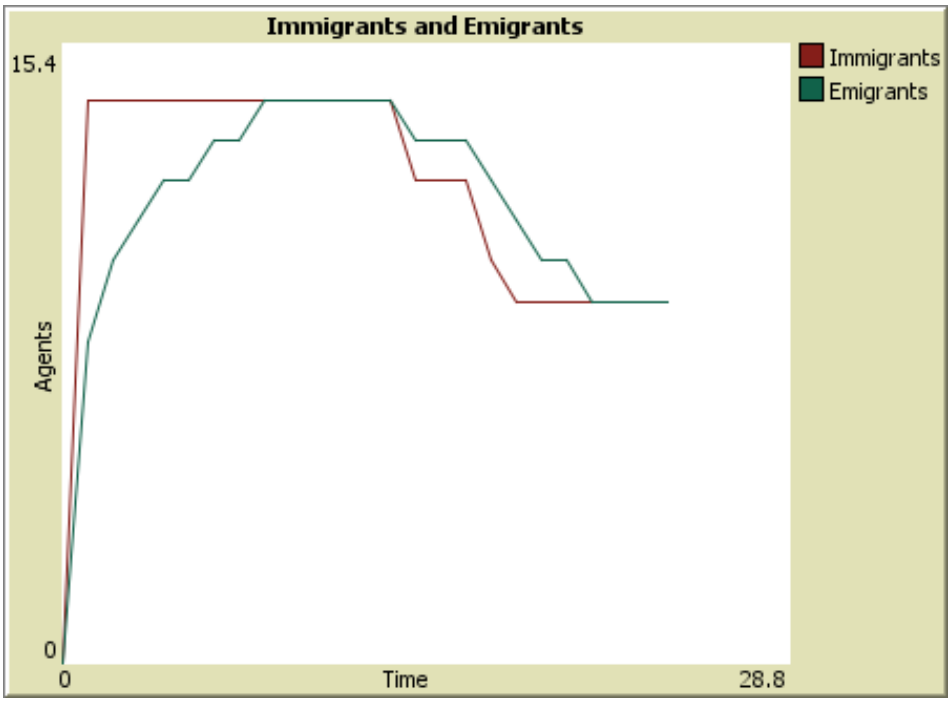
Similarly to the discrepancy between potential and actual migrants to Germany, only a part of agents residing in Germany who intend to emigrate, actually emigrate. The stock of returned agents increases with time. Figure 6.10. represents the number of yearly returning migrants and the stock of returned migrants. The grey line illustrates the number of agents with a return intention.

Figure 6.10. Returning Migrant Flows and Stocks in Turkey



The number of immigrants to and emigrants from Germany at each time period is shown in Figure 6.11.

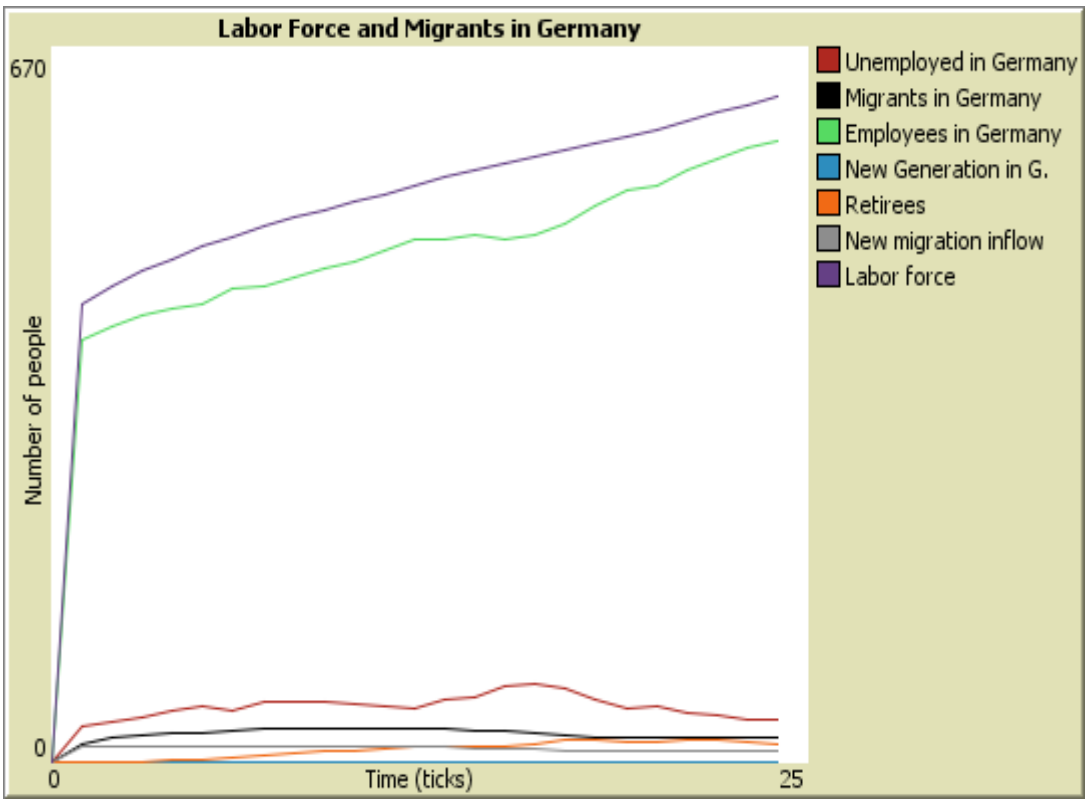
Figure 6.11. Number of Immigrants to and Emigrants from Germany for 24 Iterations



6.7.4. Composition of the Labour Force

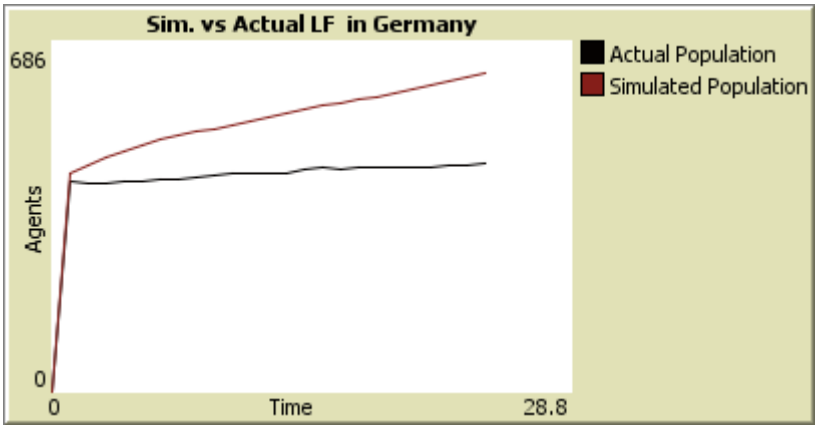
Figures 6.12. illustrates the composition of the labour force in Germany and Turkey, respectively. The labour force includes the employed, unemployed, retirees and new entrants to the labour market (the young). In Germany during the 24 iterations of the model, there is a steady increase in the labour force (population) as well as in the number of employees.

Figure 6.12. Migrants and Labour Force Composition in Germany



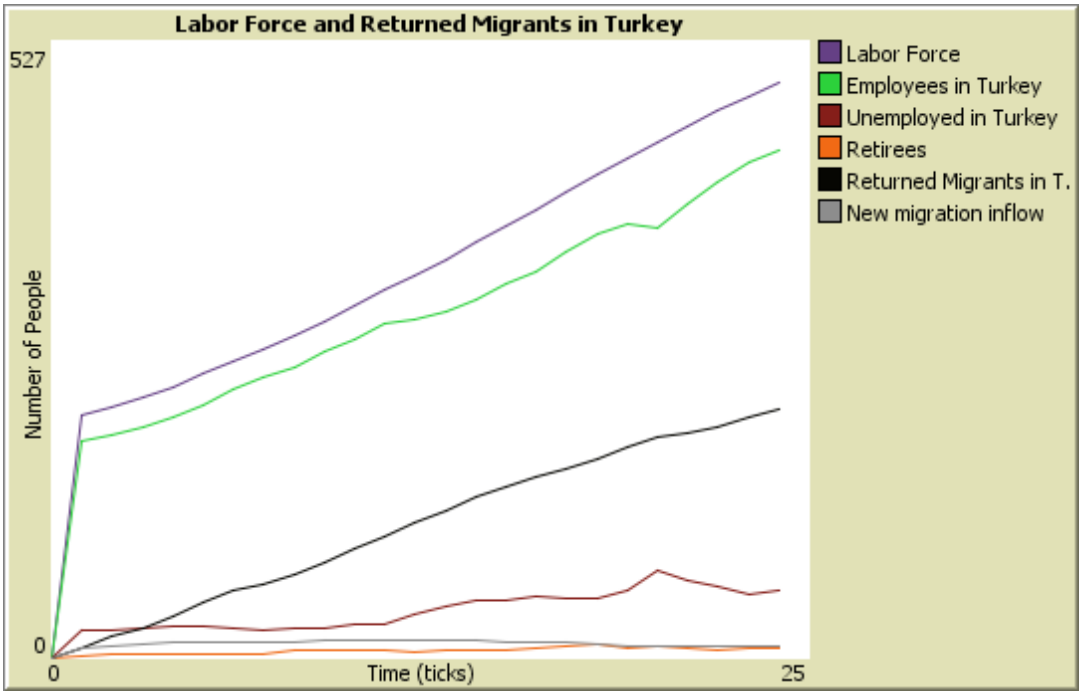
The difference between the simulated and actual labour force (the whole population in the model) in Germany is shown in Figure 6.13. The simulated population is higher. The reason might be that (German) agents in the model die only when they reach the age of 82. Another reason might be that the model overestimates the employment of Turkish immigrants.

Figure 6.13. Simulated and Actual Labour Force Particiation in Germany



Similarly to Germany, the number of employees and the total labour force in Turkey continuously increases, as shown in Figure 6.14. There is also an overall increase in the unemployment as well. Migration flows from Germany to Turkey are almost constant so that the number of returned migrant stock increases with time.

Figure 6.14. Return Migrants and Labour Force Composition in Turkey



6.8. Migration Scenarios

Four scenarios of migration can be simulated using the same parameters for the individual migration probability but varying the exogenous variables for the sending and receiving countries: the immigration quota (of Germany) and the political migration parameter (of Turkey). Table 6.4. shows the expected changes in migration flows in both possible directions:

Table 6.4. The Four Migration Scenarios

	High Immigration-quota	**Low Immigration-quota**
High Political-Migration-parameter	**Scenario 1** Only few people can migrate. Potential migration >> Actual migration Number of people with return intention decreases. Number of actually returning people decreases.	**Scenario 2** Fewer people than in Sc. 1 can migrate. Potential migration >>> Actual migration Number of people with return intention and number of actually returning people decreases more than in Scenario 1.
Low Political-Migration-parameter	**Scenario 3** Less people intend to migrate than in Scenario 1 and 2. Potential migration > Actual migration The number of people with return intention and the number of actually returning people increases.	**Scenario 4** Less people intend to migrate than in Sc. 1 and 2. Less people can migrate than in Sc. 3. Potential migration >> Actual migration The number of people with return intention and the number of actually returning people are less than in Scenario 3.

The simulation results confirm these expected results, as will be depicted in the parts 6.8.1-6.8.4.

6.8.1. Scenario 1: High political-migration parameter and high immigration quota

In the first scenario, both exogenous factors are high. Due to the immigration quota, only a limited number of agents who intend to migrate can actually move. As expected, the number of potential migrants is higher than that of actual migrants. The migrant stock population increases with time. Figure 6.15. illustrates the migrant flows and stocks in Germany.

Due to the high value of the political parameter, the number of people with return intenion decreases. Consequently, fewer people actually return. There are few returning migrants as shown in Figure 6.16.

Figure 6.15. Migrant Stocks and Flows in Germany in Scenario 1

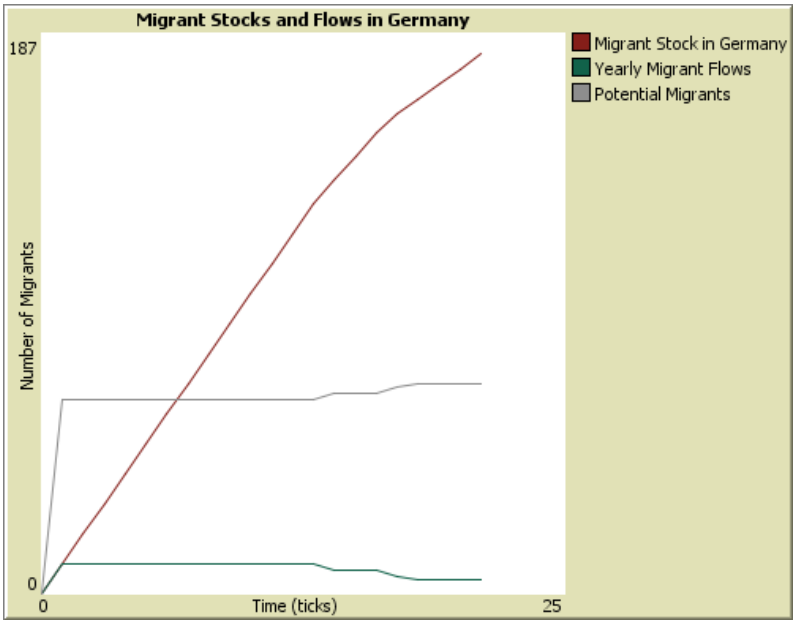
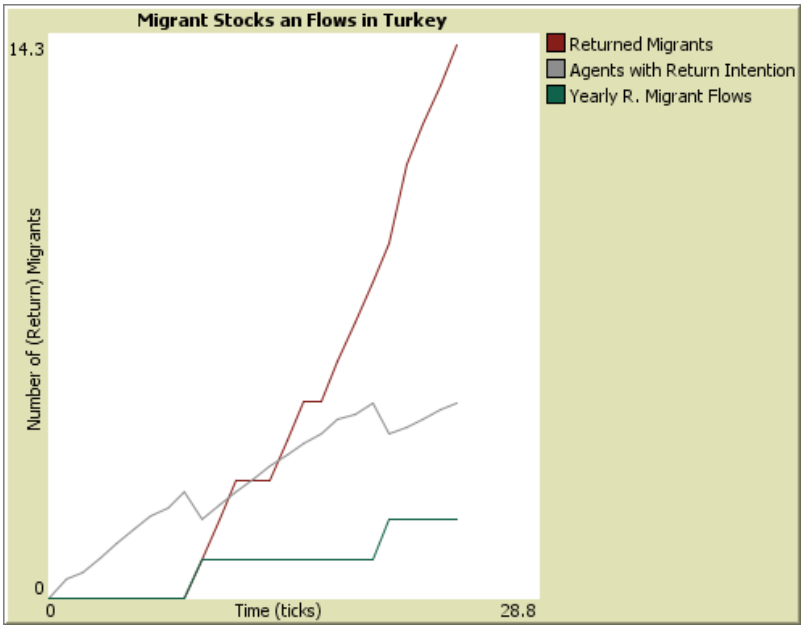


Figure 6.16. Migrant Stocks and Flows in Turkey in Scenario 1



6.8.2. Scenario 2: High political-migration parameter and low immigration quota

Due to the low immigration quota, the discrepancy between the number of potential migrants and yearly migrant flows has grown (compared to Scenario 1). Still, there are more people intending to migrate and the migrant stock grows. Figure 6.17. shows the migrant stocks and flows in Germany. The high political migration parameter, on the other hand, is responsible for the decrease in the number of people with return intention and return migrants (Figure 6.18.).

Figure 6.17. Migrant Stocks and Flows in Germany in Scenario 2

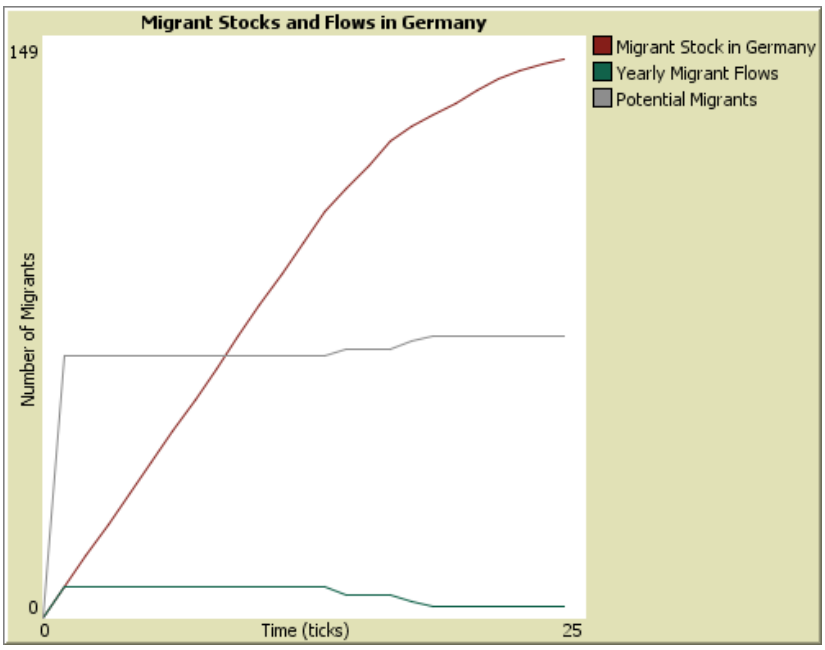
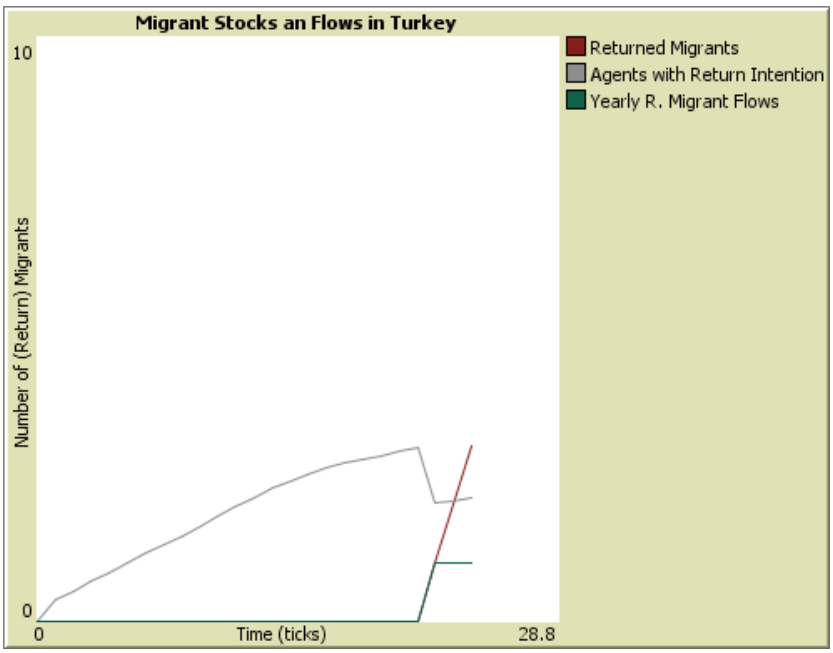


Figure 6.18. Migrant Stocks and Flows in Turkey in Scenario 2



6.8.3. Scenario 3: Low political-migration parameter and high immigration quota

When the political migration parameter is low, less people intend to migrate than in the previous two scenarios. Due to the high immigration quota, more people can actually migrate so that the difference between actual and potential migrants is smaller than in the previous scenarios. The migrant stock first increases, then starts decreasing. Also the difference between the number of returning migrants and that of people with return intention is smaller. Clearly more agents do return. Figures 6.17. and 6.18. show the migrant stocks and flows in Germany and Turkey, respectively.

Figure 6.19. Migrant Stocks and Flows in Germany in Scenario 3

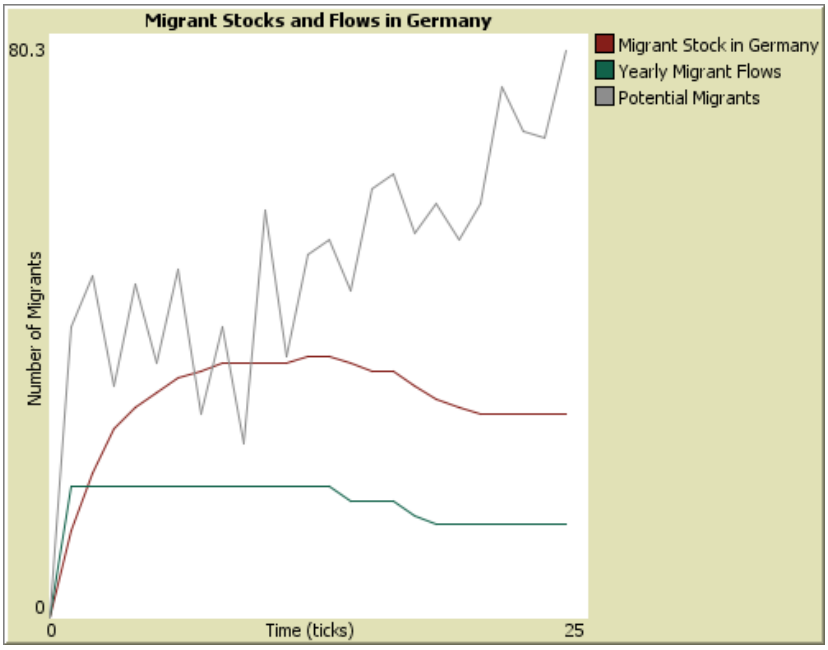
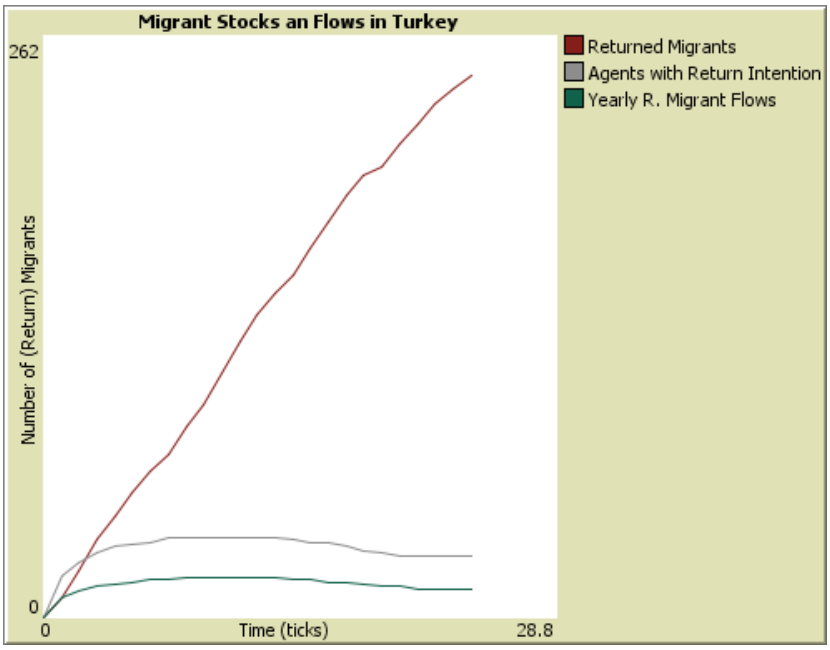


Figure 6.20. Migrant Stocks and Flows in Turkey in Scenario 3



6.8.4. Scenario 4: Low political-migration parameter and low immigration quota

In the 4th and last scenario, both exogenous factors are low. Again the number of yearly migrant flows and the total migrant stock in Germany decrease (and are very low compared to the high immigration quota case). Despite the low political migration parameter and low quota, a high number of people have migration intention. This might be because of high values of individual baseline probability, employment/income or family/network parameters.

Similar to Scenario 3, the difference between the number of returning migrants and that of people with return intention is small and more agents do return. Figures 6.21. and 6.22. illustrate the migrant stocks and flows in Germany and Turkey, respectively.

Figure 6.21. Migrant Stocks and Flows in Turkey in Scenario 4

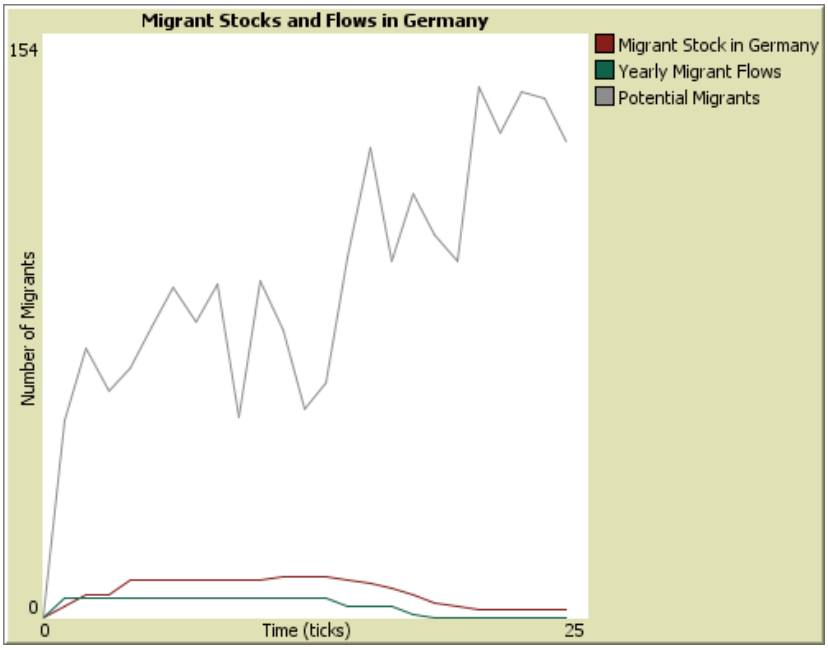
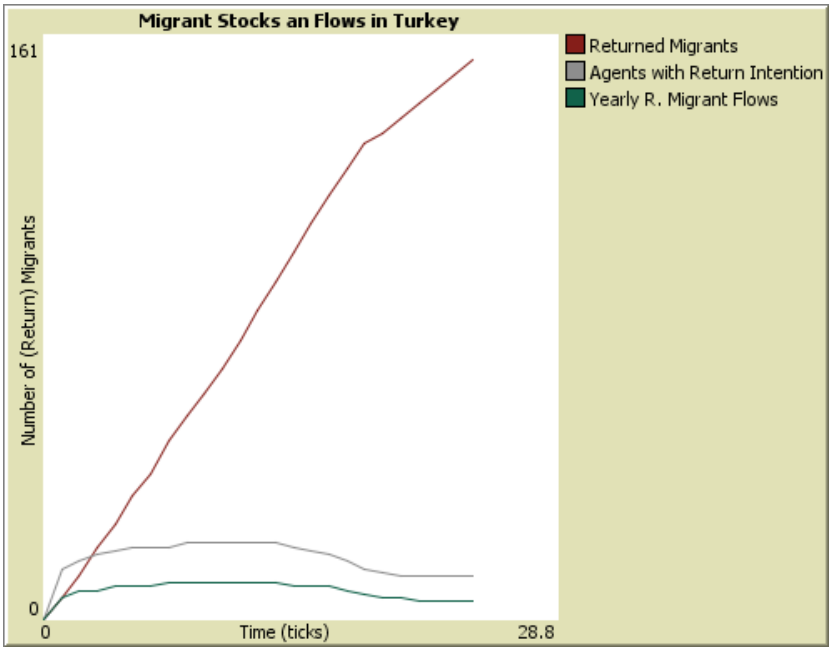


Figure 6.22. Migrant Stocks and Flows in Turkey in Scenario 4



Chapter 7 CONCLUSION

"History shows that it is not only senseless and cruel, but also difficult to state who is a foreigner." ***f[Claudio Magris, (1989) in Danube: A Sentimental Journey from the Source to the Black Sea]***

7.1. Brief Review of the Theoretical Parts

At each point of time, migration is a matter of intense political and social debate. The aim of the underlying dissertation thesis was to analyse and simulate the migration behaviour between Turkey and Europe, particularly Germany. The latter was chosen as a country of focus since it hosts the biggest Turkish migrant stock in the European Union. History shows that migration has always been and does never end but that motivations for and patterns of migration change over time. Changes in political, economic, demographic and social situations of countries strongly affect migration patterns.

In the second chapter, the Turkish migration process to Europe was analyzed through a qualitative and quantitative analysis of migration patterns to the EU (the receiving country perspective) and a quantitative analysis of patterns from Turkey (the sending country perspective). Turkish migration in the 1960s was in form of labour migration, which changed to family unifications after the oil embargo in 1973. Political climate both in the sending and receiving countries led to the continuation of family migrations and to an increase in asylum applications in the 1980s and 1990s. In the 2000s, Turkish migration to Europe significantly decreased due to the EU enlargement waves in 2004 and 2007, and the global economic crisis of 2008-2009. For the first time in the history of migration between Europe and Turkey, migration flows from Europe to Turkey have exceeded the flows in the contracting direction in the late 2000s (İçduygu, 2010). Relatively enhanced economic and political conditions in Turkey, restart of negotiations with the EU and prospects of full membership, which existed until the political and technical stalemate in formal accession talks in 2012 played a major role in the decrease in migration flows. In the following decade, the outbreak of civil war in Syria led not only to an increase of migration flows but to mass migration. Hosting a large number of Syrian migrants, Turkey has become a transit migration country since 2011.

It was argued that Turkish migrants underwent the four stages in the development of international migration defined by Castles and Miller (1993, 1998, and 2014):

"(i) Temporary labor migration of young workers, remittance of earnings and continued orientation to the homeland; (ii) prolonging of stay and the development of social networks based on kinship or common area of origin and the need for mutual help in the new environment; (iii) family reunion, growing consciousness of long-term settlement, increasing orientation towards the receiving country, and emergence of ethnic communities with their own institutions; and (iv) permanent settlement which, depending on the policies of the government and the behavior of the population of the receiving country, leads either to

secure legal status and eventual citizenship, or to political exclusion, socioeconomic marginalization and the formation of permanent ethnic minorities." (Castles, Miller; 1993:25)

The chapter following migration history between Turkey and Europe was devoted to a brief discussion of selected international migration theories and the identification of determinants, which have a key role in the migration process from Turkey to EU 15 countries. Selected sociological, socio-economic, economic, and unifying international migration models and theories were described. Some theories (e.g. the neoclassical macro- and micro-theory, the dual labour market theory, and the world systems theory) aim to explain the initiation of migration, whereas others (e.g. the network theory, the institutional theory, cumulative causation and the migration systems theory) aim to explain its perpetuation.

Migration theories can also be classified as 'functionalist' or 'historical-structural' theories. In the former, the society is viewed as a system or collection of interdependent actors, which has an essential tendency towards equilibrium. Functionalists see migration is as a positive phenomenon serving to the interests of all parties and leading to greater equality within as well as between societies (Castles, Haas and Miller, 2014). The push-pull model discussed in the previous part, the human capital theory and the neoclassical theory are functionalist theories.

Historical-structural theories, on the other hand, can be traced back to the neo-Marxist political economy. They emphasize the ways in which social, economic, cultural and political structures constrain the behaviour of individuals and lead to disequilibrium. Economic and political power are not equally distributed, while cultural and social practices strengthen structural inequalities. Migration, by providing 'cheap and exploitable labour force' serves to the interests of wealthy nations and leads to 'brain drain' from less developed nations. Thus, it leads to more inequalities and increases the gap between developed and developing countries (Castles, Haas and Miller, 2014). The dependency theory, the world systems theory, the globalization theory and the segmented labour market theory are some of the historical-structural theories.

Most economic models have the common proposition that migration is driven by spatial and distributional differences in net returns to human labour. However, it is argued that the main incentives of migrants are much more than economic. Since the migration decision is affected by a combination of economic, political, cultural, social and psychological factors, a multidisciplinary approach to the migration issue would be more realistic. The Migration Systems Theory (Kritz and Zlotnik, 1992) and the Multidisciplinary Approach and Mobility Transition (Massey, 2002) e.g. have such a unifying systems approach.

In general, it can be argued that no one of the theories of international migration is capable of capturing all aspects of the phenomenon. Rather, they can be regarded as complementary. In recent years, many theorists have proposed interdisciplinary methodologies, combinations of theoretical models and synthetic approaches, that connect migration theory with general social theory, and view migration as

part of broader social transformations. Analogously, the dissertation thesis aimed to develop a model that combines the basic premises of several migration theories.

Having reviewed theoretical models of migration in literature, it was concluded that a theoretical framework of the migration patterns between Turkey and the EU should comprise (i) structural forces promoting emigration from Turkey, (ii) structural forces that attract Turkish migrants to European countries, (iii) main incentives of Turkish migrants, and (iv) political and economic structures that connect Turkey and the EU. The Migration Systems Theory combining direct and indirect economic, demographic, political and social determinants was chosen and adopted to build the theoretical framework for the agent-based migration model.

Unlike (migration) theories, which by nature must be general, models relate to a particular event and have a large degree of flexibility. The consideration of economic, demographic and regional aspects has led to the formation of demo-economic modeling with regional or multiregional differentiation in the 1970s. It is based on the idea that the population development of a region depends both on natural growth rates and to a higher extent on migration rates. Migration flows are connective links between the economic development and the population development of a region. Most laborers who are planning to migrate can do so only if there is an available job in the destination. Thus, migration largely on labor-creating economic growth determinants of the regions. On the other hand, growth rates are affected by migration rates. Chapter 4 was devoted to the description of several demo-economic modelling examples: the Birg Model (1983), IDEM (Fachin and Venanzoni, 2002) and BACHUE-International (Moreland, 1978).

The first model was a dynamic demo-economic model investigating the interactions of job creation, migration and natural population increase (Birg, 1982, 1983). It aims to analyze the roles of job creation and migration for regional development through dynamic continuous equations solved for the regions. The second model was IDEM (Fachin and Venanzoni, 2002), that combines a multi-regional cohort-component model with economic variables of labor supply and productivity. The analysis is limited to Italy and is focused on internal migration rather than international. The third model was BACHUE-International (Moreland, 1978), which is a generalized and simplified econometric model for a developing economy. It is composed of three subsystems – demographic, economic and income distribution subsystems, which are linked through relations of variables.

For explaining and simulating migration flows between Germany and Turkey in Chapter 6, the agent-based modelling technique was chosen. Agent-based models (ABMs) pre-suppose behavioural rules and verify if these micro-based rules can be used to explain ‘macroscopic regularities’ (Billari et. al., 2006:2). They capture differences between individuals and allow their interaction. It is only with the development of agent-based modelling that micro-level interactions between heterogeneous agents could be modelled (Hamill and Gilbert, 2016).

Chapter 5 therefore reviewed the agent-based models of migration in literature. These were classified in the same way as Klabunde and Willekens (2016) did – according to the behavioural theories used:

(i) Minimalist models, (ii) microeconomic models with expected utility maximization, (iii) psycho-social and cognitive models, (iv) models based on heuristics without direct empirical correspondence, (v) models based on decision theory and direct observation, and (vi) models based on purely empirical, observational rules without mention of a theory.

7.2. Overview of the Main Features and Results of the Agent-Based Model

The sixth and final chapter then provides an agent-based model to simulate international migration flows between Turkey and Germany from 1991 to 2015. It is an example of models based on decision theory and direct observation. The basic premise is that individuals take a number of factors into consideration to decide whether to migrate. Beside macroeconomic and political developments in the source and destination countries, the existence of migrant networks plays a significant role in migrants' decisions. Similar to the Migration Systems Theory (Kritz and Zlotnik, 1992), the model has a unifying approach and attempts to combine propositions of the neoclassical economic theory, network theory, and decision theory.

The reference pattern for the model is immigration from Turkey to Germany in the simulation period. In order to be useful for analysis, the model needs to match certain stylized facts determined from empirical findings. Then the model was calibrated and matched against data.

The model assumed that migrants maximize a utility function, which is implicit in their behavioural motives. Migrants use heuristics to cope with uncertainty, e.g. in terms of future earnings and changes in EU immigration policies. Behavioural theories were chosen from literature on international migration, and fed as behavioural heuristics for both migration and return migration in the model.

Agents try to maximize their utility, which is not necessarily only their wage. The migration decision depends on the employment probability and expected income of an agent in the destination country, on the location of his network members, the existence of a migrant community in the destination, on the political stability in the source country, and on the immigration control policy of the destination country. Agents may migrate, and return (if they become unemployed for subsequent years or if they retire). The decision to return, on the other hand, depends on a baseline probability, on the agent's age, length of stay in the host country and current employment status. Agents have a baseline return probability at any time that captures subjective reasons for return migration, e.g. ties to the home country, discrimination experiences, family or partnership reasons.

Taking the stylized facts on migration into consideration, the model had to match following general patterns: Direction of migration flows had to be mainly from Turkey to European countries, while there was some return migration and retiree migration. The number of new coming Turkish immigrants per year had to decrease between 1991 and 2015. People tend to go to countries where migrant networks (family or friends) exist. Restrictive immigration policies were effective in decreasing migration flows.

The model was initialized with 410 and 204 agents in Germany and Turkey, respectively. At model initiation, the ratio of the populations in the model was equal to the ratio of labour force populations of the two countries. The simulation was made for 24 years, to simulate flows between 1991 and 2015. In each year (tick of the model), agents calculated their individual probability to migrate based on the factors mentioned before.

Migration flows remained steady for 13 successive years. There was always a higher number of agents who wanted to migrate but due to the immigration quota, only a certain number of them could move. In 2004, when the first EU enlargement happened, immigration policy became stricter and the quota for employees decreased. The flows continued decreasing also afterwards because of the global economic crisis in 2008/2009. The migrant stock firstly increased and then decreased due to retirements and increasing return migration flows.

Similar to the difference between the number of potential and actual migrants to Germany, only a share of agents living in Germany who intended to move to Turkey did actually migrate. However, that was not due to policy restrictions. Migrants settled in a host country can intend to return or move to their country of origin because of subjective reasons but few of them actually do so. This difference could be observed in the concerning graph. Agents in Germany had clearly lower probabilities to migrate than agents in Turkey. In the simulation period, the number of returning agents stayed almost stable until the EU enlargement waves and then decreased until the end of simulation.

In accordance with migration data for the simulation period, at the beginning of simulation, net migration to Germany was positive until immigration and emigration became equal for some time. Then emigration exceeded immigration during the last 8 simulation years. Migration data also shows that shortly after 2004 immigration and emigration of Turkish citizens (to/from Germany) almost equalled, while after the second EU enlargement (2007) emigration surpassed immigration.

There was a difference between the simulated and actual labour force in Germany. Namely, the simulated population was higher. Reasons behind it might be a higher modelled population increase and a lower death rate. Another reason might be that the model overestimated the employment of Turkish immigrants.

As a final experiment, four migration scenarios were built depending on the exogenous variables – immigration quota introduced by Germany and the so-called political migration parameter by Turkey. In the first scenario, both factors were high. Due to the high immigration quota, only a small number of agents who intend to migrate could move. Due to the high value of the political parameter, there was a decrease in the number of people with return intenion, and fewer people returned to their country of origin.

In the second scenario, the difference between the number of potential migrants and yearly migrant flows was bigger than in the first scenario because of the low immigration quota. The high political migration parameter caused a decrease in the number of people with return intention and return migrants.

The third scenario was made with a low political-migration parameter and a high immigration quota. When the political migration parameter was low, less people intended to migrate than in the previous two scenarios. Due to the high immigration quota, more people could actually migrate so that the difference between actual and potential migrants was smaller than in the previous scenarios. The migrant stock first increased, then started decreasing. Also the difference between the number of returning migrants and that of people with return intention was smaller. It could be observed that more agents returned.

The fourth and final scenario aimed to show what would happen if both exogenous factors were low. Again the number of yearly migrant flows and the total migrant stock in Germany decreased (compared to the high immigration quota case). Unexpectedly, a high number of people had migration intention. This might be because of high values of individual baseline probability, employment/income or family/network parameters. Similar to Scenario 3, the difference between the number of returning migrants and that of people with return intention was small and more agents returned.

7.3. Final Remarks

The goal of this dissertation was to simulate migration patterns between Germany and Turkey. Overall, it can be concluded that the model was able to reproduce the shape of migration paths during a predetermined period. The basic idea was that migration is an action that happens at the end of a decision process and strongly depends on external factors. It was shown through simulation that unexpected economic or political developments, which lead to restrictive immigration policies, cause a decrease in migration flows. How much such a decrease will be or how much agents are willing to migrate can be modelled to provide background information for policy analysis.

Since it was a first attempt to model Turkish migration to Europe, it can be improved in many ways yet. For instance, the demographic structures of agents can be modelled based on statistical data. Events in agents' life cycle can be stochastic instead of deterministic. For this thesis, secondary data were used. Another improvement could be matching the model parameters against longitudinal data (if available).

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;                              APPENDIX

; GLOBAL DECLARATIONS

UNDIRECTED-LINK-BREED [ families family ]
UNDIRECTED-LINK-BREED [ friendships friendship ]

breed [ firms firm ]
breed [ people person ]
breed [ countries country ]

patches-own [ my-country ]
people-own  [ origin                        citizen
              employed                      employment-status-factor
              age                           age-factor
              migration-status              potential-migrant
              time-spent-in-germany         duration-factor
              my-migration-probability      my-return-probability
              family-at-dest                nOfMyNetwork    nOfMyFamily
              migrants-at-dest              employment-probability
              Income-Ratio
              myEmployer                    myLastEmployer
              myWage                        myInitialWage    myLastWage
              tempStatus                    tempStatus-2
              durationOfU                   StartOfUnempl
              my-work-history               dateOfEntry
            ]

countries-own [ countryid ] ; possible to define additional macro variables

firms-own     [ firmid                      mySize
                myEmployees                 MigrantEmployees
                listOfMyWages               myWageOffer
                myVacancies                 listOfMyEmployees
                myVacancyWages
              ]

globals       [ patches-1                   patches-2
                radius-1                    radius-2
                TotalPopulation-1           TotalPopulation-2
                TotalLabourForce-1          TotalLabourForce-2
                BirthRate-1                 BirthRate-2
                Birth-Rate-Germany          Birth-Rate-Turkey
                PoliticalStabilityIndex-1   PoliticalStabilityIndex-2
                datagermanwage              dataturkishwage
                nominalGermanWage           nominalTurkishWage
                datagermanemployment        dataturkishemployment
                dataemploymentchangegermany dataemploymentchangeturkey
                datagermanUnemployment      dataturkishUnemployment
                employmentInGermany         employmentInTurkey
                unemploymentInGermany       unemploymentInTurkey
                populationInGermany         populationInTurkey
                LabourForceInGermany        LabourForceInTurkey
                PSI-1                       PSI-2
                PSI                         EuPol
                new-LF-1                   new-LF-2
                empl-LF-ratio-1             empl-LF-ratio-2
```

```
new-empl-1                  new-empl-2
new-unempl-1                new-unempl-2
potential-migrants-1        potential-migrants-2
migration-probability-list-1  migration-probability-list-2
nOfWorkers-1                nOfWorkers-2
nOfRetirees-1               nOfRetirees-2
nOfRetiredEmployees-1       nOfRetiredEmployees-2
nOfRetiredUnemployed-1      nOfRetiredUnemployed-2
nOfRetiredMigrants
nOfNewEntrants-1            nOfNewEntrants-2

minNetworkSize
avNetworkSize
maxNetworkSize
sdNetworkSize

accumMinNetworkSize
accumAvNetworkSize
accumMaxNetworkSize
accumSDNetworkSize

meanPlot
sdPlot
minPlot
maxPlot

NofMigrants
new-migration
return-migration
potential-migrants
N-of-people-with-return-intention
NofReturnMigrants

unNormalisedMeanWage-1    unNormalisedMeanWage-2
wageDistribution-1        wageDistribution-2
bottomDecile-1            bottomDecile-2
lowerQuintile-1           lowerQuintile-2
middleQuintile-1          middleQuintile-2
medianWage-1              medianWage-2
upperQuintile-1           upperQuintile-2
topQuintile-1             topQuintile-2
topDecile-1               topDecile-2
bottomDecileList-1        bottomDecileList-2
lowerQuintileList-1       lowerQuintileList-2
middleQuintileList-1      middleQuintileList-2
medianList-1              medianList-2
upperQuintileList-1       upperQuintileList-2
topQuintileList-1         topQuintileList-2
topDecileList-1           topDecileList-2
meanBottom10-1            meanBottom10-2
meanLower20-1             meanLower20-2
meanLower40-1             meanLower40-2
meanMedian-1              meanMedian-2
mean60-1                  mean60-2
meanTop20-1               meanTop20-2
meanTop10-1               meanTop10-2
decile-1                  decile-2
```

```
                model-1                  model-2
                target-1                 target-2
                cumulativeDifferenceSquared-1 cumulativeDifferenceSquared-2

                minMyWage-1              minMyWage-2
                minWageList-1            minWageList-2
                meanMin-1                meanMin-2
                sdMin-1                  sdMin-2
                meanMyWage-1             meanMyWage-2
                meanWageList-1           meanWageList-2
                meanMean-1               meanMean-2
                sdMean-1                 sdMean-2
                maxMyWage-1              maxMyWage-2
                maxWageList-1            maxWageList-2
                meanMax-1                meanMax-2
                sdMax-1                  sdMax-2
                accumWages-1             accumWages-2

                lessThanAverageWage%-1           lessThanAverageWage%-2
                lessThanAverageWage%List-1       lessThanAverageWage%List-2
                lessThanHalfAverageWage%-1       lessThanHalfAverageWage%-2
                lessThanHalfAverageWage%List-1   lessThanHalfAverageWage%List-2
                moreThanTwiceAverageWage%-1      moreThanTwiceAverageWage%-2
                moreThanTwiceAverageWage%List-1  moreThanTwiceAverageWage%List-2

                bar-interval
              ]

; SETUP and LOADING DATA

to setup
  clear-all
  reset-ticks
  let i 0
  create-countries 2 [
      set i i + 1
      set countryid i
      ]

  set patches-1 patches with [ pxcor < 0 ]
  ask patches-1   [ set pcolor 135
                    set my-country one-of countries with [ countryid = 1 ]
                  ]
  set patches-2 patches with [ pxcor >= 0 ]
  ask patches-2   [ set pcolor 85
                    set my-country one-of countries with [ countryid = 2]
                  ]

  ask patch (min-pxcor / 2) ( 0 ) [ set plabel "DESTINATION COUNTRY" ]
  ask patch (max-pxcor / 2) ( 0 ) [ set plabel "SOURCE COUNTRY" ]

 load-data

 set-default-shape people "person"
 set-default-shape firms  "factory"

  create-people 410 [     ; initially create the total labour force NLTN divided by
```

```
100.000
    set citizen  1
    set origin 1
    set migration-status 0
    set color blue
    set sıze 3
    set my-work-history [ ]
    set myEmployer nobody
    set age ( 20 + ( random 184 / 4 ) ) ; set age randomly but evenly distributed
from 20 to 65, to nearest quarter
    move-to-empty-one-of patches-1
    ]

   ask n-of 10 people with [ citizen = 1 ] [ set origin 2  set color white ] ; 10
Turkish migrants in the destination country at initial setup

  create-people 204 [     ; initially create the total labour force NLTN divided by
100.000
    set citizen 2
    set origin 2
    set migration-status 0
    set time-spent-in-germany 0
    set color white
    set sıze 3
    set my-work-history [ ]
    set myEmployer nobody
    set age ( 20 + ( random 184 / 4 ) ) ; set age randomly but evenly distributed
from 20 to 65, to nearest quarter
    move-to-empty-one-of patches-2
  ]

  create-firms 1   [
      set firmid 1
      set color black
      set sıze 28
      set mySize 1000
      set myEmployees 0
      set listOfMyWages [   ]
      set myVacancyWages [  ]
      set myWageOffer 0
      set myVacancies 0
      setxy -25 25
      ]
   create-firms 1   [
      set firmid 2
      set color black
      set sıze 28
      set mySize 1000
      set myEmployees 0
      set myVacancyWages [  ]
      set myWageOffer 0
      set myVacancies 0
      setxy 25 25
      ]

  set accumMinNetworkSize [  ]
  set accumAvNetworkSize [  ]
```

```
  set accumMaxNetworkSize [  ]

 end


to load-data

ifelse (file-exists? "NominalWages_Germany_1991-2014.txt")
   [
     set datagermanwage []
     file-open "NominalWages_Germany_1991-2014.txt"
     while [not file-at-end?]
        [set datagermanwage lput file-read datagermanwage
        ]
    file-close
   ]
   [user-message "There is no NominalWages_Germany_1991-2014.txt file in current
directory!"
   ]

ifelse (file-exists? "NominalWages_Turkey_1991-2014.txt")
   [
     set dataturkishwage []
     file-open "NominalWages_Turkey_1991-2014.txt"
     while [not file-at-end?]
        [set dataturkishwage lput file-read dataturkishwage
        ]
    file-close
   ]
   [user-message "There is no NominalWages_Turkey_1991-2014.txt file in current
directory!"
   ]

ifelse (file-exists? "NETN_Germany_1991-2016.txt")
   [
     set datagermanemployment []
     file-open "NETN_Germany_1991-2016.txt"
     while [not file-at-end?]
        [set datagermanemployment lput file-read datagermanemployment
        ]
    file-close
   ]
   [user-message "There is no NETN_Germany_1991-2016.txt file in current
directory!"
   ]

ifelse (file-exists? "NETN_Turkey_1991-2016.txt")
   [
     set dataturkishemployment []
     file-open "NETN_Turkey_1991-2016.txt"
     while [not file-at-end?]
        [set dataturkishemployment lput file-read dataturkishemployment
        ]
    file-close
   ]
   [user-message "There is no NETN_Turkey_1991-2016.txt file in current directory!"
   ]
```

```
ifelse (file-exists? "NUTN_Germany_1991-2016.txt")
   [
     set datagermanUnemployment []
     file-open "NUTN_Germany_1991-2016.txt"
     while [not file-at-end?]
        [set datagermanUnemployment lput file-read datagermanUnemployment
        ]
    file-close
   ]
   [user-message "There is no NUTN_Germany_1991-2016.txt file in current
directory!"
   ]

ifelse (file-exists? "NUTN_Turkey_1991-2016.txt")
   [
     set dataturkishUnemployment []
     file-open "NUTN_Turkey_1991-2016.txt"
     while [not file-at-end?]
        [set dataturkishUnemployment lput file-read dataturkishUnemployment
        ]
    file-close
   ]
   [user-message "There is no NUTN_Turkey_1991-2016.txt file in current directory!"
   ]

ifelse (file-exists? "PopulationInGermany.txt")
   [
     set TotalPopulation-1 []
     file-open "PopulationInGermany.txt"
     while [not file-at-end?]
        [set TotalPopulation-1 lput file-read TotalPopulation-1
        ]
    file-close
   ]
   [user-message "There is no PopulationInGermany.txt file in current directory!"
   ]

ifelse (file-exists? "PopulationInTurkey.txt")
   [
     set TotalPopulation-2 []
     file-open "PopulationInTurkey.txt"
     while [not file-at-end?]
        [set TotalPopulation-2 lput file-read TotalPopulation-2
        ]
    file-close
   ]
   [user-message "There is no PopulationInTurkey.txt file in current directory!"
   ]

ifelse (file-exists? "NLTN_Germany_1991-2016.txt")
   [
     set TotalLabourForce-1 []
     file-open "NLTN_Germany_1991-2016.txt"
     while [not file-at-end?]
        [set TotalLabourForce-1 lput file-read TotalLabourForce-1
        ]
```

```
    file-close
   ]
   [user-message "There is no NLTN_Germany_1991-2016.txt file in current
directory!"
   ]

ifelse (file-exists? "NLTN_Turkey_1991-2016.txt")
   [
     set TotalLabourForce-2 []
     file-open "NLTN_Turkey_1991-2016.txt"
     while [not file-at-end?]
        [set TotalLabourForce-2 lput file-read TotalLabourForce-2
        ]
    file-close
   ]
   [user-message "There is no NLTN_Turkey_1991-2016.txt file in current directory!"
   ]


ifelse (file-exists? "Crude_birth_rates_Germany_1966-1991.txt")
   [
     set BirthRate-1 []
     file-open "Crude_birth_rates_Germany_1966-1991.txt"
     while [not file-at-end?]
        [set BirthRate-1 lput file-read BirthRate-1
        ]
    file-close
   ]
   [user-message "There is no Crude_birth_rates_Germany_1966-1991.txt file in
current directory!"
   ]

ifelse (file-exists? "Crude_birth_rates_Turkey_1966-1991.txt")
   [
     set BirthRate-2 []
     file-open "Crude_birth_rates_Turkey_1966-1991.txt"
     while [not file-at-end?]
        [set BirthRate-2 lput file-read BirthRate-2
        ]
    file-close
   ]
   [user-message "There is no Crude_birth_rates_Turkey_1966-1991.txt file in
current directory!"
   ]

ifelse (file-exists? "PSI_Germany_1991-2016.txt")
   [
     set PoliticalStabilityIndex-1 []
     file-open "PSI_Germany_1991-2016.txt"
     while [not file-at-end?]
        [set PoliticalStabilityIndex-1 lput file-read PoliticalStabilityIndex-1
        ]
    file-close
   ]
   [user-message "There is no PSI_Germany_1991-2016.txt file in current directory!"
   ]
```

```
ifelse (file-exists? "PSI_Turkey_1991-2016.txt")
   [
     set PoliticalStabilityIndex-2 []
     file-open "PSI_Turkey_1991-2016.txt"
     while [not file-at-end?]
        [set PoliticalStabilityIndex-2 lput file-read PoliticalStabilityIndex-2
        ]
    file-close
   ]
   [user-message "There is no PSI_Turkey_1991-2016.txt file in current directory!"
   ]
end



;;:::::::::::::::::::::::::::::::::::::::::::::: TO MOVE
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

to move-to-empty-one-of [locations]  ;; people procedure

  move-to one-of locations
  let this-country [my-country] of one-of locations
  let i 0
  let stopit FALSE
  let maxtries count patches with [ my-country = this-country ]
  while [ any? other turtles-here and stopit = FALSE ]
  [ set i i + 1
    move-to one-of locations
    if (i >= maxtries) [ set stopit TRUE ]
  ]

end


;;:::::::::::::::::::::::::::::::::: MIGRATION BASED ON WAGES - EMPLOYMENT - FAMILY
TIES - POLITICAL STABILITY - IMMIGRATION POLICY
::::::::::::::::::::::::::::::::::::::

to go

  update-and-plot-networks ; visualize network sizes of people

  reset-values ; reads yearly population, wage and employment data from file;

  setup-wages ; actual normal distribution of nominal wages - mean wage is the
nominal Wage read from file (is updated with ticks in reset-values)

  employ-people ; procedure matches employees and firms (employmentInX and migrants
of the previous period are matched, rest of the LF remains unemployed)

  decide-on-migration ; agents calculate their migration probability, decide and
migrate or remigrate (or not)

  plot-individual-migration-probability

  enter-exit-labour-force ; aging and retirement process, new generation entering
the LF
```

```
  calculate-new-populations ; take into account the retired, newcomers to the
labour market, cyclical unemployment and migrants

  tick
  set family-parameter              ( family-parameter - 0.01 )
  set network-parameter             ( network-parameter - 0.01 )
  set political-stability-parameter ( political-stability-parameter + 0.01 )
  if ticks =  13 [ set immigration-quota immigration-quota - 2 ]
  if ticks >= 13 [ set immigration-policy-parameter ( immigration-policy-parameter
+ 0.2 ) ]
  if ticks =  16 [ set immigration-quota immigration-quota - 2 ]
  if ticks =  17 [ set immigration-quota immigration-quota - 1 ]
  if ticks =  24 [ stop ]

end


to update-and-plot-networks

   clear-links
   if show-networks = true [ ask people [ create-links-with other people in-radius
networkSize ]]  ; network links are updated after each tick

   ask people  [ set nOfMyNetwork count other people in-radius networkSize
                 set nOfMyFamily count other people in-radius 2
               ]

   set minNetworkSize precision ( min [  nOfMyNetwork ] of people ) 2
   set avNetworkSize precision ( mean [  nOfMyNetwork ] of people ) 2
   set maxNetworkSize precision ( max [  nOfMyNetwork ] of people ) 2

   set accumMinNetworkSize lput minNetworkSize accumMinNetworkSize
   set accumAvNetworkSize lput avNetworkSize accumAvNetworkSize
   set accumMaxNetworkSize lput maxNetworkSize accumMaxNetworkSize

   set-current-plot "Personal Network Sizes"
   set-plot-x-range 0 100
   set-plot-y-range 0 100
   set-plot-pen-interval 1
   histogram [ nOfMyNetwork ] of people

   set meanPlot precision ( mean [ nOfMyNetwork ] of people ) 2
   set sdPlot precision ( standard-deviation [ nOfMyNetwork ] of people ) 2
   set minPlot min [ nOfMyNetwork ] of people
   set maxPlot max [ nOfMyNetwork ] of people

end


to reset-values

  set nominalGermanWage item (ticks) datagermanwage
  set nominalTurkishWage item (ticks) dataturkishwage
  set employmentInGermany item (ticks) datagermanemployment
  set employmentInTurkey item (ticks) dataturkishemployment
  set unemploymentInGermany item (ticks) datagermanUnemployment
```

```
  set unemploymentInTurkey item (ticks) dataturkishUnemployment
  set LabourForceInGermany item (ticks) TotalLabourForce-1
  set LabourForceInTurkey item (ticks) TotalLabourForce-2
  set populationInGermany item (ticks) TotalPopulation-1
  set populationInTurkey item (ticks) TotalPopulation-2
  set Birth-Rate-Germany item (ticks) BirthRate-1
  set Birth-Rate-Turkey item (ticks) BirthRate-2
  set PSI-1 item (ticks) PoliticalStabilityIndex-1
  set PSI-2 item (ticks) PoliticalStabilityIndex-2

  set new-migration 0
  set return-migration 0

end


to setup-wages

 set nOfWorkers-1  count people-on patches-1   set nOfWorkers-2 count people-on
patches-2
 set minWageList-1 [  ]                    set minWageList-2 [  ]
 set meanWageList-1 [  ]                   set meanWageList-2 [  ]
 set maxWageList-1 [  ]                    set maxWageList-2 [  ]
 set lessThanAverageWage%List-1 [  ]       set lessThanAverageWage%List-2 [  ]
 set lessThanHalfAverageWage%List-1 [  ]   set lessThanHalfAverageWage%List-2 [  ]
 set moreThanTwiceAverageWage%List-1 [  ]  set moreThanTwiceAverageWage%List-2 [  ]
 set bottomDecileList-1 [  ]               set bottomDecileList-2 [  ]
 set lowerQuintileList-1 [  ]              set lowerQuintileList-2 [  ]
 set middleQuintileList-1 [  ]             set middleQuintileList-2 [  ]
 set medianList-1 [  ]                     set medianList-2 [  ]
 set upperQuintileList-1 [  ]              set upperQuintileList-2 [  ]
 set topQuintileList-1 [  ]                set topQuintileList-2 [  ]
 set topDecileList-1 [  ]                  set topDecileList-2 [  ]
 set decile-1 [  ]                         set decile-2 [  ]
 set model-1 [  ]                          set model-2 [  ]
 set target-1 [  ]                         set target-2 [  ]

 ; list of all wages generated
 set accumWages-1 [ ]                      set accumWages-2 [ ]

 distribute-wages

end


to employ-people

  if ticks = 0 [ set new-empl-1 floor ( employmentInGermany / 100 )
                 set new-empl-2 floor ( employmentInTurkey / 100 )
                 set new-LF-1  floor (( employmentInGermany +
unemploymentInGermany) / 100 )
                 set new-LF-2  floor (( employmentInTurkey + unemploymentInTurkey)
/ 100 )
               ]

  ask firms with [ firmid = 1 ] [
               set myVacancies new-empl-1
```

```
               set myVacancyWages [  ]
               ask n-of new-empl-1   people with [ citizen = 1 ] [  set myEmployer
myself  set color green ]
               ask n-of new-unempl-1 people with [ citizen = 1 ] [  become-
unemployed ]
               set myEmployees count people with [ myEmployer = myself ]
               set MigrantEmployees count people with [ myEmployer = myself and
origin = 2 ]
               set listOfMyWages [ myWage ] of people with [ myEmployer = myself ]
               set listOfMyEmployees [ who ] of people with [ myEmployer = myself ]

            ]

  ask firms with [ firmid = 2 ] [
               set myVacancies new-empl-2
               set myVacancyWages [  ]
               ask n-of new-empl-2   people with [ citizen = 2  ] [  set myEmployer
myself  set color green ]
               ask n-of new-unempl-2 people with [ citizen = 2  ] [  become-
unemployed ]
               set myEmployees count people with [ myEmployer = myself ]
               set listOfMyWages [ myWage ] of people with [ myEmployer = myself ]
               set listOfMyEmployees [ who ] of people with [ myEmployer = myself ]

            ]
end


to decide-on-migration

  calculate-probability ;agents in source country are asked to calculate individual
migration probability, migrants to calculate return probability
  migrate

end


to calculate-probability

   set migration-probability-list-1 [  ]
   set migration-probability-list-2 [  ]
   set potential-migrants-1 count people with [ citizen = 2 and origin = 2 ]
   set potential-migrants-2 count people with [ citizen = 1 ]

   ask people with [ citizen = 2 and origin = 2 ] ; Turks in Turkey
   [
     set baseline-probability random-float 1
     if ticks = 0 [ ifelse any? people with [ citizen = 1 and origin = 2 ] in-
radius 6
                       [ set family-at-dest 1 set color yellow ]
                       [ set family-at-dest 0 ]
                  ]
     set migrants-at-dest (( count people with [ citizen = 1 and origin = 2 ] ) /
count people-on patches-1 * 100 )  ; share of migrants in total population at the
dest.
     set employment-probability ( count people with [ myEmployer = 1 ] / count
people-on patches-1 ) ; share of employed people in total population at the dest.
```

```
     set PSI ( PSI-1 / PSI-2 ) ; the ratio of the political stability index of the
destination country to that of the source c. It is always negative.
     set EuPol 1  ; Its effect depends on the immigration policy parameter. If the
parameter is set to 0, the policy doesn't affect migration, if it's set to 1, it is
a restrictive policy.
     set Income-Ratio ( nominalGermanWage / nominalTurkishWage ) ; the ratio of
wages in Germany to wages in Turkey

     set my-migration-probability ( baseline-probability + family-parameter *
family-at-dest + network-parameter * migrants-at-dest + employment-probability-
parameter * employment-probability + income-parameter * Income-Ratio
                                  - political-stability-parameter * PSI -
immigration-policy-parameter * EuPol )
   ]

  ; Normalize my-migration-probability to values between 0 and 1:
    let min-mig-prob min [ my-migration-probability ] of people with [ citizen = 2
and origin = 2 ]
    let max-mig-prob max [ my-migration-probability ] of people with [ citizen = 2
and origin = 2 ]
    ask people with [ citizen = 2 and origin = 2 ]
    [
       set my-migration-probability (( my-migration-probability - min-mig-prob ) /
( max-mig-prob -  min-mig-prob))
       set migration-probability-list-1 lput my-migration-probability migration-
probability-list-1
    ]

  ask people with [ citizen = 1 ]
   [
     ifelse origin = 2 ; Turks in Germany
     [
       set baseline-return-probability random-float 0.2
       if ( age < 30 )                 [ set age-factor 0.01 ]
       if ( 30 <= age  and age <= 49 ) [ set age-factor 0.03 ]
       if ( age >= 50 )                [ set age-factor 0.04 ]
       set time-spent-in-germany       ( time-spent-in-germany  + 1 )
       if time-spent-in-germany = 1    [ set duration-factor 0.5  ]
       if time-spent-in-germany = 2    [ set duration-factor 0.4  ]
       if time-spent-in-germany = 3    [ set duration-factor 0.3  ]
       if time-spent-in-germany = 4    [ set duration-factor 0.2  ]
       if time-spent-in-germany = 5    [ set duration-factor 0.1  ]
       if time-spent-in-germany > 5    [ set duration-factor 0.05 ]
       ifelse myEmployer = nobody and age <= 65 [ set employment-status-factor 0.5
]
                                                [ set employment-status-factor 0
]

       set my-migration-probability ( baseline-return-probability + age-factor *
age + duration-factor + employment-status-factor )
     ]
     [
       set my-migration-probability random-float 0.1 ; Germans
     ]

     let min-mig-prob-2 min [ my-migration-probability ] of people with [ citizen =
1 ]
```

```
     let max-mig-prob-2 max [ my-migration-probability ] of people with [ citizen =
1 ]

     set my-migration-probability (( my-migration-probability - min-mig-prob-2 ) /
( max-mig-prob-2 -  min-mig-prob-2)) ;individual return probabilities are also
normalized.
     set migration-probability-list-2 lput my-migration-probability migration-
probability-list-2

   ]
end


to migrate ; those in the source country decide whether or not to migrate. If they
actually can migrate depends on the immigration quota of the destination country.

set potential-migrants (count people with [ origin = 2 and citizen = 2 and my-
migration-probability > 0.5 and age <= 50 and migration-status < 3 ])

if pol-mig-parameter > 50 [ set potential-migrants potential-migrants +  pol-mig-
parameter ]

ifelse potential-migrants >= immigration-quota
[ repeat immigration-quota [
  ask one-of people with [ origin = 2 and citizen = 2 and my-migration-probability
> 0.5 and age <= 50 and migration-status < 3 ]  ; Circular migration is possible
but not infinitely. A Turkish person can migrate and return.
  [ create-links-with other people in-radius 2 [ tie ] ; Household members are tied
to the migrant and will also migrate?
    ask other people in-radius 2 [ set family-at-dest 1
                                   ask links [ untie ]] ; the people in the family
network don't move together with this person. But the undirected link still exists.
If the links are not untied, there will be family migration.
    move-to-empty-one-of patches-1 ; people from source country migrate if their
migration probability is higher than their threshold
    set migration-status migration-status + 1
    set tempStatus-2 "Migrant"
    set color black
    set citizen 1
    set new-migration (new-migration + 1)
    set NofMigrants count people with [ citizen = 1 and origin = 2 ]
    set potential-migrants potential-migrants - 1
  ]
 ]
]
[ repeat potential-migrants [
  ask one-of people with [ origin = 2 and citizen = 2 and my-migration-probability
> 0.5 and age <= 50 and migration-status < 3 ]  ; Circular migration is possible
but not infinitely. A Turkish person can migrate and return.
  [ create-links-with other people in-radius 2 [ tie ]
    ask other people in-radius 2 [ set family-at-dest 1
                                   ask links [ untie ]]
    move-to-empty-one-of patches-1 ; people from source country migrate if their
migration probability is higher than their threshold
    set migration-status migration-status + 1
    set tempStatus-2 "Migrant"
    set color black
```

```
    set citizen 1
    set new-migration (new-migration + 1)
    set NofMigrants count people with [ citizen = 1 and origin = 2 ]
  ]
 ]
]

; Only 1/3 of Turks living in Germany, who intend to return, actually do so.
set N-of-people-with-return-intention (count people with [ origin = 2 and citizen =
1 and my-migration-probability >= 0.5 ])

if pol-mig-parameter > 50 [ set N-of-people-with-return-intention ( N-of-people-
with-return-intention / 50 ) ]

if N-of-people-with-return-intention > 0 [
repeat floor (N-of-people-with-return-intention / 3) [
  ask one-of people with [ origin = 2 and citizen = 1 and my-migration-probability
>= 0 ] ;and migration-status < 3 ] ; Turks residing in Germany
   [ move-to-empty-one-of patches-2
     set migration-status migration-status + 1
     set citizen 2
     set tempStatus-2 "Returned Migrant"
     set return-migration (return-migration + 1)
     set N-of-people-with-return-intention N-of-people-with-return-intention - 1
     set NofReturnMigrants count people with [ tempStatus-2 = "Returned Migrant" ]
   ]
 ]
]

end


to plot-individual-migration-probability

  set-current-plot "Individual Probability to Migrate"
  clear-plot
  set-current-plot-pen "MP Turkey" ; Migration Probability of people in Turkey
  let list-1 [ ]
  let m 1
  while [  m <= potential-migrants-1 ] [
    set list-1 lput m list-1
    set m m + 1
    ]
  (foreach list-1 migration-probability-list-1 [ plotxy ?1 ?2 ])

  set-current-plot-pen "MP Germany"  ; Migration Probability of people in Germany
  let list-2 [ ]
  let n 1
  while [  n <= potential-migrants-2 ] [
    set list-2 lput n list-2
    set n n + 1
    ]
  (foreach list-2 migration-probability-list-2 [ plotxy ?1 ?2 ])

end
```

```
to  plot-migrant-stock-at-destination

   set-current-plot "Turkish Migrant Stock"
   set-plot-x-range 0 100
   set-plot-y-range 0 100
   set-plot-pen-interval 1

end


to enter-exit-labour-force ; Retirement and new generations entering the LF

; Aging and retirement process
  ask people [ set age ( age + 1 ) ]
  ask people with [ age = 65 ]  [ set tempStatus "Retired" set color grey ]

  set nOfRetirees-1 count people with [ citizen = 1 and tempStatus = "Retired" ]
  set nOfRetirees-2 count people with [ citizen = 2 and tempStatus = "Retired" ]

  set nOfRetiredEmployees-1  count people with  [ citizen = 1 and tempStatus =
"Retired" and myEmployer != nobody ]
  set nOfRetiredEmployees-2  count people with  [ citizen = 2 and tempStatus =
"Retired" and myEmployer != nobody ]

  set nOfRetiredUnemployed-1 count people with  [ citizen = 1 and tempStatus =
"Retired" and myEmployer = nobody ]
  set nOfRetiredUnemployed-2 count people with  [ citizen = 2 and tempStatus =
"Retired" and myEmployer = nobody ]

  set nOfRetiredMigrants     count people with  [ citizen = 1 and origin = 2 and
tempStatus = "Retired" ]
  ask n-of ( nOfRetiredMigrants / 3 ) people with [ citizen = 1 and origin = 2 and
tempStatus = "Retired" ]
       [
        move-to-empty-one-of patches-2
        set color 112
        set migration-status 10   ; to make sure the retired person will not move
again.
        set tempStatus-2 "Returned Migrant"
        ] ;;  retired migrants return to their home country; display their number

  ask people with [ tempStatus = "Retired" and citizen = 1 and origin = 1 and age =
82 ] [ die ]
  ask people with [ tempStatus-2 = "Returned Migrant" and age = 78 ]  [ die ]

; Young workers join the labour force: New Generation (calculated as annual crude
birth-rate * Labour Force population of 25 years ago)
      set nOfNewEntrants-1 floor ( populationInGermany * Birth-Rate-Germany /
100000 )
      create-people nOfNewEntrants-1
                  [ set citizen  1  set origin 1    set my-work-history [ ]    set
myEmployer nobody
                    set dateOfEntry ( 1991 + ticks )
                    set age 25
                    move-to-empty-one-of patches-1
                    set myWage ( 10 * ( e ^ random-normal 1 0.7 ) )
                    set myWage precision ( myWage * nominalGermanWage /
```

```
unNormalisedMeanWage-1 ) 0
                    set myInitialWage myWage
                    set tempStatus "New"
                    become-unemployed
                  ]

      set nOfNewEntrants-2 floor ( populationInTurkey * Birth-Rate-Turkey  / 100000
)
      create-people nOfNewEntrants-2
                  [ set citizen  2  set origin 2    set my-work-history [ ]    set
myEmployer nobody
                    set dateOfEntry ( 1991 + ticks )
                    set age 25
                    move-to-empty-one-of patches-2
                    set myWage ( 10 * ( e ^ random-normal 1 0.7 ) )
                    set myWage precision ( myWage * nominalTurkishWage /
unNormalisedMeanWage-2 ) 0
                    set myInitialWage myWage
                    set tempStatus "New"
                    become-unemployed
                  ]
end


to become-unemployed

      set myLastEmployer myEmployer
      set myEmployer nobody
      set myLastWage myWage
      set myWage 0
      set color red
      set tempStatus "Unemployed"

end


to calculate-new-populations

; Employment and unemployment data read from file. The employment/Labor force ratio
is calculated. New labour force is endogenously calculated. Then the number of the
employed is calculated as (new population)*(empl/LF).

 set empl-LF-ratio-1  employmentInGermany / ( employmentInGermany +
unemploymentInGermany )
 set empl-LF-ratio-2  employmentInTurkey  / ( employmentInTurkey +
unemploymentInTurkey )

 set new-LF-1         ( new-LF-1 + new-migration - return-migration +
nOfNewEntrants-1 )
 set new-empl-1 floor ( new-LF-1 * empl-LF-ratio-1  )
 set new-unempl-1     ( new-LF-1 - new-empl-1 )

 set new-LF-2         ( new-LF-2 - new-migration + return-migration +
nOfNewEntrants-2 )
 set new-empl-2 floor ( new-LF-2 * empl-LF-ratio-2 )
 set new-unempl-2     ( new-LF-2 - new-empl-2 )
```

```
end


;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; NORMAL DISTRIBUTION
OF WAGES ::::::::::::::::::::::::::::::::::::::::::::::::::::::::

to distribute-wages

 let workers-1 people-on patches-1
 let workers-2 people-on patches-2

repeat 100 [

  ask workers-1 [ set myWage precision ( 10 * ( e ^ random-normal 1 sdWage-1 ) ) 0
]
  ask workers-2 [ set myWage precision ( 10 * ( e ^ random-normal 1 sdWage-2 ) ) 0
]

  ; normalise
  set unNormalisedMeanWage-1 mean [ myWage] of workers-1
  set unNormalisedMeanWage-2 mean [ myWage] of workers-2

  ask workers-1 [ set myWage myWage * nominalGermanWage /  unNormalisedMeanWage-1
                  set myInitialWage myWage ]
  ask workers-2 [ set myWage myWage * nominalTurkishWage /  unNormalisedMeanWage-2
                  set myInitialWage myWage ]

  ; measure min, mean and max
  set minMyWage-1 min [ myWage ] of  workers-1
  set minMyWage-2 min [ myWage ] of  workers-2

  set minWageList-1 lput minMyWage-1 minWageList-1
  set minWageList-2 lput minMyWage-2 minWageList-2

  set meanMyWage-1 mean [ myWage ] of workers-1
  set meanMyWage-2 mean [ myWage ] of workers-2

  set meanWageList-1 lput meanMyWage-1 meanWageList-1
  set meanWageList-2 lput meanMyWage-2 meanWageList-2

  set maxMyWage-1 max [ myWage ] of  workers-1
  set maxMyWage-2 max [ myWage ] of  workers-2

  set maxWageList-1 lput maxMyWage-1 maxWageList-1
  set maxWageList-2 lput maxMyWage-2 maxWageList-2

  ; compared to average wages
  set lessThanAverageWage%-1 precision ( count workers-1 with [ myWage <
meanMyWage-1 ] / 10 ) 2
  set lessThanAverageWage%-2 precision ( count workers-2 with [ myWage <
meanMyWage-2 ] / 10 ) 2

  set lessThanAverageWage%List-1  lput lessThanAverageWage%-1 lessThanAverageWage%
List-1
  set lessThanAverageWage%List-2  lput lessThanAverageWage%-2 lessThanAverageWage%
List-2
```

```
  set lessThanHalfAverageWage%-1 precision ( count workers-1 with [ myWage < (
meanMyWage-1 * 0.5 ) ] / 10 ) 2
  set lessThanHalfAverageWage%-2 precision ( count workers-2 with [ myWage < (
meanMyWage-2 * 0.5 ) ] / 10 ) 2

  set lessThanHalfAverageWage%List-1  lput lessThanHalfAverageWage%-1
lessThanHalfAverageWage%List-1
  set lessThanHalfAverageWage%List-2  lput lessThanHalfAverageWage%-2
lessThanHalfAverageWage%List-2


  set moreThanTwiceAverageWage%-1 precision ( count workers-1 with [ myWage > (
meanMyWage-1 * 2 ) ] / 10 ) 2
  set moreThanTwiceAverageWage%-2 precision ( count workers-2 with [ myWage > (
meanMyWage-2 * 2 ) ] / 10 ) 2

  set moreThanTwiceAverageWage%List-1  lput moreThanTwiceAverageWage%-1
moreThanTwiceAverageWage%List-1
  set moreThanTwiceAverageWage%List-2  lput moreThanTwiceAverageWage%-2
moreThanTwiceAverageWage%List-2


  ; shape of distribution
  set wageDistribution-1 sort [ myWage ] of workers-1
  set wageDistribution-2 sort [ myWage ] of workers-2

  set bottomDecile-1 item ( precision ( nOfWorkers-1 / 10 ) 0 ) wageDistribution-1
  set bottomDecile-2 item ( precision ( nOfWorkers-2 / 10 ) 0 ) wageDistribution-2

  set lowerQuintile-1 item ( precision ( nOfWorkers-1 / 5 ) 0 ) wageDistribution-1
  set lowerQuintile-2 item ( precision ( nOfWorkers-2 / 5 ) 0 ) wageDistribution-2

  set middleQuintile-1 item ( precision ( 2 * nOfWorkers-1 / 5 ) 0 )
wageDistribution-1
  set middleQuintile-2 item ( precision ( 2 * nOfWorkers-2 / 5 ) 0 )
wageDistribution-2

  set medianWage-1 median wageDistribution-1
  set medianWage-2 median wageDistribution-2

  set upperQuintile-1 item ( precision ( 3 * nOfWorkers-1 / 5 ) 0 )
wageDistribution-1
  set upperQuintile-2 item ( precision ( 3 * nOfWorkers-2 / 5 ) 0 )
wageDistribution-2

  set topQuintile-1 item ( precision ( 4 * nOfWorkers-1 / 5 ) 0 ) wageDistribution-
1
  set topQuintile-2 item ( precision ( 4 * nOfWorkers-2 / 5 ) 0 ) wageDistribution-
2

  set topDecile-1 item ( precision ( 9 * nOfWorkers-1 / 10 ) 0 ) wageDistribution-1
  set topDecile-2 item ( precision ( 9 * nOfWorkers-2 / 10 ) 0 ) wageDistribution-2


  set bottomDecileList-1 lput bottomDecile-1 bottomDecileList-1
  set bottomDecileList-2 lput bottomDecile-2 bottomDecileList-2
```

```
  set lowerQuintileList-1 lput lowerQuintile-1 lowerQuintileList-1
  set lowerQuintileList-2 lput lowerQuintile-2 lowerQuintileList-2

  set middleQuintileList-1 lput middleQuintile-1 middleQuintileList-1
  set middleQuintileList-2 lput middleQuintile-2 middleQuintileList-2

  set medianList-1 lput medianWage-1 medianList-1
  set medianList-2 lput medianWage-2 medianList-2

  set upperQuintileList-1 lput upperQuintile-1 upperQuintileList-1
  set upperQuintileList-2 lput upperQuintile-2 upperQuintileList-2

  set topQuintileList-1  lput topQuintile-1 topQuintileList-1
  set topQuintileList-2  lput topQuintile-2 topQuintileList-2

  set topDecileList-1 lput topDecile-1 topDecileList-1
  set topDecileList-2 lput topDecile-2 topDecileList-2

  ; creates list of all wages over all runs i.e. if there are 1,000 agents and 100
runs, it will contain 100,000 items
   set accumWages-1 (sentence [myWage] of workers-1 accumWages-1)
   set accumWages-2 (sentence [myWage] of workers-2 accumWages-2)
]
;-----------------------------------------------
; RESULTS
; results over all runs

set meanBottom10-1 precision ( mean bottomDecileList-1) 1
set meanBottom10-2 precision ( mean bottomDecileList-2) 1
set decile-1 lput 10 decile-1
set decile-2 lput 10 decile-2
set model-1 lput meanBottom10-1 model-1
set model-2 lput meanBottom10-2 model-2
set target-1 lput targetBottom10-1 target-1
set target-2 lput targetBottom10-2 target-2
set cumulativeDifferenceSquared-1 ( ( targetBottom10-1 - meanBottom10-1 ) ^ 2  )
set cumulativeDifferenceSquared-2 ( ( targetBottom10-2 - meanBottom10-2 ) ^ 2  )

set meanLower20-1  precision ( mean lowerQuintileList-1) 1
set meanLower20-2  precision ( mean lowerQuintileList-2) 1
set decile-1 lput 20 decile-1
set decile-2 lput 20 decile-2
set model-1 lput meanLower20-1 model-1
set model-2 lput meanLower20-2 model-2
set target-1 lput targetLower20-1 target-1
set target-2 lput targetLower20-2 target-2
set cumulativeDifferenceSquared-1 ( cumulativeDifferenceSquared-1 + (
targetLower20-1 - meanLower20-1 ) ^ 2  )
set cumulativeDifferenceSquared-2 ( cumulativeDifferenceSquared-2 + (
targetLower20-2 - meanLower20-2 ) ^ 2  )

set meanLower40-1  precision ( mean middleQuintileList-1) 1
set meanLower40-2  precision ( mean middleQuintileList-2) 1
set decile-1 lput 40 decile-1
set decile-2 lput 40 decile-2
set model-1 lput meanLower40-1 model-1
set model-2 lput meanLower40-1 model-2
```

```
set target-1 lput targetLower40-1 target-1
set target-2 lput targetLower40-1 target-2
set cumulativeDifferenceSquared-1 ( cumulativeDifferenceSquared-1 + (
targetLower40-1 - meanLower40-1 ) ^ 2  )
set cumulativeDifferenceSquared-2 ( cumulativeDifferenceSquared-2 + (
targetLower40-2 - meanLower40-2 ) ^ 2  )

set meanMedian-1 precision ( mean medianList-1 ) 1
set meanMedian-2 precision ( mean medianList-2 ) 1
set decile-1 lput 50 decile-1
set decile-2 lput 50 decile-2
set model-1 lput meanMedian-1 model-1
set model-2 lput meanMedian-2 model-2
set target-1 lput targetMedian-1 target-1
set target-2 lput targetMedian-2 target-2
set cumulativeDifferenceSquared-1 ( cumulativeDifferenceSquared-1 + ( targetMedian-
1 - meanMedian-1 ) ^ 2  )
set cumulativeDifferenceSquared-2 ( cumulativeDifferenceSquared-2 + ( targetMedian-
2 - meanMedian-2 ) ^ 2  )

set mean60-1  precision ( mean upperQuintileList-1) 1
set mean60-2  precision ( mean upperQuintileList-2) 1
set decile-1 lput 60 decile-1
set decile-2 lput 60 decile-2
set model-1 lput mean60-1 model-1
set model-2 lput mean60-2 model-2
set target-1 lput target60-1 target-1
set target-2 lput target60-2 target-2
set cumulativeDifferenceSquared-1 ( cumulativeDifferenceSquared-1 + ( target60-1 -
mean60-1 ) ^ 2  )
set cumulativeDifferenceSquared-2 ( cumulativeDifferenceSquared-2 + ( target60-2 -
mean60-2 ) ^ 2  )

set meanTop20-1  precision ( mean topQuintileList-1) 1
set meanTop20-2  precision ( mean topQuintileList-2) 1
set decile-1 lput 80 decile-1
set decile-2 lput 80 decile-2
set model-1 lput meanTop20-1 model-1
set model-2 lput meanTop20-2 model-2
set target-1 lput targetTop20-1 target-1
set target-2 lput targetTop20-2 target-2
set cumulativeDifferenceSquared-1 ( cumulativeDifferenceSquared-1 + ( targetTop20-1
- meanTop20-1 ) ^ 2  )
set cumulativeDifferenceSquared-2 ( cumulativeDifferenceSquared-2 + ( targetTop20-2
- meanTop20-2 ) ^ 2  )

set meanTop10-1 precision ( mean topDecileList-1) 1
set meanTop10-2 precision ( mean topDecileList-2) 1
set decile-1 lput 90 decile-1
set decile-2 lput 90 decile-2
set model-1 lput meanTop10-1 model-1
set model-2 lput meanTop10-2 model-2
set target-1 lput targetTop10-1 target-1
set target-2 lput targetTop10-2 target-2
set cumulativeDifferenceSquared-1 ( cumulativeDifferenceSquared-1 + ( targetTop10-1
- meanTop10-1 ) ^ 2  )
set cumulativeDifferenceSquared-2 ( cumulativeDifferenceSquared-2 + ( targetTop10-2
```

```
- meanTop10-2 ) ^ 2  )

; outputs
output-print (word "Wage Distribution in Country-1" )
output-print " "

output-print (word "Mean minimum " precision ( mean minWageList-1 ) 1 " ("
precision ( standard-deviation minWageList-1 ) 1 ")" )
output-print (word "Mean mean " precision (  mean meanWageList-1 ) 1 " ("
precision ( standard-deviation meanWageList-1 ) 1 ")" )
output-print (word "Mean max " precision ( mean maxWageList-1 ) 1 " ("  precision (
standard-deviation maxWageList-1 ) 1 ")" )
output-print " "
output-print (word "Mean % Less Than Average Wage "  precision ( mean
lessThanAverageWage%List-1 ) 1
                                                  " (" precision ( standard-
deviation lessThanAverageWage%List-1 ) 1 ")" )

output-print (word "Mean % More Than Twice Average Wage " precision (  mean
moreThanTwiceAverageWage%List-1 ) 1
                                                   " (" precision ( standard-
deviation moreThanTwiceAverageWage%List-1  ) 1 ")" )

output-print " "
output-print (word "Bottom decile (10%) "  meanBottom10-1" (" precision ( standard-
deviation  bottomDecileList-1 ) 1 ")" )
output-print (word "Lower quintile (20%) " meanLower20-1 1 " (" precision (
standard-deviation lowerQuintileList-1 ) 1 ")" )
output-print (word "Middle quintile (40%) "  meanLower40-1  1 " (" precision (
standard-deviation middleQuintileList-1 ) 1 ")" )
output-print (word "Mean median (50%) " meanMedian-1 " ("  precision ( standard-
deviation medianList-1 ) 1 ")" )
output-print (word "Upper quintile (60%) " mean60-1 " (" precision ( standard-
deviation upperQuintileList-1 ) 1 ")")
output-print (word "Top quintile (80%) " meanTop20-1  " (" precision ( standard-
deviation topQuintileList-1 ) 1 ")")
output-print (word "Top decile (10%) " meanTop10-1 1 " (" precision ( standard-
deviation  topDecileList-1 ) 1 ")" )
output-print (word "Sum of squares " precision cumulativeDifferenceSquared-1 1 )
output-print " "
output-print " "

output-print (word "Wage Distribution in Country-2" )
output-print " "

output-print (word "Mean minimum " precision ( mean minWageList-2 ) 1 " ("
precision ( standard-deviation minWageList-2 ) 1 ")" )
output-print (word "Mean mean " precision (  mean meanWageList-2 ) 1 " ("
precision ( standard-deviation meanWageList-2 ) 1 ")" )
output-print (word "Mean max " precision ( mean maxWageList-2 ) 1 " ("  precision (
standard-deviation maxWageList-2 ) 1 ")" )
output-print " "
output-print (word "Mean % Less Than Average Wage "  precision ( mean
lessThanAverageWage%List-2 ) 1
                                                  " (" precision ( standard-
deviation lessThanAverageWage%List-2 ) 1 ")" )
```

```
output-print (word "Mean % More Than Twice Average Wage " precision (  mean
moreThanTwiceAverageWage%List-2 ) 1
                                                    " (" precision ( standard-
deviation moreThanTwiceAverageWage%List-2  ) 1 ")" )

output-print " "
output-print (word "Bottom decile (10%) "  meanBottom10-2" (" precision ( standard-
deviation  bottomDecileList-2 ) 1 ")" )
output-print (word "Lower quintile (20%) " meanLower20-2 1 " (" precision (
standard-deviation lowerQuintileList-2 ) 1 ")" )
output-print (word "Middle quintile (40%) "  meanLower40-2  1 " (" precision (
standard-deviation middleQuintileList-2 ) 1 ")" )
output-print (word "Mean median (50%) " meanMedian-2 " ("  precision ( standard-
deviation medianList-2 ) 1 ")" )
output-print (word "Upper quintile (60%) " mean60-2 " (" precision ( standard-
deviation upperQuintileList-2 ) 1 ")")
output-print (word "Top quintile (80%) " meanTop20-2  " (" precision ( standard-
deviation topQuintileList-2 ) 1 ")")
output-print (word "Top decile (10%) " meanTop10-2 1 " (" precision ( standard-
deviation  topDecileList-2 ) 1 ")" )
output-print (word "Sum of squares " precision cumulativeDifferenceSquared-2 1 )
output-print " "
output-print " "

;:::::::::::::::::::::::::::::::::: PLOTS ::::::::::::::::::::::::::::::

; to produce percentage distribution of households by budget
  set-current-plot "Wages"
  set-plot-x-range 0 30000
  set-plot-y-range 0 30
  set bar-interval 100 ; width of each bar

end
```

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Education

2009–cont. **PhD in Economics and Social Sciences**.
Vienna University of Technology

2006–2007 **43th Diploma Program**.
Diplomatic Academy of Vienna

2005–2008 **Master's Degree in Economics and Computer Science**.
Vienna University of Technology

2001–2005 **Bachelor's Degree in Economics and Computer Science**.
Vienna University of Technology

1992–2000 **Österreichisches Sankt Georg's Kolleg**.

PhD thesis

title *An Agent-Based Model of Migration from Turkey to Germany*

supervisor Prof. Gerhard Hanappi

abstract Aim of the PhD thesis is to analyze and model migration flows from Turkey towards EU countries, particularly Germany, in the period between 1961 and 2015. An agent-based model is built to simulate migratory flows from Turkey in time periods selected according to the major events affecting migration, such as economic shocks, political developments and introduction of restrictive policies. Agent based modeling is chosen for being a practical analytical method for representing the evolution of structures at the macro level from micro-level decisions. The model has a unifying approach and attempts to combine propositions of different migration theories. Based upon the migration history between Turkey and Europe, it is assumed that migration flows are initiated through governmental or institutional actions, e.g. labor recruitment activities of governments or employers. Once migration has started, it is sustained through migrant networks and by continuing demand for labor in receiving countries. Migration is a life-cycle decision, and overlapping generations exist. 'Agents' in the model decide on migration according to (the existence of) family and migrant stock at destination, employment probabilities at destination, effectual immigration policies and political stability at the source country. Initial values of state variables are modeled according to actual demographic and macroeconomic data of the European Commission (AMECO Database) and of the World Bank.

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Work Experience

2013–cont. **Research Assistant**, *Istanbul Bilgi University*, Institute of Social Sciences.
MBA Program.
Achievements:
- Program Coordinator of Management Information Systems Online Program (2015-2016).
- Teaching Project Management (2016-2017).
- Teaching Assistant of Operations Management, Business Management, Statistics.

2012–2013 **Human Resources Consultant**, *Kratos Consultancy and Human Resources Firm*. Istanbul.
Responsibilities:
- Consultancy of companies such as IBM, Atos, Ericsson and JP Morgan at the recruitment of their IT staff

Conferences and Symposia

ICIMHS Zurich 2017 **19th International Conference on International Migration and Human Security**, *"The Effects of an Immigration Policy on the Economic Integration of Migrants and on Natives' Attitudes: The Case of Syrian Refugees in Turkey*.

EBES Vienna 2016 **Eurasia Business and Economics Society**, *"Primary Factors keeping Employees at their Positions: Cases from Turkish Workplaces"*.

EBES Istanbul 2016 **Eurasia Business and Economics Society**, *"Mobbing: A Qualitative Analysis of Cases from Turkish White-collar Employees"*.

Symposium - 2015 **Metamorphosis of Europe - Step 2, European Unification in Trouble**, *organized by Vienna University of Technology and Austrian Chamber of Labour*, "Immigration - Consequences and Prospects".

ICPD Montreal 2015 **17th International Conference on Population and Development**, *"Immigration and Gender Equality – An Analysis of the Labor Market Characteristics of Turkish Migrants Living in Germany"*.

EAEPE Istanbul 2006 **Developing Economies: Multiple Trajectories, Multiple Developments**, *"Education and Labour Markets in SEE Countries"*.

Areas of Interest

Economics
Labour Economics,
Developmental Economics,
Welfare Economics,
Immigration Policy,
Integration policy

Foreign Languages

English	Advanced	*Cambridge Proficiency Exam*
German	Advanced	*Externistenreifeprüfungszeugnis*
French	Advanced	*DALF C1*
Italian	Intermediate	

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