September 2016
Volume: 13, **No**: 3, pp. 377 – 392
ISSN: 1741-8984
e-ISSN: 1741-8992
www.migrationletters.com

MIGRATION LETTERS

Article history: Received 23 October 2015; accepted 29 April 2016

Contribution of migration to replacement of population in Turkey

Dalkhat M. Ediev †
M. Murat Yüceşahin §

Abstract

Relationship between migration and replacement of population has attracted a great deal of scholarly attention. Migration is considered to be a key factor in the growth and replacement of populations. Net migration sometimes exceeds natural change and drive population growth. Migration can compensate for missing births in low-fertility areas, provinces, or countries. Although past and recent general fertility trends, regional inequalities, and migration patterns in Turkey have been well documented through demographic surveys and censuses, the relationship between migration and the replacement of population by region in the country has not been adequately examined. Thereby, in this study, we explore the contribution of migration to the replacement of population in Turkey. Turkey's regions, at the NUTS 1 level, are very diverse in their levels of fertility and migration, which makes it very interesting to study the two processes in tandem. We use a recently proposed methodology of studying the population replacement levels through the indicators of Combined Reproduction and Times to Half-Replacement, which can be computed from limited data and offers good insights into the demographic consequences of a given combination of fertility and migration levels.

Keywords: Migration; fertility; population replacement; modelling; population geography; Turkey

Introduction

Migration is usually contextualized with fertility and mortality in most fundamental explanations of the basic components of population change. So indeed individuals have an impact on the size of population through birth and death naturally but, in all probability, many times through migration (White and Lindstrom, 2006; Rowland, 2012). Migration is the most-repeated demographic behaviour of individuals and the least predictable component of population change, and it is harder to define than the other demographic growth processes, namely mortality and fertility (Yaukey et al., 2007: 324; Newbold, 2010: 126; Yüceşahin et al., 2015: 2-4). However, migration is frequently the main

† Dalkhat M. Ediev, North-Caucasian State Humanitarian-Technological Academy, Cherkessk, Russia; Wittgenstein Centre (International Institute for Applied Systems Analysis), Vienna, Austria.
Email: ediev@iiasa.ac.at.
§ M. Murat Yüceşahin, Department of Geography, Ankara University, Ankara, Turkey.
Email: mmyucesahin@yahoo.com.

component of population growth or decline both at the community and regional levels. Apart from its complexity, migration theoretically favours population growth at the place of destination at the expense of growth at the place of origin, both directly through the simple exchange of population and indirectly through contributions to the population reproduction, age selectivity, and differential fertility (Sivamurthy, 1982; Mitra, 1984; Ediev, 1999 and 2007; Alho, 2008; Ortega and del Rey, 2007; Ediev et al., 2014). Therefore, it is important to take into account the implications of migration for the net migration rate (Rogers, 1966; Willekens, 1977; Rogers and Willekens, 1978; Inaba, 2009) at the regional level. In the long term, migration is also likely to favour the workforce at the place of destination, to the detriment of the place of origin. Selectivity on the one hand brings younger labourers and skills in demand to the destination's workforce, and on the other hand removes these from the population of origin (Yaukey et al., 2007).

In many countries, net migration greatly exceeds natural change, driving population growth or slowing population decline (Ediev et al., 2014). The contributions of net migration to population change are even more substantial at the subnational level. However, conventional demographic indicators ignore the role of migration as a supplement to fertility as a factor of population replacement and change. The indirect contributions of migration to population change may be studied by recently devised indicators measuring the migratory contributions to population reproduction as compared to fertility (Ediev et al., 2014: 624-625). Here, we apply this approach to study how migration affects population change and replacement across Turkey.

As in most other developing countries, the fertility rate in Turkey has seen dramatic declines over the past five decades. The fact that Turkey's total fertility rate declined from 6.28 children per woman to around two between the early 1960s and the early 2000s shows that the country has experienced a rapid fertility transition. Thus, a number of studies argue that Turkey is in the final phase of the demographic transition (Yavuz, 2006; Yüceşahin and Özgür, 2008; Yüceşahin, 2009; HUIPS, 2010). Although Turkey has recently reached slightly above the replacement level of fertility, there remain marked regional demographic differentials.

Beginning with the proclamation of the Turkish Republic in 1923, the inadequacy and imbalanced diffusion of social and economic developmental initiatives, meant to spread modernisation throughout the country, served to exacerbate the substantive regional inequalities to the detriment of the eastern regions (Yüceşahin and Özgür, 2008). During the whole period after 1923, regional divergence in socio-economic development was accompanied by marked inter-provincial migration and prominently concentrated migration flows, particularly from poor eastern provinces to the relatively developed western regions and particularly the large metropolitan areas of the country. This process, especially after the 1950s, led to a rapid urbanisation process which resulted mainly from rural to urban migration and market adjustment to

the inter-sector shift from agriculture to manufacturing and services (Eraydın, 2006: 37). As a result, between 1950 and 2010, the percentage of the country's urban population tripled from 25 to around 77. In the same period Turkey's population also climbed from 20.5 to around 76 million. In terms of the regional imbalances in the country, the most interesting change was the rise in the gap in fertility levels between the western and the south-eastern regions: fertility levels of very high-fertility provinces were 1.73 times the levels of low-fertility provinces in 1980, compared with 3.12 in 2000 (Yüceşahin and Özgür, 2008: 142). This change clearly points to how the difference in demographic characteristics between Turkey's western and south-eastern regions has gradually widened over time.

Although past and recent general fertility trends, regional inequalities, and migration patterns in Turkey have been well documented in research through the analysis of demographic sample surveys and censuses, the relationship between migration and the replacement of population by region in the country has not been examined extensively. The regions[1] of Turkey are very different in terms of levels of fertility and migration, which makes it very interesting to study the two processes in their geographic aspect. To this end, we use recently proposed methodology for studying the population replacement levels by the indicators of Combined Reproduction and Times to Half-Replacement (Ediev et al., 2014), which can be computed from limited data and offer good insights into the demographic consequences of a given combination of fertility and migration levels.

Background: Turkey's recent migration and fertility patterns

Geographical patterns of migration are the result of a combination of complex processes (Stillwell et al., 2008: 142). From the beginning of the 20th century, the inadequacy and imbalanced diffusion of social and economic developmental initiatives in Turkey served to exacerbate substantial regional inequalities to the detriment of the eastern regions. The liberal economic policies of the 1950-1960 period rapidly translated into investments in Turkey's western regions, with an intense capital accumulation and commercial tradition (Elmas, 2001). Thus, employment and production rose in the service and manufacturing sectors especially in the country's western and coastal regions, such as Istanbul, East Marmara, West Marmara, the Aegean, and West Anatolia. As a result, regional divergences in economic and social development led to significant increases in inter-provincial migration during the second half of the 20th century, mainly from relatively poor eastern provinces or regions to the developed western parts of the country.

Although the factors affecting migration flows are not limited to economic factors, the rapid urbanization process from the 1950s resulting from intensive migration from rural to urban areas became a factor of market adjustment to

[1] At the NUTS 1 level.

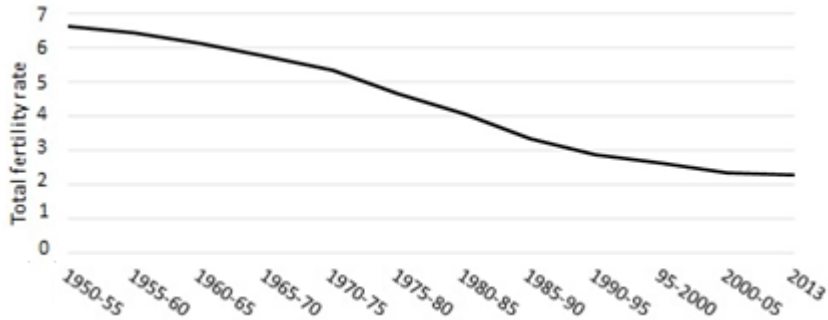
the inter-sectoral shift from agriculture to manufacturing and services. And the migration from east to west has increased continuously since 1980, but it is still not among the largest migration flows. In addition, rises in literacy, per capita income, employment in non-agricultural sectors, and urbanisation throughout the country (Table 1) but more rapidly in western regions heightened the differences between the east and west and determined the country's east-west dualism.

Table 1. Average levels of some selected developmental indicators in Turkey, 1935-2010

Indicator	Year								
	1935	1945	1955	1965	1975	1985	1990	2000	2010
Population (million)	16.3	18.8	24.1	31.4	40.7	50.7	56.5	67.8	73.7
Literacy (%)	19.3	30.2	41.0	48.8	63.7	77.5	80.5	87.3	89.7
Labour force in agriculture (%)	81.8	73.7	77.5	71.9	67.3	60.0	53.7	48.4	25.2
Urban population (%)	23.5	24.9	28.8	34.4	41.8	53.0	59.0	64.9	76.3
GDP per capita*	Na	Na	Na	1019**	1548	3327	4660	6950	10079

Source: Data from the SIS (1996; 2002; 2003) and TSI (2014a; b; c; d)
** US dollars. ** 1971 data. Na: Not available.*

Figure 1. The pace of fertility decline in Turkey, 1950-2013



Source: Data from the UN (2015) and HUIPS (2014)

Over the last century Turkey has witnessed various extensive socio-economic and cultural changes. These ongoing shifts, which can be seen as the "modernisation" of the state, institutions, and society, are continuing to shape the social structure. Since the proclamation of the Turkish Republic in 1923, significant changes have taken place in some basic demographic measures (Table 1). The 1927 census gave Turkey's population as 13.6 million (CSO, 1953: 5), versus its current population of over 75 million (Turkish Statistical

Institute[2], TSI, 2015). The fertility rate has declined over the past five decades. In the early 1960s, the Total Fertility Rate (TFR) was around 6 children per woman, while current TFR is slightly above the replacement level (2.26 children per woman aged 15-49 in 2013, Figure 1) (HUIPS, 2014: 60). Life expectancy at birth increased considerably from 41.0 to 73.4 years in the 1950-1955 and 2005-2010 periods for both sexes (UN, 2015).

Although Turkey entered the last phase of demographic transition during the 1980s (Yavuz, 2006; Yüceşahin and Özgür, 2008) and the last period of demographic transition is expected to be completed by the mid-21st century (Koray 1997; Ünalan 1997; Yüceşahin 2009; HUIPS 2010), substantial regional variations in fertility levels still persist, as can be observed at the NUTS 1 level from the only available data source, the Turkey Demographic and Health Survey 2008 (HUIPS, 2009) (Table 2; Figure 2).

Table 2. Trends in net migration rate (per 1,000 population) in the 2007-2008 and 2013-2014 periods and TFR (children per woman) in 2008, by region[3]

	TFR	Net migration rate						
NUTS 1 region	2008	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14
Istanbul	1.78	2.10	3.06	7.77	8.98	2.20	4.69	1.00
West Marmara	1.38	9.73	4.03	4.62	4.95	7.74	5.89	13.96
Aegean	1.91	3.70	1,74	0.10	0.13	2.60	1.59	4.61
East Marmara	1.80	12.57	6.37	5.51	6.18	5.27	6.56	7.69
West Anatolia	2.40	2.98	4.60	5.59	7.05	3.62	3.84	5.25
Mediterranean	2.09	2.15	0.52	0.58	-1.24	-1.09	-0.72	0.35
Central Anatolia	2.09	-9.00	-4.99	-8.95	-8.78	-4.11	-4.80	-6.63
West Black Sea	1.90	-4.35	-2.40	-11.16	-8.80	-3.20	-5.69	-7.72
East Black Sea	2.10	-2.24	0.63	-8.98	-9.88	7.29	-3.61	-1.77
North East Anatolia (TRA)	2.59	-26.12	-14.72	-13.58	-12.46	-15.35	-19.19	-19.34
Central East Anatolia (TRB)	3.33	-10.89	-9.09	-9.08	-16.49	-7.19	-7.12	-12.23
South East Anatolia (TRC)	3.47	-7.56	-7.12	-3.80	-4.11	-7.55	-5.70	-6.12

Data from HUIPS (2009) and TSI (2015)

According to the regions at the NUTS 1 level, the spatial distribution of TFRs in 2008 illustrates that while the Istanbul, West Marmara, and East

[2] Formerly the Central Statistical Office (CSO), now the State Institute of Statistics (SIS).

[3] The Address Based Population Registration System (ABPRS) was established in 2007 with the aim of monitoring population information related to permanent residence and population movements on a regular basis. From this system, information related to the size of the population and its basic characteristics is produced.

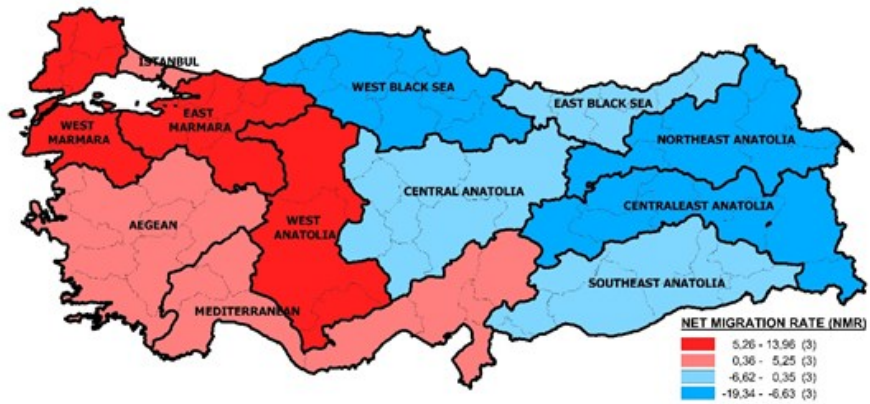
Data on internal migration has been produced annually starting with information referring to the 2007-2008 period. The coverage of internal migration: National residents who migrate between within the Republic of Turkey are covered. Definitions: Internal migration: Internal migration is defined as changes in the usual residence addresses of the population within one year in the specific areas (region, province, district, etc.) inside the country in ABPRS. In-migration: Migrants who arrive at a specific area from other areas within the country. Out-migration: Migrants who depart from a specific area to other areas within a country. Net migration: The difference between in-migration and out-migration for a specific area. If in-migration exceeds out-migration, net migration is positive. If out-migration exceeds in-migration, net migration is negative. Net migration rate: This is the number of net migration per thousand persons who are able to migrate (TSI, 2016).

Marmara regions had the lowest levels[4] of TFRs, North East Anatolia, Central East Anatolia, and South East Anatolia had the highest fertility levels[5]. Therefore, it may be stressed that significant regional fertility differences currently persist between the western and eastern parts of the country.

Figure 2. Distribution of total fertility rates by region, 2008

Source: Data from HUIPS (2009)

Figure 3. Distribution of the net migration rate by region in the 2013-2014 period



Source: Data from TSI (2015)

Through the Turkish Statistical Institute (TSI) founding the Address Based Population Registration System (ABPRS) in 2006 and NUTS regions, it has been possible to follow migration trends from 2007 by 12 different regions (Table 2). Between 2007 and 2014, while five regions (Istanbul, West Marmara, East Marmara, Aegean, and West Anatolia) had continuously positive net

[4] Between 1.78 and 1.90 children per woman aged 15-49.
[5] Between 2.59 and 3.47 children per woman aged 15-49.

migration rates, six (Central Anatolia, West Black Sea, East Black Sea, North East Anatolia, Central East Anatolia, and South East Anatolia) had continuously negative migration rates. While the Mediterranean region had positive migration rates in the 2007-2008, 2009-2010, and 2013-2014 periods, it had slightly negative net migration rates in the 2010-2011 and 2012-2013 periods.

According to the regions at the NUTS 1 level (Table 2; Figure 3), the spatial distribution of net migration in the 2013-2014 period shows that West Marmara achieved the highest positive rate (14.0‰). The East Marmara region had the second-highest net migration rate (7.7‰). The West Anatolia (5.35‰), Aegean (4.6‰), Istanbul (1.0‰) and Mediterranean (0.4‰) regions had positive net migration rates in the 2013-2014 period, respectively. On the other hand, the North East Anatolia region had the lowest negative net migration rate (-19.3‰) both in the most recent period as in the whole period in 2007-2008 and 2013-2014. The Central East Anatolia region had the second-lowest negative net migration rate (-12.2‰) in the most recent period. And the West Black Sea (-7.7‰), Central Anatolia (-6.6‰), South East Anatolia (-6.1‰), and East Black Sea regions all had negative net migration rates in the most recent period.

Data and method

In this study, the data were derived from different statistical sources by different indicators as follows: As baseline data for in- and out- migration, net migration, and female population by region at the NUTS 1 level for the periods of 2007-2008, 2008-2009, 2009-2010, 2010-2011, 2011-2012, 2012-2013, and 2013-2014, the data were taken from the Address Based Population Registration System (ABPRS) (TSI, 2015). For the region-specific total fertility rates, the data were taken from the only and latest data source of the Turkey Demographic and Health Survey 2008 (HUIPS, 2009).

To assess what role migration plays as a source of population change and the population replacement prospects, where both fertility and migration are taken into account, in Turkish regions, we compute the Effective Net Migration (ENM), Migratory Fertility (MF), Combined Reproduction (CR), and Time to Half-Replacement (THR) as suggested by Ediev et al. (2014). These indicators, similar to the conventional TFR, refer to a hypothetical birth cohort that may emerge if current fertility, mortality, and migration rates are fixed time-constant over a period long enough for the cohort to complete its reproduction. The former index, ENM, indicates how many migrants of reproduction age (namely, aged 15-44 years) flow into or out of the hypothetical cohort. In the original work, Ediev et al. (2014) compute the ENM by assuming time-constant age-specific migration rates and survival probabilities. That approach is hard to implement in our study due to data limitations. Therefore, we opt for the less data-demanding indirect approximation suggested by Ediev et al (2014: 632):

$$ENM \approx 29.4m + 1.11m^2 \quad (1)$$

where m is the female net migration rate at ages 15-44 computed as the net migration of women in that age range divided by the female population of the same age in the receiving population. Ediev et al (2014: 632) suggest the regression (1) to be accurate, with R^2 of 99.8% in a rich database comprising countries of various demographic profiles.

ENM measures the amount of migration per 1,000 births in the original birth cohort of the receiving (or sending, in case of negative ENM) population that contributes to the fertility immediately in the cohort where the migrants flow in or out. Their children (born either before or after the migration took place) are assumed to come, earlier or later, with their parents to the receiving population and to contribute to the generations formed by children of the original birth cohort. Hence, migratory contributions to the fertility in the receiving[6] population are measured by the Migratory Fertility, MF, as a product of ENM and of TFR of migrants:

$$MF = \frac{ENM}{1000} \cdot TF_{migr} \quad (2)$$

where the TFR of the migrant population is assumed to be identical to the TFR in the general population[7]. Combined Reproduction, then, is a composite of the original TFR in the population of interest and of MF:

$$CR = TFR + MF = TFR + \frac{ENM}{1000} \cdot TF_{migr} \quad (3)$$

Conveniently, CR has an interpretation similar to that of the conventional TFR: it indicates how many children, relative to the number of births in the parental cohort, will be born to the next generation given the continuation of current rates and assuming children are born to both the original parental generation and to the migrants that flow in/out of that generation. So, a CR of about 2.2[8] indicates the stability of cohorts' sizes, generation after generation, while a CR exceeding that level indicates expanding sizes of birth cohorts, and a lower CR indicates prospects of shrinking cohort sizes.

As population replacement happens through fertility in the original population and to the migrants, another indicator, THR, measures – roughly and with many precautions to be kept in mind[9] – by what time half of the births in the receiving population will be formed by the descendants of migrants coming into the population from the current moment on. THR is formally approximated by assuming exponential growth of the cohorts' sizes:

$$THR = T\frac{ln(0.5)}{ln(\frac{TFR}{CR})} \quad (4)$$

where $T \approx 30$ is the demographic generation length. Although THR may not

[6] Sending in the case of negative ENM.
[7] We find that this assumption, originally used by Ediev et al. (2014) in the context of international migration, may be even better justified in the context of internal migrations considered here.
[8] Assuming Turkish mortality rates as of 2013.
[9] See Ediev et al., 2014 for discussion.

be taken at its face value as an indicator of actual social turnover, its short values may indicate substantial future social and cultural changes initiated by sheer population compositional changes due to migration[10].

We compute the above-described indicators for all regions of Turkey to see the variation of population reproduction and replacement across the country. Due to the lack of reliable data and also given our focus on cross-Turkey comparisons, we do not consider international migrations that play a minor role as compared to the internal population movements at the regional level.

Results

In Figure 4, we show the main estimated indicators at once, for the period 2007-2014 [11]. Geographic variations of ENM, CR, and MF may also be seen in Figures 5 to 7. Detailed results are presented in Table 3.

As indicated by the estimation results, migration does play an important role as a supplement or counter-actor to fertility in the replacement of the populations of Turkish regions. Most of the regions in Turkey have a combination of fertility and internal migration that prevents substantial population decline in the long run.

In Istanbul, the East Marmara, and West Anatolia – despite relatively low TFR in the first two – the net in-migration is so high that CR in these regions reaches about 2.5 or even higher[12]. That enables dynamic population growth in those three regions, by about 25-50% every 30 years.

In North East Anatolia, Central East Anatolia, and South East Anatolia, the CR is also as high as 2.5-3.0 – yet in these regions CR remains that high due to high TFR and despite substantial out-migration. These three regions are on a track of high growth and stable supply of migrants to other regions.

In Central Anatolia, the West Black Sea, and the East Black Sea, despite TFR being close to 2.0, substantial out-migration (MF of about -0.4) leads to low CR of 1.5-1.7[13]. Similarly, low CR and population declining prospects apply to the West Marmara, where, however, weak population reproduction prospects are formed by low TFR and insufficient in-migration.

In four regions, THR is relatively short (replacement of half-population by migrants[14] in less than 100 years) due to either low TFR (the West Marmara) or high net migration (West Anatolia), or a combination of both (Istanbul, the East Marmara).

[10] THR does not, however, indicate if that change may be offset by assimilation or migration reversals; neither does it show how substantial is the change originating in migration as compared to the level of "normal" social evolution.

[11] Note that we show TFR for Turkey as a whole only for comparative purposes, and without any allowance made for international migration, as mentioned above. Also keep in mind that, due to a lack of data, we use regional TFRs for 2008.

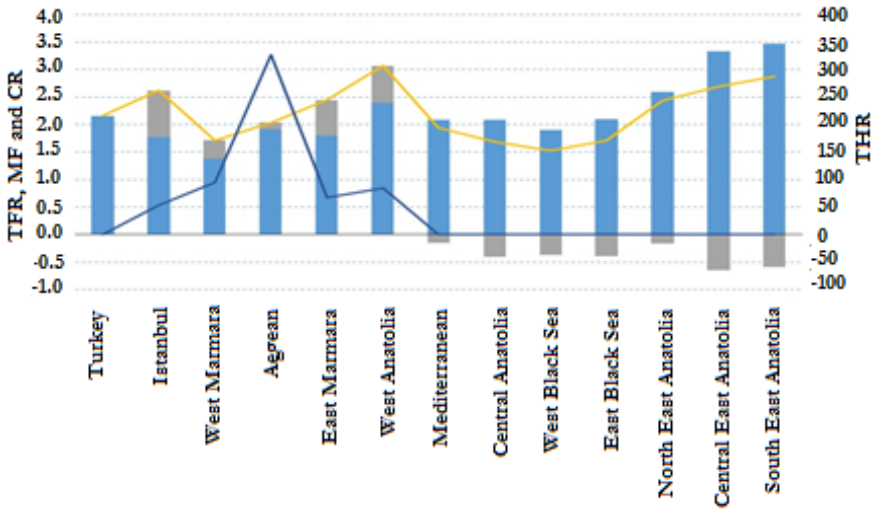
[12] More than 3 in West Anatolia.

[13] Meaning a population decline by about 25-30% every 30 years.

[14] The interpretation of THR given here is rather informal because THR calculations are based on a set of simplifying assumptions (Ediev et al., 2014).

Generally speaking, migration to the Northern-Western regions substantially boosts population reproduction at the expense of weakening the population reproduction in the East and the South of the country. On the other hand, migration also plays a role as a stabilizer of population change: MF tends to be positive in regions with relatively low fertility but negative in regions with high fertility. While the TFR varies from 1.4 to 3.5, CR that includes the contributions of migration varies in a narrower range from 1.5 to 3.1. The standard deviation of CR (0.5) is also smaller than the standard deviation of TFR (0.6). The compensatory role of net migration may also be seen from the negative correlation coefficient (-0.52) between regional TFR and MF.

Figure 4. Total Fertility (TFR), Migratory Fertility (MF), Combined Reproduction (CR), and Time to Half-Replacement (THR) by region, 2007-2014



Source: Data from TSI (2015), authors' calculations

The estimation results averaged over the whole period 2007-2014 hide substantial time variation over the period. The ENM variation coefficients calculated as the ratio of the standard deviation to the mean over the period are, expectedly, high for the regions with low levels of migration (the Aegean, Mediterranean, North Eastern Anatolia) but also for the East Black Sea region, which experienced substantial and volatile out-migration during the period. The three regions with the highest rates of out-migration, on the other hand, experienced stable migration outflows (Central Anatolia, the West Black Sea, Central East Anatolia). When translated into CR, migration variation over time has had only a limited effect: only in four regions (Istanbul, the West Marmara, East Marmara, and North East Anatolia) did the CR variation coefficient exceed 10 percent, due to extremely volatile net migration or its high

contribution to CR. Note, however, that we did not have detailed data on fertility change over time and, therefore, estimated variation of CR is only partial and might be revised upwards given more detailed fertility data.

Table 3. Total Fertility (TFR), Effective Net Migration (ENM), Migratory Fertility (MF), Combined Reproduction (CR), and Time to Half-Replacement (THR) by region: data and estimates for the period 2007-2014

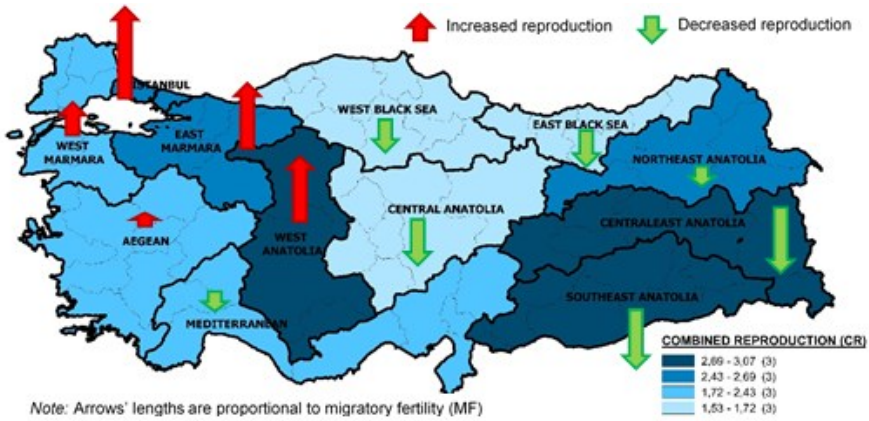
	TFR	ENM	ENM: coefficient of variation	MF	CR	CR: coefficient of variation	THR
Turkey	2.16	0.0	0%	0.00	2.16	0%	…
Istanbul	1.78	470.6	45%	0.84	2.62	15%	54
West Marmara	1.38	243.5	66%	0.34	1.72	14%	95
Aegean	1.91	65.7	96%	0.13	2.04	6%	327
East Marmara	1.80	359.4	47%	0.65	2.45	13%	68
West Anatolia	2.40	278.6	37%	0.67	3.07	8%	85
Mediterranean	2.09	-69.9	97%	-0.15	1.94	7%	…
Central Anatolia	2.09	-191.9	11%	-0.40	1.69	2%	…
West Black Sea	1.90	-194.0	11%	-0.37	1.53	2%	…
East Black Sea	2.10	-187.7	59%	-0.39	1.71	9%	…
North East Anatolia	2.59	-60.5	1738%	-0.16	2.43	26%	…
Central East Anatolia	3.33	-193.3	11%	-0.64	2.69	2%	…
South East Anatolia	3.47	-171.2	14%	-0.59	2.88	3%	…

Source: Data from TSI (2015), authors' calculations
Notes: TFR data refers to 2008; ENM and CR are shown with their variation coefficients calculated as the respective standard deviations divided by the average rates over 2007-2014.

Figure 5. Distribution of Effective Net Migration by region, estimated for the period 2007-2014

Source: Data from TSI (2015), authors' calculations

Figure 6. Distribution of Combined Reproduction by region, estimated for the period 2007-2014



Source: Data from TSI (2015), authors' calculations

Figure 7. Distribution of Migratory Fertility by region, estimated for the period 2007-2014

Source: Data from TSI (2015), authors' calculations

Conclusion

In large part, migration likely reflects the intrinsic nature of population movement: by moving from an origin to a destination, space is involved, and we can ask questions about the impact migration has on both sending and receiving regions. Migration is the most complex of all the vital processes. Its impact on population size and composition is often quite significant, especially in today's mobile world (Weinstein and Pillai, 2001: 223; Newbold, 2010: 125). Therefore, migration is often the main component of population growth or decline at the community and regional levels (Rowland, 2006: 385). Undoubtedly, the demographic characteristics of regions that migration occurs in or across will influence population change. And migration can be viewed as

an especially important type of movement, in two respects. From the purely demographic viewpoint, migration[15] is a component of change that together with natural increase, determines the magnitude and rate of population growth (Weinstein and Pillai, 2001: 202).

Unlike the birth and death components of population change, migration affects population change in two geographic units (Plane and Rogerson, 1994: 93): the origin and destination places or regions. Particularly in settings with apparent regional fertility differences, migration can compensate for missing births, especially in low-fertility regions. Therefore, depending on the fertility level of the migrated population from an origin, a destination region can compensate for its population growth, or vice versa.

Communities can experience substantial population inflows and outflows which, while altering the membership of the population, have far less of a share in all migrations and may be absorbed in population replacement rather than in net growth. Over the long run, the net effect of population movements usually entails community change of some kind, but the extent of this change can be small compared to the great volume of two-way migration (Rowland, 2006: 385). From this point of view, we tried to explore and measure the effect of internal migration on the reproduction of population between regions in Turkey. Thus, the indicators we use in this study – MF, CR, and THR – seek to measure the efficiency with which inward and outward movements produce a net reproduction of population. Due to the weakness of regional migration and fertility data, the indicators used in this study were designed to be as simple and robust as possible. Nonetheless, our findings show the significance of the indirect effect of internal migration on reproduction in Turkey regionally.

Table 4. Regions of Turkey grouped by fertility and migration levels in 2007-2014

	Regions with low fertility (TFR<2.2)	**Regions with high fertility (TFR>2.2)**
Regions with negative net migration (MF<0)	West Black Sea (1.5) Central Anatolia (1.7) East Black Sea (1.7) Mediterranean (1.9) West Marmara (1.7)	North East Anatolia (2.4) Central East Anatolia (2.7) South East Anatolia (2.9) West Anatolia (3.1)
Regions with positive net migration (MF>0)	Aegean (2) East Marmara (2.4) Istanbul (2.6)	

Source: Data from TSI (2015), authors' calculations
Notes: TFR stands for the Total Fertility Rate, MF for Migratory Fertility; numbers in parentheses show Combined Reproduction (CR) summarizing the demographic effects of fertility and migration; see the main text for explanations.

[15] In-and-out-combined.

Our analysis shows the strong demographic effects of migration across Turkey. The grouping of regions according to fertility and migration levels is presented in Table 4. In high-fertility eastern regions, migration acts as a counterbalance reducing the CR closer to the replacement level[16]. In the lower-fertility western regions, but also in higher-fertility West Anatolia, positive net migration supplements CR and boosts population growth, with the exception of the West Marmara and Aegean, where the migratory effect was insufficient to produce CR above the replacement level. In the four central regions, average-to-low fertility combined with negative ENM leads to CR below the replacement level. Hence, migration plays a role of demographic stabilizer in the westernmost and easternmost provinces. At the same time, it strengthens population replacement in West Anatolia (where above-average TFR combined with positive net migration produces a remarkable CR of 3.1) and further depresses population growth prospects in the average-to-low fertility regions of the Black Sea regions and the two regions to the south.

The positive demographic effects of migration on four regions (Istanbul, the East Marmara, West Marmara, and West Anatolia) come with a tag of short THR (replacement of half-cohort by migrants and their descent in 50-100 years).

Despite substantial variation of migration over time and the associated uncertainty of its demographic consequences, one may assume continuation of its current effect in regions with more stable net migrations: Central Anatolia, the West Black Sea, Central East Anatolia, and South East Anatolia. The same consideration applies to the four regions with high positive effects from migration (Istanbul, the West Marmara, East Marmara, and Mediterranean) where despite high variation over time, ENM was never negative over the period studied.

As for data not considered, our study did not take into account the effects of international migrations in Turkey. Yet, we should briefly note the scale of the possible demographic consequences of the recent refugee crisis that hit the country. Recent estimates show that there are currently more than 2 million Syrian refugees in Turkey (UNHCR, 2015). If we assume permanent stays in the country of the majority of Syrians, we can predict that Syrian population dynamics will probably affect Turkey's population change and reproduction patterns in the near future. By comparison, the migration turnover between the regions of Turkey over the whole period 2007-2014 was ca. 7 mln. people[17]. That includes all inter-regional migrations and includes opposite-way migrations too. If we refine the net effect of opposite-way migrations by summing up only the positive regional net-migration, the total population exchange between the regions was only 1.3 mln. over the period of 2007-2014[18].

[16] Yet the CR is still above 2.5 in all three eastern regions.

[17] We compute the turnover as the sum over all the regions of numbers of female in-migrants.

[18] In this refined calculation, we consider only the female population and sum up the net migrations over all the regions where the net migration sum for the years 2007-2014 was positive.

Compared to any of these numbers, the influx of more than 2 million refugees may have a substantial demographic impact both nationwide and for specifically affected regions.

References

Alho JM. (2008). Migration, fertility, and aging in stable populations, *Demography* 45 (3): 641-650.

CSO (Central Statistical Office) (1953). *Population Censuses 1927-1950: Statistical Resumes No: 8*. Ankara: Republic of Turkey Prime Ministry Central Statistical Office.

Ediev DM. (1999). *Demographic and Economic-Demographic Potentials*. PhD Thesis. Moscow: Moscow Institute of Physics and Technology.

Ediev DM. (2007). *Demographic Potentials: Theory and Applications*. Moscow: Max-Press.

Ediev D., Coleman, D. and Scherbov, S. (2014). New measures of population reproduction for an era of high migration, *Population, Space and Place* 20 (7): 622-645.

Eraydın, A. (2006). "Mekânsal süreçlere toplu bakış (Holistic view to the spatial processes". In: A. Eraydın (ed) *Değişen Mekân: Mekânsal Süreçlere İlişkin Tartışma ve Araştırmalara Toplu Bakış: 1923-2003 (Changing Space: Holistic View to the Debates and Research Regarding Spatial Processes: 1923-2003)*. Ankara: Dost, 25-67.

HUIPS (Hacettepe University Institute of Population Studies) (2014). *2013 Turkey Demographic and Health Survey*. HUIPS, Ministry of Development, The Scientific and Technological Research Council of Turkey, Ankara: HUIPS Press.

HUIPS (2010). *Türkiye'nin Demografik Dönüşümü: Doğurganlık, Aile Planlaması, Anne-Çocuk Sağlığı ve Beş Yaş Altı Ölümlerdeki Değişimler, 1968-2008* (*Turkey's Demographic Transition: Fertility, Family Planning, Mother-Child Health and Changes in Under-Five Mortality, 1968-2008*). Ankara: HUIPS et al.

HUIPS (1999). *Turkey Demographic and Health Survey 1998*. HUIPS, Hacettepe University Institute of Population Studies, Ministry of Health General Directorate of Mother and Child Health and Macro International Inc.: Ankara.

Inaba, H. (2009). "The net reproduction rate and the type-reproduction number in multiregional demography", *Vienna Yearbook of Population Research 2009*: 197-215.

Koray, S. (1997). Dynamics of demography and development in Turkey: Implication to the potential for migration to Europe, *Nüfusbilim Dergisi (Turkish Journal of Population Studies)* 19: 37-56.

Mitra S. (1984). Review of 'growth and structure of human population in the presence of migration by Sivamurthy (1982), *Journal of the American Statistical Association* 79 (386): 480-481.

Newbold, KB. (2010). *Population Geography: Tools and Issues*. Plymouth: Rowman & Littlefield Publishers, Inc.

Ortega JA and del Rey. LA. (2007). Birth replacement ratios in Europe: A new look at period replacement. Paper presented at the *2007 Annual Meeting of the Population Association of America*, New York, 29-31 March 2007.

Plane, D. A. and Rogerson, P. A. (1994). *The Geographical Analysis of Population with Applications to Planning and Business*. New York: John Wiley & Sons Inc.

Rogers A. (1966). The multiregional matrix growth operator and the stable interregional age structure, *Demography* 3 (2): 537-544.

Rogers A. and Willekens F. (1978). The spatial reproductive value and the regional momentum of zero population growth. *Environment and Planning A*, 10: 503-518.

Rowland, D. (2012). *Demographic Methods and Concepts*. Oxford: Oxford University Press.

SIS (State Institute of Statistics) (1996). *1995 Statistical Yearbook of Turkey*. SIS, Ankara: State Institute of Statistics.

SIS 2002. *2001 Statistical Yearbook of Turkey*. SIS, Ankara: State Institute of Statistics.

SIS 2003. *The 2000 Census (Turkey General)*. SIS, Ankara: State Institute of Statistics.

Sivamurthy M. (1982). *Growth and Structure of Human Population in the Presence of Migration*. London: Academic Press.

Stillwell, J. Hussain, S. and Norman, P. (2008). The internal migration propensities and net migration patterns of ethnic groups in Britain, *Migration Letters* 5 (2): 135- 150.

TSI (Turkish Statistical Institute) (2016). Migration Statistics: Metadata; Analytical Framework, Concepts, Definitions, and Classifications. TSI, Turkish Statistical Institute. Available at http://www.turkstat.gov.tr/VeriBilgi.do?alt_id=1067, on [accessed 4 January 2016].

TSI (2015). *SRE-1 Regional in-Migration, out-Migration, Net-Migration and Net-Migration Rate.* Address Based Population Registration System Database. TSI, Turkish Statistical Institute. Available at http://www.tuik.gov.tr, on [accessed 22 May 2015].

TSI (2014a). *National Education Statistics Database*. Address Based Population Registration System (ABPRS) Results, TSI, Turkish Statistical Institute. Available at http://www.tuik.gov.tr [accessed 31 July 2014].

TSI (2014b). *Labour Force Statistics*. Address Based Population Registration System (ABPRS) Results, TSI, Turkish Statistical Institute. Available at http://www.tuik.gov.tr [accessed 31 July 2014].

TSI (2014c). *Population of Province/District Centers and Towns/Villages.* Address Based Population Registration System (ABPRS) Results, TSI, Turkish Statistical Institute. Available at http://www.tuik.gov.tr [accessed 31 July 2014].

TSI (2014d). *Press Release: The Gross Domestic Product IV. Quarter: October, November, December/2010*. 31 March 2011. TSI, Ankara: Turkish Statistical Institute.

UN (United Nations) (2015). *The 2015 Revision of World Population Prospects*. Available at http://esa.un.org/unpd/wpp/ [accessed 19 October 2015].

UNHCR (United Nations High Commissioner for Refugees) (2015). *Population Statistics Database: Registered Syrian Refugees*. Available at http://popstats.unhcr.org/en/overview#_ga=1.63290922.405841273.1444816374 [accessed 15 October 2015].

Ünalan, T. (1997). Turkey's population at the beginning of the 21st century, *Nüfusbilim Dergisi (Turkish Journal of Population Studies)* 19: 57-72.

Weinstein, J. and Pillai, V. K. (2001). *Demography: The Science of Population*. Boston: Allyn and Bacon.

White, M.J. and Lindstrom, D.P. (2006). Internal migration. In: D.L. Poston & M. Micklin (eds) *Handbook of Population*. Texas: Springer, 311-346.

Willekens, F. (1977). *The Spatial Reproductive Value: Theory and Applications*. RM-77-9, Laxenburg: IIASA.

Yaukey, D., Anderton, D. L. and Lundquist, J. H. (2007). *Demography: The Study of Human Population*. Long Grove: Waveland Press, Inc.

Yavuz, S. (2006). Completing the Fertility Transition: Third Birth Developments by Language Groups in Turkey, *Demographic Research* 15: 435-460.

Yüceşahin, M.M. (2009), Türkiye'nin Demografik Geçiş Sürecine Coğrafi Bir Yaklaşım (A Geographical Approach to Turkey's Demographic Transition Process), *Coğrafi Bilimler Dergisi (The Journal of Turkish Geographical Sciences)*, 7(1): 1-25.

Yüceşahin, M.M., Milewski, N., Sirkeci, I. and Rolls, A.S. (2015). Introduction: Family and demography in Turkish mobility. In: N. Milewski, I. Sirkeci, M.M. Yüceşahin & A.S. Rolls (eds) *Family and Human Capital in Turkish Migration.* London: Transnational Press London, 1-10.

Yüceşahin, M.M. and Özgür, E.M. (2008). Regional fertility differences in Turkey: Persistent high fertility in the southeast, *Population, Space and Place* 14 (2), 135-158.