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ESTIMATING THE COMPLETENESS OF BIRTH REGISTRATION SYSTEM IN TURKEY: COMPARISON BETWEEN MERNIS AND TURKEY DEMOGRAPHIC AND HEALTH SURVEY

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SUMMARY

Acquiring reliable demographic data to calculate demographic indicators demands a well-established civil registration system whose quality depends on the completeness, coverage, validity and timely reporting of the civil registration system. Completeness of a birth registration system is important to assess the quality of the registration system as the recognition of an individual by the state starts with registration of birth. Completeness improved in the century long history of registration in Turkey but the registration data remained relatively unexplored.

This study aims to determine the current under-5 completeness and timeliness of the birth registration system for the following: Turkey, male and female births, adolescent mother's births and each of the five regions of Turkey. For this purpose, MERNIS birth registration information was used and compared to the birth registration results of TDHS-2013. Calculations of the unregistered population and late registrations are estimated via the available registration information of births occurred within the period of 2009 – 2015. The completeness and the timeliness of birth registration system are calculated as the end of 2015 for Turkey and subpopulations of interest separately. Results show that female births, adolescent mother's births and births occurring in East have lower completeness and lower timeliness compared to male births, adult mother's births, regions except East, respectively. Furthermore, timeliness is found to be significantly lower than the average for East and adolescent mother's births. Deceased children form the majority of the unregistered children. Under-5 birth registration completeness and timeliness of Turkey as the end of 2015 is calculated to be 98.9%, and 95.4%, respectively.

Findings of this study indicate birth registration completeness improved since 2009. Completeness and timeliness rates of Turkey are acceptable with the need of improvements for East and adolescent mother's births. Moreover, unified

information collection of newborns in hospitals could carry the improvements further. The method introduced here can be used to calculate birth registration completeness of years to come when up-to-date data is present.

ÖZET

Demografik göstergeleri hesaplamak için gereken güvenilir demografik verilerin edinilmesi sivil kayıt sisteminin tamlığına, kapsayıcılığına, geçerliliğine ve zamanlılığına bağlıdır. Devletin bireyi tanıması doğum kaydı ile başladığından, doğum kayıt sisteminin tamlığı, kayıt sisteminin kalitesini değerlendirmek için önemlidir. Kayıtların tamlığı, Türkiye'nin yüzyılı aşkın süreli kayıt sistemi süresince gelişmiş olsa da, kayıt verisi görece az çalışılmıştır.

Bu çalışma doğum kayıt sisteminin, Türkiye, oğlan ve kız doğumlar, genç anne doğumları ve 5 bölgedeki doğumlar için güncel tamlığını ve zamanlılığını belirlemeyi amaçlamıştır. Bu amaçla, MERNIS doğum kayıt bilgisi, TNSA-2013 doğum kaydı sonuçlarıyla karşılaştırılarak kullanılmıştır. 2009-2015 yılları için kayıtsız nüfus hesaplanmış, mevcut kayıt bilgileri aracılığıyla da geç kayıtlılık tahmin edilmiştir. Doğum kayıt sisteminin tamlığı ve zamanlılığı, 2015 sonu itibarıyla Türkiye ve ilgili alt nüfus için ayrı ayrı hesaplanmıştır. Sonuçlar, kız doğumların, adölesan anne doğumlarının ve Doğu'da meydana gelen doğumların, oğlan doğumlara, yetişkin anne doğumlarına ve Doğu dışındaki bölgelerde gerçekleşen doğumlara kıyasla daha düşük tamlığa zamanlılığa sahip olduğunu göstermektedir. Ayrıca, Doğu'daki doğumların ve genç anne doğumlarının kayıt tamlığı ve zamanlılığı ortalamadan anlamlı olarak düşük bulunmuştur. Kayıtsız çocukların büyük bir kısmını doğum kaydı yapılmadan ölen çocuklar oluşturmaktadır. 2015 sonu itibariyle Türkiye'nin 5 yaş altı doğum kayıtlarının tamlığı ve zamanlılığı sırasıyla %98,9 ve %95,4 olarak hesaplanmıştır.

Bu çalışmanın bulguları, Türkiye'nin 2009'dan bu yana tamlığı ve zamanlılığının geliştiğini göstermektedir. Doğu'daki doğumlar ve adölesan anne doğumları için iyileştirmeye ihtiyaç olmakla beraber, Türkiye için doğum kayıtları kabul edilebilir gözükmektedir. Ayrıca, doğumların hastanelerde tek bir sistemle kayıt ettirilmesi

iyileştirmeleri hızlandırabilir. Burada tanıtılan yöntem, güncel veri mevcut olduğunda, gelecek yılların doğum kaydı tamlığını hesaplamak için kullanılabilir.

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LIST OF ABBREVIATIONS

ABPRS	Address Based Population Registration System
ADB	Asian Development Bank
CCRS	Central Civil Registration System
CEE/CIS	Central and Eastern Europe and the Commonwealth of Independent States
CRC	Civil Registration System
CRC4D	Civil Registration Center For Development
CRVS	Civil Registration and Vital Statistics
DHS	Demography and Health Survey
DIE	State Institute of Statistics
DNS	Death Notification System
GDCRN	General Directorate of Civil Registration and Nationality
HUIPS	Hacettepe University Institution of Population Studies
ICCPR	International Covenant on Civil and Political Rights
ILO	International Labor Organization
MDG	Millennium Development Goals
MERNIS	Merkezi Nüfus İdaresi Sistemi
MICS	Multiple Indicator Cluster Survey
NAD	National Address Database
SDG	Sustainable Development Goals
TDHS	Turkey Demography and Health Survey
TurkStat	Turkey Statistical Institution
UBCbT	Unregistered Births Captured by TurkStat
UBRU	Unregistered Births Remained Unregistered
UN	United Nations
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Emergency Fund
USA	United States of America
WHO	World Health Organization

CHAPTER 1
INTRODUCTION

Demography consists of three main study topics, which are fertility, mortality and migration. Changes in population are identified with these three topics of interest. Demographers, researchers with interest in population, and policy makers who focus on population issues need complete and correct data in order to study the changes in the identifiers of population. Data of the population often comes from three main sources: censuses, which cover the entire population and gather limited information from every individual; international and national sample surveys, which covers a sample of the entire population and collect more detailed information; and registration systems, which are continuously updated more detailed databases of populations where coverage is limited according to census.

Civil registration is the continuous, permanent, compulsory recording of the occurrence of vital events such as the number of births, deaths or the total number of the population according to the definition of the United Nations (UNICEF 2013). Civil registration systems are the primary sources of vital statistics because of their perpetual up-to-date characteristics. Permanent records created by governments or by institutions collect the registration data, and the compulsory nature of vital registration is intended to form complete information of population. Therefore, acquiring reliable data to calculate demographic indicators from simple aggregate numbers to more complex rates demands a well-established civil registration system. Both researchers and policy makers need trustworthy data to evaluate the contemporary trends of population and understand the changes in demographic events. Correspondingly, the quality of the vital statistics depends on the completeness, coverage, validity and timely reporting of the civil registration system.

The use of people's registered information in governance dates back to old times, where administrations mainly used the records for economic purposes such as collecting taxes. Collecting data was much harder and measures taken to collect required information was tougher. Nonetheless, the former desire for complete and accurate data was also necessary as it is today. With the availability of new technologies, especially computational information and communication technology, vital statistics are easier to collect and interpret. Surveillance of populations with the help of public service records complementing each other, provide information on individuals more than ever. The diversified resources of registration increased the availability of databases and improved the coverage of registration. Especially developed regions of the world can keep daily updated information of demographic events in their countries and even cross borders sometimes. On the other hand, despite the advancements in computation and integrated systems of public services, vital registration systems still have low coverage, completeness and timeliness in less developed regions, usually due to missing or inaccurate data.

An important component of the vital registration system is birth registration for the reason that the existence of a human being is first recognized by the government via the registration of birth. The entrance of the information of an individual to the registration system starts with the birth registration. Article 7 of the Convention on the Rights of the Child (UN 1989) states that every child has the right to be registered at birth by the state. Every record of a person in the registration system has at least one precondition; the first acknowledgment of that human's existence in the world at some point in time. Therefore, in theory, completeness of any registration system is bound above with the birth registration completeness. For aforementioned reasons, birth registration plays an important role in the determination of vital registration system quality and completeness.

Registration of demographic events can be defined as complete if all geographical areas and all individuals are covered. The incompleteness of the

registration is largely due to people's ignorance of the registration system, reluctance in registering events, cultural values, the structure of the system, places of births (births at home, in inaccessible areas, or in a population that is set apart from mainstream society because of its ethnicity, poverty or geographical remoteness) (Williams 2014). The failures of registration, due to aforementioned reasons, can be grouped in two categories: (1) the failure to cover the entire geographic area of a country or all groups in the population, and (2) the failure to register all the vital events in the established registration area (Shryock 1973). The importance of these reasons usually vary according to the type of registration, country and the existing governance. In this thesis I will focus on the second group and analyze the completeness of birth registration.

Various methods have been used to test the completeness of the birth registration systems for different countries. In literature, there exist methods to compare registration directly with census data and sample surveys particularly made with the purpose of calculating completeness; on the other hand, some other studies used indirect methods. For Turkey, studies for completeness of the registration system are lacking since such secondary data sources are not available. Accordingly, the completeness of the birth registration system has not been widely explored. Unregistered births and under five registrations has been investigated through survey data and census but registration information of the vital registration system has never been used in this process. Currently, sole data source of the whole population in the context of vital registration information is the civil registration system. In order to evaluate this civil registration system, completeness and timeliness must be investigated through available data.

The establishment of the civil registries in Turkey dates back to the first population census conducted in 1904. The modernization of the civil registration system in Turkey was announced in 2000 with the introduction of the Central Civil Registration System (MERNIS) and converted to the online system in 2001. Turkish Identification Number was introduced on October 28, 2000 and applied to all citizens

born after 1840, dead or alive which accumulates around 120 million people at that time. Address Based Population Registration System (ABPRS) was established in 2007. Starting from 2008, changes in the addresses were updated by municipalities and special administration of provinces and changes in the places of residences were updated by the population registration offices based on declaration of persons (TurkStat, 2013). Birth registration in Turkey is mandatory and should be done within 30 days of birth and can be done by showing the official birth certificate or oral statement. Birth statistics are produced from MERNIS database since 2001 and the data is revised 5 years retrospectively, in order to cover delayed registration information.

Awareness expanded on the importance of birth registration and its completeness in Turkey in 1990s as it is increased in the world. In 1994, a committee of experts from State Planning Organization, Ministry of Interior, Ministry of Health and Hacettepe University Institute of Population Studies, led by State Institute of Statistics was formed. The working group report was published by the members of the committee working on birth and death registration in Turkey. Birth registration completeness was estimated to be 40% in 1984 (DIE 1997) and report assets that total number of birth information was estimated through the distributed identity cards. This was the first attempt of investigating the completeness of registration system in Turkey. After 1993, the results of TDHS gave numbers for the completeness of birth registration of under-5 children for previous 5 years of survey. TDHS results show that birth registration was 74% complete in 1993 and increased to 94% in 2008. Including the 2013 survey, for 20 years, the completeness of the birth registration is provided from TDHS.

This study intends to fill the gap in the literature on completeness of the birth registration system in Turkey and give up to date results of birth registration completeness of Turkey by analyzing directly birth registration information. The scope of this thesis is to evaluate the completeness and timeliness of the birth registration

information of gathered from TurkStat with the help of the Turkey Demographic and Health Survey (TDHS) data. The birth registration information of TurkStat consisted of two main sources, MERNIS and Death Notification System (DNS). The major source of investigation is MERNIS data, which is mainly made of the information based on individual registrations. The DNS data contains the births captured by TurkStat, which cannot be matched to MERNIS data. These births, which are deceased before registered, have unknown registration dates since they are not registered in MERNIS. Residential information is collected according to place of birth before 2009 and changed to usual place of residence of mother starting from 2009. TurkStat started using birth registration dates from Central Civil Registration System in 2009, correspondingly, in this thesis; I will study the current condition of the birth registration and investigate the improvement it has experienced since 2009. The study will give up-to-date results of birth registration completeness in Turkey and the change in completeness of the system year by year, from 2009 to 2015. The study will contribute to the completeness and timeliness assessment of the birth registration information through available survey data. The improvements and changes in the birth registration data will be stated within this study. Limitations of the current system and requirements for a better system will be specified. The events, which are suspected of influencing the registration system, will be checked and explained. Since the completeness and timeliness of the birth registration system is undisputed, it is convenient to investigate its completeness and limitations and seek for the possible improvements where necessary.

The title of this MA thesis is “Estimating the Completeness of Birth Registration System in Turkey: Comparison between Registration System and Surveys”. The analysis will be based on the primary research question of “how complete is the registration of birth statistics of Central Civil Registration System?”

In this thesis I will investigate the following questions as well:

-what are the changes in completeness of the birth registration data since 2009?

-what is the time gap of birth and its registration and how does it changes based on the region of registration, age of mother and sex of the children?
-how can completeness of the birth statistics be measured with Turkey Demographic and Health Surveys?
-what are the effects of the variables regarding the mother such as the mother's age and place of residence and sex of the child to completeness and timeliness of the registration system?
-what is the estimated number of unregistered children under five as of end of 2015?

While examining the completeness of the registration system, my hypothesis will be that births to women of ages less than 18 have longer intervals between the date of birth and date of registration than the births to women of ages 18 or more. I expect to find a meaningful differentiation between adult and teenage mothers. In addition, another hypothesis will be whether the East region of Turkey has less completeness and the proportion of timely registers are lower in this region. Apart from these hypotheses I claim to find that the registration system is improving through the establishment of ABPRS, that the completeness has increased and time gap of registration decreased.

I design my research to examine the birth registration completeness starting from 2009. In this context, the birth registration information between 2009 and 2015 is obtained from TurkStat, where birth registration information from MERNIS and information of births captured by Death Notification System (DNS) combined. This information contains age groups, usual place of residence of mother, and the sex of the child. The registration information will be evaluated with the use of TDHS-2013 data. TDHS-2013 data will be used to compare and understand the magnitude of unregistered population. In the second section, Pregnancy and Fertility, of TDHS-2013 contains the questions asked to women for their under-10 children, "Is … recorded in the population registry?" and "How much time elapsed between …'s birth and registration?". The comparison will help to understand the birth registration trends and

the progress of the birth registration through the establishment of The Address Based Population Registration System.

Throughout the thesis, some assumptions are made to interpret the available information of birth registration. The first and the utmost important assumption is that the registration delay among two data sources are consistent and the unregistered number of births are compatible. In another words, I assumed that the percentage of unregistered births between two data sources is identical inspired from the pattern between registration behavior of registered people. The thesis also assumed that all participants of the DHS sample honestly answered the registration questions as especially the late registrations after 6 months or more can cause month-heaping.

The absence of a secondary birth registration source may have a potential impact on the study. On the other hand, TDHS was the only source of household based registration information for under-10 population. The nature of the registration event where a declaration of day of birth is sufficient to register a new-born can also effect the study, but people's statements have similar effects on both data sources. Nevertheless, testing the completeness and timeliness of the registration system for the first time will contribute to the literature.

The Address Based Population Registration system has been improving since the establishment of the system. However, it is important to determine the data quality of any registration system regardless of their age. This study will examine the completeness and timeliness of the birth registration system in five main chapters. Introduction chapter will give the justification of the thesis, its scope and research questions. The second chapter will review the literature, discuss early studies and present the current situation of World and Turkey in terms of birth registration completeness. This chapter will also explain the birth registration system in Turkey. The third chapter will introduce the registration and TDHS data sets and explain the

approach used in order to analyze birth registration completeness. The fourth chapter will give the descriptive statistics and results of the analysis for completeness and timeliness of birth registration. The conclusion chapter will be the fifth and last chapter of the thesis and will discuss the results and give recommendations.

CHAPTER 2
LITERATURE REVIEW

Data quality has always been an important area of research for demographers through the history of demography literature. The accuracy and the quality of the results of censuses, sample surveys and registration systems is questioned and completeness is examined for both academic and non-academic purposes. National and international agencies devote considerable attention to the completeness of the civil registration and vital statistic systems. Different mathematical models and statistical methods have been developed and used for this cause.

In this chapter, I will clarify the birth registration and its completeness and timeliness in detail and discuss the literature. In the first place, I will focus on the child rights and the position of the birth registration in child rights. Then I will talk about the first studies of completeness and quality assessments of registration systems. Following the historical part, I will discuss the importance of birth registration completeness from development point of view. The country examples from developed and underdeveloped regions will be the sequent part. After examining the countries and regions, I will introduce international recommendations. After that, I will represent the contemporary literature of birth registration completeness in Turkey and at the end, I will give detailed information about civil registration system in Turkey and legal regulations of the system.

2.1 CHILD RIGHTS

Modern censuses are considered to be taken place in mid-19th century. However, first attempts of the completeness assessments came nearly a century after the modern censuses. Quality of the collected data from provincial and national censuses was investigated by the Census Bureau in USA. Several technical and case studies published by international institutes and journals of statistics. The need for an internationally agreed statistics emerged and following the World War II, collecting vital statistics and information had an increase in importance. After the establishment of United Nations in 1945 and the Universal Declaration of Human Rights, which is adopted by the United Nations General Assembly in 1948, child rights attract notice by extension of the focus on human rights.

The Convention on the Rights of the Child (CRC), which is the successor of Declaration of the Rights of the Child, is the current international document in force regarding to child rights. Turkey is a signatory to the CRC. The right of the child to a name and nationality from birth is contained in Principle 3 of the Declaration of the Rights of the Child proclaimed in 1959, which later formed the basis for Convention on the Rights of the Child (CRC) in 1989. The Principle 3 of the Declaration of the Rights of the Child stated that "the child shall be entitled from his birth to a name and a nationality." (UN 1989). Corresponding to that, in Article 7, CRC recognizes the right to birth registration. Article 7 is placed after the Articles where child is formally defined and that every child has the inherent right to life. This shows the birth registration provides the very first basis for the fulfilment of other rights of the child. Article 7 of the CRC establishes that each child "shall be registered immediately after birth and shall have the right from birth to a name, the right to acquire a nationality and. as far as possible, the right to know and be cared for by his or her parents." (UN 1989).

In addition to the CRC, in article 24 of the International Covenant on Civil and Political Rights (ICCPR), adopted in 1966, also establishes that "every child shall be registered immediately after birth and shall have a name" and "every child has the right to acquire a nationality." (ICCPR 1966). Article 12(2) of the International Covenant on Economic, Social and Cultural Rights adopted in 1966 also stated that healthy development of the child is a step to be taken to achieve the full realization of this right. The right to birth registration and the right to a name and nationality are also set forth in the Convention on the Reduction of Statelessness, the International Convention on the Elimination of All Forms of Racial Discrimination, and the International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families (Todres 2003). After CRC, the following international documents involving regulations for children either give reference to the corresponding Articles in CRC or contain the right of a child to a name and nationality thus right to birth registration.

Starting from the second half of 1990s, promoting children's right to birth registration has found a forefront place in the UNICEF agenda. In UNICEF's seminal article, The Progress of Nations (1998) highlighted birth registration as the 'first right' on which access to other rights was dependent, and gave impetus to UNICEF's current work on birth registration (UNICEF 2013). In the 2001 agenda of "A World Fit for Children", "developing systems to make sure the registration of every child at or shortly after birth, and fulfil his or her right to acquire a name and a nationality, in accordance with national laws and relevant international instruments" was declared under the goals, strategies and actions chapter (UN 2000). Later, the resolution entitled "Birth registration and the right of everyone to recognition everywhere as a person before the law" adopted by the United Nations Human Rights Council in 2012. The document gives an overview of the situation, international legal framework, effects of the lack of registration, possible implementations and the governance recommendations. The resolution shows the significance of the birth registration and human rights linkage and analyze the non-registration effects (UN 2013).

The references of birth registration in different ranges of international conventions and resolutions strengthens the importance of registering a birth and making it an important starting point to explore human rights. On the other hand, the right to birth registration is vital not only because it is an individual self-benefit human right, but also it enables each child to assert a broad range of other human rights. These rights can be grouped under economic, social and cultural rights as well as civil and political rights (UNICEF 1998). Preventing the access to registration through discrimination of any kind, such as discrimination by child's race, sex, language, religion, nationality, ethnic origin, disability or any other status thus inhibits the child from abovementioned rights. Identification system grants the citizenship rights and also transfer the characteristic properties to the newborns. With improvements, less births are excluded from the registration system but the loss of excluded increases (Çavlin 2011). In the following part of this subsection I will discuss these additional rights of the child coming from birth registration.

A non-registered child is excluded from many rights mentioned in Child Conventions. Right for education can be one of these exclusions since it is dependent on the birth registration mostly. Children without birth certificates cannot enroll to schools in some countries which violates their right to education under Article 28 of the Convention on the Rights of the Child. Even if they continue their school, they will need a birth certificate to graduate and receive a diploma. Thus, the lack of a birth registration, absence of a right, prevents their another right, education. On the other hand, Article 11 of the Committee on Economic, Social and Cultural Rights defined compulsory education as "no one is entitled to treat as optional the decision of whether a child should have access to primary education". As stated in this article some countries don't require birth certificate for school enrolment. Therefore, the requirement of a birth certificate for education rights creates an ambiguity (UN 2014).

The recent study of Apland et al. gives some insight to the complicated relationship between birth registration and education indicators (Apland et al. 2014).

According to the study, in Vietnam, birth certificate is a necessity for school enrolment. Similarly, from 2009, the presentation of a birth certificate becomes a mandatory condition for enrolment in national exams in Kenya. These policies link birth registration and school enrolment directly. In Kenya, the regulations helped promoting birth registrations but in Vietnam, it was already considerably high (95%) so it has no accountable effect. The risk of exclusion from school enrolment is a great obstacle for supporting similar policies. Besides, in India and Sierra Leone, access to education is not blocked by lack of birth certificate. Especially in India, the laws are clearly stating that children have a permission to access education without such obligations (Apland et al. 2014). However, in practice, the requirement of a birth certificate is thought to be a necessity in these countries. Nevertheless, the focus of the international partners is always on promoting human rights of children. For this reason, improving the birth registration in every country will remove this ambiguity.

Access to health services is another child right that is linked to having an identity and birth certificate. 5.9 million children under the age of 5 died in 2015 and more than half of these child deaths are caused by conditions that could be prevented or treated with access to simple, affordable interventions according to the World Health Organization (WHO 2016). Health monitoring systems work better with registered children since birth certificates and health cards often issued together. Health services and health insurance coverages requires birth certificate (UNICEF 2013). Vaccination schedules of children who can access to health services can be tracked better and their nutrition and overall health are monitored easily. Access to health services with a certificate guarantee a better start for a child. Lack of registration creates obstacles to children to access healthcare.

Birth registration is important on preventing child labor. According to International Labor Organization (ILO), global number of children in labor is 168 million children in 2012, more than half of them are in hazardous work (Diallo et al. 2013). Employment rate in between 6 and 17 age group was realized as 5.9%, which

corresponds to 893 thousand children in same age group in Turkey (TurkStat 2013b). Many countries have 18 age barrier for hazardous work but this barrier works if there exists a birth certification to prove their age. The study of Fagernas shows that countries with minimum working age regulation is effective twice in reducing under-aged employment if there is a birth registration law in effect (Fagernas 2012).

Social security numbers are needed in some countries in order to employ in formal sector and a birth certificate is a prerequisite for acquiring this social security numbers. Apart from employment, registering a business, claiming a land, accessing credit or opening back accounts may also be required such legal identity (Cody 2009). Asian Development Bank (ADB) found that people only benefit from having legal identity if the benefits and opportunities that accrue from being in possession of a document exist in the first place, which currently is not the case in many developing countries. However, as ADB points out, as countries become abler to provide basic services and opportunities for those living in their country, such documentation will become increasingly essential (Cody 2009).

A registered birth provides a protection against abuse of the child in addition to the rights it provides. Childs can become easily the victims of economic and social exploitation. Child prostitution, child trafficking and child labor can be prevented with a birth registration since a certificated birth helps identifying children more easily. Identification of the child and determining the age also become crucial in justice system. When children commit an offense it is important them to prove they are under the minimum age of criminal responsibility. Disadvantaged groups of the society, unregistered girls, disabled children, foreigners and migrants are affected from lack of birth registration more. These groups often excluded from the public domain and the services and in addition to their disadvantages, lack of a birth certificate and an ID makes them more invisible.

UNICEF (2013) has argued that: “birth registration may signify the beginning of the legal contract between the individual and the state known as citizenship... While birth registration does not itself confer citizenship upon the child, it is often essential for its acquisition based on each country’s law.” This legal contract has benefits to the state as well as it provides rights to the child. Beside all of the acquisition state had through promoting birth registration and ensuring the child rights, since healthy individuals make better societies, state obtains the very intrinsic tool of governance with the better registration system which is the information of the population. Governments can allocate resources, provide health and social services better and predict the future population trends more accurate with complete population data. The birth registers provide the initial entry to the system with registering a new-born. The aggregate data of population updates with every entry. Thus effective system of birth registration determines the accuracy of the population data and can be counted as the first step to the governance.

In addition to the collection of the data for aggregate statistical purposes, the very knowledge of births is important to know for the sake of births itself. Rights of a child can be ensured only if he or she is recognized by the government. Providing the rights and services to a child starts with the question of “how many?” The number of vaccine shots needed can be calculated or the number of schools should be built can be decided with the total number of births. The crucial information of age and sex distribution can be gathered for planning the health and education services from the registration of birth data. In this context, accuracy of the data is also important to determine the current trends in population and specify the vulnerabilities of the subpopulations and reveal the inequalities.

Another side of the human right aspect is that an accurate birth registration system has the ability of giving the opportunity to governments to monitor populations in detail. Provided ID cards can be used against common good. Associated with the vital registration system, a poorly-managed birth registration can give governments a

tool to manage and restrict populations and influence them politically. In order to prevent this violation, the population and registration laws point out the fragile status of privacy protection. In the end, well established registration systems and democratic population laws make the government both capable and responsible.

2.2 EARLY STUDIES

In literature, we can see the completeness tests were performed before there was any specific attention on child or human rights. The paper of Tracy (1931) based on a study in Canada, where a sample of children born in the one-year interval following the census was matched against a file of birth records can be considered as one of the first applications of the nationwide completeness tests. The studies carried out prior to 1931 census in order to investigate the registration status of births showed an estimate of 94 to 95 percent completeness (National Center for Health Statistics (US) 1945). The works of Emery (1990) showed, the birth registration completeness in Ontario, Canada moved from 86% to 97% between 1900 and 1930. At the same times we can see examples of interest about completeness in micro scales such as the study in Georgia (Jaffe 1951).

The first attempts were very straight forward and used direct methods for comparison. The idea was comparing two data sources of births, matching the births between data sources and comparing the births unmatched in two data sources. In order to see the differences, Tracy took the proportion matched between the sample survey and the census as the estimate of registration completeness in his test. In a 1931 census mono-graph, Tracy estimated a maximum completeness of 100 percent for the 1927-1931 period and a minimum completeness of 96 percent for 1931. Later, a modification of this test was applied to the censuses in United States starting from 1940 population census (Moriyama 1990). According to this study, the completeness of birth registration in 1940 was found to be 92.5% in USA (Lenhart 1943).

In 1949, Chandra Sekar and Edwards Deming have examined the approaches of the completeness of birth registration tests and have suggested a method for overcoming difficulties primarily caused by missing a birth on both enumerations, which then enlighten the forthcoming researches (Sekar and Deming 1949). Three systematic national tests for the completeness of the birth registration in the United States have been conducted, one in 1940, a second in 1950, and a third in 1969-70. The 1940 and 1950 tests were made by matching infants under 3 or 4 months age enumerated in the corresponding censuses with birth certificates placed on record in a small time interval of the censuses (Love and Novoa 1970). The general test results showed that completeness of birth registration of 92.5 percent in 1940 and 97.9 percent in 1950. The most remarkable differences in each year were found between whites and non-whites and between births happen in a medical facility and births in home (Shryock, 1973).

Based on census registration completeness data in United States, a paper published later discussing the comparison of two methods for obtaining per cent completeness of birth registration by states. First method was relating a matched set of records for the state as a whole to the total group of matched and unmatched records combined. The second was by a cumulative technique suggested by Sekar and Deming (Shapiro 1952). Differences in the results by the two methods were found to be minor except in those areas having a comparatively high degree of under-registration.

Apart from continuous obstacles of registration, disasters and especially wars and armed conflicts have a negative impact on birth registrations. After World War II, offices of vital statistics in USA increased their attention for decreasing under registration. The 1950 test of birth registration completeness in USA was designed with keeping the post war conditions in mind (Shapiro 1952). The conflicts in Ethiopia and Sudan also cause the birth registration system to fail since there was no established system prior to conflict (UNICEF 2007).

The 1970 birth registration test in United States was different from former studies. It was conducted using the household survey rather than the census to gather information on birth reports. For children under 5 years old, a form was filled by interviewers who are enumerated in the Current Population Survey and the Health Interview Survey. After the research the forms and birth records of the corresponding years were matched manually for the years 1965-1970 (Moriyama 1990). The study suggested 99.2% complete birth registration for the 1964-1968 period. While this percentage rises to 99.4% for white people, it has 98.0 for black and population of other race. Apart from United States, a number of countries in Latin America and in Asia conducted tests for birth registration completeness in conjunction with the 1950 and 1960 decennial population censuses (Moriyama 1990).

2.3 INTERNATIONAL DOCUMENTS

International agencies played an important role in the improvement of the vital registration systems. Parallel to child and human right declarations, recommendations and principles for vital statistical systems have been continuously published. In these handbooks vital registration systems are defined, subjects to be covered in vital registration systems are discussed and every step of a vital statistic system explicitly explained. In addition to definitions and explanations, quality assurance methods are investigated, sources for vital statistics are described and recommendations for a better service are suggested. First of this kind of handbook was published in 1953 by UN on the name of "Principles and Recommendations for a Vital Statistics System". Later in 1973 a revision was published, then in 2001 the second revision was issued. The third and the current last revision was submitted to UN in 2013 and adopted in 2014.

In the first edition of the handbook, UN defined a delayed or late registration and asserted that every ethnic group of geographic area should be included

in the statistical reporting area and records of registrations should be collected for everyone. It is also stressed that all events occur in the related population should be recorded independent from the completeness of registration coverage or the availably of data. It is also recommended that qualitative and quantitative indications of completeness of registration for every area should be included in reports of registration (UN 1953). It is important to point out that UN published the handbook for vital statistic systems in order to specify the definitions, regulations and principles of registration before the convention was accepted. In later editions of the recommendations of international documents we can see that stating essential items of registration becomes a recommendation of the handbook itself.

In 1955, Manual II "The Methods of Appraisal of Quality of Basic Data for Population Estimates" was published by the Population Branch of the United Nations Bureau of Social Affairs (UN 1955). The Manual have presented methods for evaluating completeness, accuracy and consistency of data from censuses, surveys, and vital registration. Chapter 2 of Manual II was reserved to completeness of vital statistics. The reasons for non-registration was discussed in addition to the method of direct check of birth registrations. This direct method was also applied to the 1950 census of Puerto Rico. As the methods for estimating the quality of demographic data were gathered together for the use of social scientists for the first time, this study can be considered as one of the fundamental studies on the data quality.

The recommendations of international institutions are usually made by experts from different fields. Statisticians, demographers, public health experts and civil registration officers state their opinions. They handle different aspects of the registration system in the publications. In order to ensure that recommendations will applicable and system improvements are permanent, they examine the system deficiencies from every possible aspect. Since some form of registration is already available in most of the countries, in addition to constructing a working registration

system where there is no available system, corrections and improvements are also handled in the recommendations.

In vast majority of the recommendation documents, legal basis of the registration system forms the starting section of the recommendations. A solid civil registration law makes a good starting point for the improvement. Starting from The Universal Declaration of Human Rights in 1948, other abovementioned conventions, resolutions and declarations unlocks the path for the development of legal basis of vital registration systems. Despite the international laws in force, the national regulations usually affect the civil registration approach of a country more. Common problem about legal structure of the registration systems is outdated and incomprehensive laws and regulations. These lack of regulations affect every individual in the population but the minorities and vulnerable population can be easily the victim of this deficiencies.

Women and girls are more likely to encounter situations where they cannot easily register. In some regions, registering a birth is problematic due to limitations of marriage laws. In addition to this, refugees and displaced persons are often not covered by existing law and cannot register their vital events (WHO 2013). Furthermore, children of the refugees born in migrated place suffer also. They may become stateless and can be subjects of various violations of human rights. UNHCR and UNICEF reported risk of sexual exploitation, early and forced marriages, slavery and trafficking, and illegal adaptation for these disadvantaged people.

Handbooks and recommendations suggest to build the vital registration system step by step so the system flaws like poorly implemented laws, loopholes and ambiguities which cause vital events to remain uncovered can be discovered. Even though a good implementation of a system is completed, there are always shortages of coverage. WHO points out the common problems of completeness and coverage as; barriers to registration, failure to capture information, inconsistencies, lack of clear

roles of register officers, inconsistent data forms, confusion over definitions (WHO 2013).

Recommended solutions for the completeness problems are using financial incentives and improve the eligibility for services. Vital registration system will stay incomplete if families are unaware of the obligations which makes incentives a catalyst. The practice of registering must also be easy and friendly. Beside the efforts of individuals, health sector also has an important role on the improvement. Since most of the births are happening in hospitals, well informed staff with well-designed forms will decrease the deficiencies made by people who are willing to register. Private sector has an increasing share in the health sector so they must also be a part of this improvement. Penalties are also must be well designed and not to cause people to flee.

Table 2.1. Recommended information to be collected on birth registration

Characteristics of the child:	**Characteristics of the parents:**
• Sex	• Date of birth
• Birth weight	• Marital status
Characteristics of the event:	• Educational attainment
• Date of occurrence	• Place of usual residence
• Date of registration	• Urban or rural residence
• Place of occurrence	• Children born alive to mother during
• Place of registration	• Children born to mother and who are
• Locality of occurrence	• Fetal deaths to mother
• Urban or rural	• Date of last previous live birth
• Type of birth	• Date of marriage

Source: WHO 2013

UN documents also contains the information to be collected on official birth registration forms. According to UN document, 3 groups of information is needed to be collected; characteristics of the event, characteristics of the parent and the characteristics of the child. Date and place of the event and registration are the key

components of characteristic of the event. Date of birth and age, marital status, education level, usual place of residence are key elements of the information on parents. Sex and birth weight of the child are the information must be collected about children. Table 2.1 shows these components and others which are derived from available data.

International agencies focused on strengthening registration and vital statistic systems increasingly since then because CRVS systems are the main resources that generates evidence and data for economic, social and health decisions (WHO 2013). It is significant to strengthen these systems because CRVS systems are not only tools for monitoring the country and collecting data, but also contributes to efforts to promote equity. Every development goal can be linked to completeness of vital registration system, especially to birth registration. In this context, in 2011, a special focus has been made to the quality of registration systems. At the request of the Secretary-General of the United Nations, the Commission on Information and Accountability for Women's and Children's Health was organized by the World Health Organization. The Commission suggested that countries especially in Africa, the Americas and Eastern Asia to prioritize the strengthening of their CRVS systems (WHO, 2014).

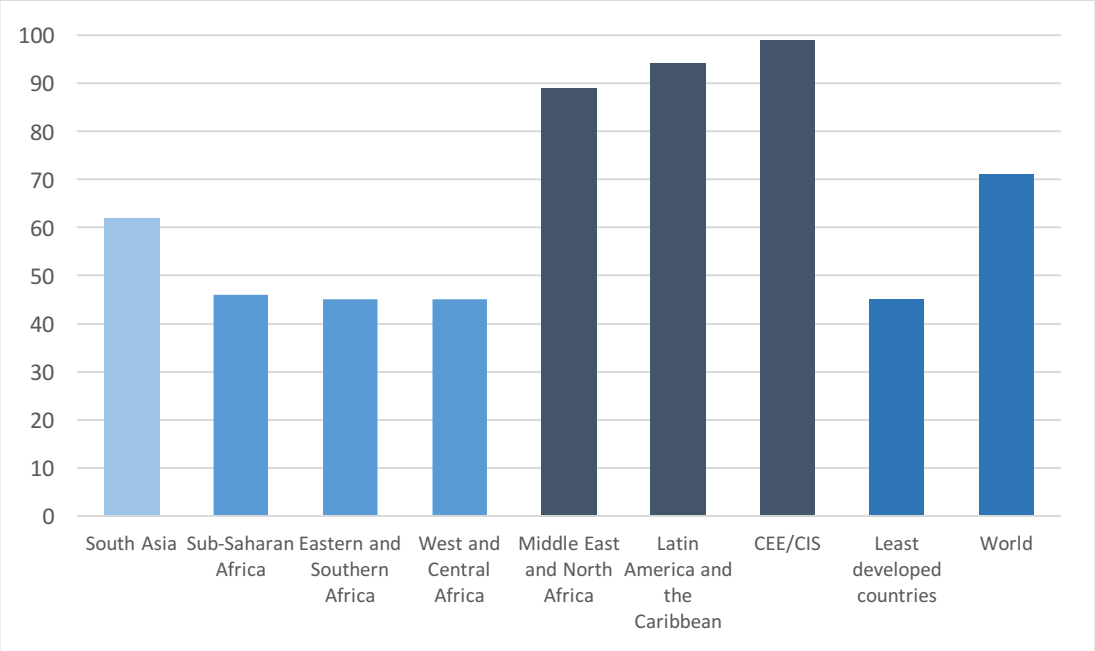
The Millennium Development Goals Report 2015 states the importance of quality data when evaluating the results. It is explicitly emphasized that better registration systems are needed in order to monitor development. For Sustainable Development Goals (SDG), the successor of MDG, the need for sustainable investments for improvement of reliability and timeliness of data stressed as "strengthening statistical capacity is the foundation for monitoring progress of the new development agenda" (MDG Report). Increasing the statistical capacity is also defined as a cross cutting issue of the new goals. Also goal 16.9 of SDG is providing legal identity for all including birth registration by 2030. As specified in MDG before, new world development indicators are selected for SDG. There was no indicator on birth

registration completeness in MDG. In SDG, under health system indicators, completeness of birth registration was added with “SP.REG.BRTH.ZS” code (World Bank 2016).

2.4 REGIONS

UN defines birth registration completeness as the percentage of children under 5 years old whose births are registered. Based mostly on Demographic Health Surveys (DHS) and Multiple Indicator Cluster Survey (MICS) results, as November 2014, birth registration completeness of the world for children under five years old is 71% (UNICEF 2016). Every 3 out of 10 children is unregistered which accumulates to 230 million children all around the world. UN (2016) data on birth registration shows that Eastern, Southern and Sub Saharan Africa and South and East Asia and Pacific (45% in Eastern and Southern Africa, 46% in Sub-Saharan Africa, %45 in West and Central Africa, 62% in South Asia and 80% in East Asia and Pacific) are the areas with smallest complete birth registration systems despite the fact that civil registration systems exist in these regions more than a century.

Figure 2.1 Birth registration completeness across regions



Source: UN (2016)

Regardless the background of the civil registration systems, considerable amount of the population is not covered by the birth registration systems. Least developed countries share the larger piece of unregistered births. Several UN and WHO reports and publications have addressed the poor state of birth in poor countries (Setel et al. 2007). In least developed countries, 45% of the births are unregistered (UN 2016). Most of the unregistered births are accounted for by developing countries; South Asia and Sub-Saharan Africa together account for 79 percent of all unregistered births. (UNICEF 2008)

Birth registration completeness dramatically vary from urban to rural and between income quintiles as it changes in regions. According to UNICEF (2014) data, birth registration is 79% complete at urban regions while only 50% complete in rural parts. The urban rural difference reaches its highest at Eastern and Southern Africa and lowest at CEE/CIS region. The income quintile also affects the birth registration behaviour. The birth registration completeness of the richest quintile of the world is

78% while the poorest quintile has 49% completeness according to UNICEF (2014). The biggest difference can be seen at Sub-Saharan Africa region while CEE/CIS region has the smallest variation.

As significance of birth registration increased, international agencies put less developed regions under scope. Brass (1996), in his paper "Demographic Data Analysis in Less Developed Countries: 1946-1996" discusses the indirect estimate techniques which help the demographers to obtain reliable results when they have inadequate or limited data. Another study is done by Pathak and Ram (1993) assessed the completeness of civil registration in India and its major states from 1981 to 1991 using Brass (1975) and Bennett and Horiuchi (1981) method (Williams 2014). Trends at the India country level show that only half of births were registered up to the mid-1990s which increased to 83.6% in 2011 (UNICEF 2013).

The situation in Africa is not very promising either. The Sub-Saharan Africa has 46%, Eastern and Southern Africa has 45% and West and Central Africa has 45% birth registration completeness. The only exception is Middle East and North Africa region with 89% completeness of birth registration. Nigeria's vital registration of births is about 30% complete with 19% and 50% in rural and urban areas respectively (UNICEF 2014), one of the lowest in Africa. Birth registration rates in Sudan have varied between 40 and 60% in the past 15 years according to the work of the Civil Registration Centre for Development-CRC4D. (CRC4D 2012).

2.5 STUDIES IN TURKEY

In Turkey, there are limited work on the quality, completeness and timeliness of the birth registration system. In 1997, "Working Group Report on Birth and Death Registration in Turkey" was published by State Statistical Institute (DIE). This report

was a joint work of experts from state and academy, stated the birth and death registration situation with examples from world, and suggested improvements. Results of the report indicated that, the birth registration completeness was around 40% in 1984. Starting from 1993, TDHS collected birth registration information of under-5 children for the preceding 5 years of each survey. Apart from TDHS, there are no other nationwide work until 2000s. In 2004, Koç's work "The variables impact on unregistered births in Turkey, and transition process to registered births" is another important study of the quality assessment of registration system literature in Turkey. In his work, Koç determined the size of unregistered birth, the variables impact on birth registration, and the median duration and transition probabilities from unregistered birth to registered birth (Koç 2004). 1993, 1998 and 2003 TDHS data was used in this study.

Further work of Koç and Eryurt took the previous research further and analysed the similar points of interest with the TDHS 2008 data (Koç and Eryurt 2010). 2008 data showed that percentage of the unregistered children decreased more radically in the 5-year period than before. According to the study, 6% of the children under 5 years old are unregistered. The absolute numbers were still high (360.000 in 6 million children) but every region had a sharp decrease in unregistered children population. According to Koç and Eryurt's work, unregistered male births decreased from 24.6% in 1993 to 5.2% in 2008 and unregistered female births decreased from 26.7% to 7.4% in the same time. It is stated that urban regions have 94.6% completeness while rural regions have 91.6% completeness. The North region has the lowest unregistered proportion with 3.4% while East region has 11.1% of births unregistered for children under 5.

The registration was low in children whom parents are in religious marriage. There is also a positive relationship between the educational level of mothers and welfare of the household and the percentage of registered birth according to Koç's work. Another important side of this work was the transition to registered state from

unregistered among children. Except the children of the resistant groups such as children born to women whose mother tongue is Kurdish, and children born to parents whose marriage type is religious, experience this transition up to age 5 (Koç 2004).

In these works, Koç and Eryurt examined the registration process in 5 and 12 statistical regions, and urban-rural residential areas. They also investigated the differences of sex of the children unregistered, education of the mother, mother tongue of the mother and welfare of the household. In this research, the median duration and transition probabilities were calculated for different variables. In Turkey, the median duration of registration was 32 months in 2008, declined from 40 months in 1993.

Another notable work in Turkey was Hoşgör's (2008) study, "The basic problem in women citizenship rights: "I have no identity card". In her study, Hoşgör handled the identity card and citizenship issues with feminist methodology and investigated the foundations of the problems in birth registration and the sociological characteristics of unregistered groups as well as groups registered late or declared incorrect statements. Her study also investigated the exclusion of such groups from society. Hoşgör's study also reveals how the relations of the state with individuals change with gender, region of the individual and social groups they belong (Hoşgör 2008). Her findings show that women and girls forms the majority of disadvantaged groups by the means of birth registration.

2.7 REGISTRATION SYSTEM AND REGULATIONS IN TURKEY

Registration system in Turkey is based on the Ottoman civil registration system (Çavlin 2011). The first population census was conducted in 1904, last years of Ottoman Empire, and the establishment of civil registries in Turkey dates back to this census. Vital events are recorded to the patrilineal family files and the place where

the files kept was the place of residence for the family. The Law of Surname passed in 1934 and every individual who doesn't have last name already, was granted a surname. Upgrading the civil registration system needed another 40 years almost. In 1972, the Law No 1543 and its successor Law No 1587 regulate the civil registration system and upgraded it. With the improvements made in the law 1587, it stated that;

> "The Ministry of Interior shall be empowered to ensure the transfer of family registries to registries kept in electronic form and to facilitate carrying out civil registration acts using these registries, to provide measures ensuring the security and privacy of the registries kept in electronic form, to repel the civil registries kept in paper form, to determine the civil registration offices empowered with issuing, registration and safekeeping of reference documents, to decide on the use of electronic signature in all kinds of civil registration acts carried out in electronic form, and to meet the requests for information from the records kept centrally in electronic form by the public institutions and the work flow in the headquarters and the districts in the scope of the principles and procedures to be determined within the completeness of civil registration services."

The Civil Registration Law also states that the paper or electronic forms of civil registries are official documents kept on a district and family basis. These civil registries include the information to determine the rights and obligations of individuals, their identity, family relations, civil status and nationality. Since civil registries are official documents, they must to be kept indefinitely.

The modernization of the civil registration system in Turkey announced in 2000 with the introduction of the Central Civil Registration System also known as MERNIS and converted to the online system in 2001. This new system was an online centralized version of the family file system inherited from Ottoman. MERNIS is a centrally administered system where changes and additions in registration can be done simultaneously over a secure network by the 966 civil registration offices among Turkey. The information is kept in the central database. Usage of the data is regulated by law and it can be shared with the administrative units. The ability of updating the database by 966 civil registration offices makes it updated constantly and effective to

use the data. The e-Government system in Turkey is also based on MERNIS. The MERNIS database consist of more than 130 million personal data files as of January 2009.

MERNIS system provides various services such as transferring traditional paper based registration information into electronic forms. It also matches the uniquely assigned Turkish Republic Identification Numbers to every citizen of Turkey and foreigners legally residing in Turkey. System is also responsible for gathering demographic data and reducing bureaucracy with information and communication technologies.

Records of birth, death, marriage and divorce events, citizenship and other vital events are registered by local population directorates of the General Directorate of Civil Registration and Nationality. Population registers are kept in the form of family ledgers, which is arranged according to the father for each family. Information related to birth events placed in Central Civil Registration System database is based on birth report or family declaration. In Turkey it is mandatory to declare the birth events by parents to the related district population directorate in one month after delivery.

Currently, the Civil Registration Services Law No 5490, dated 29.04.2006 is the main legislation regulating all aspects of civil registration is the Civil Registration Services in Turkey. The Civil Registration Services Law, charges Turkish Statistical Institute for establishing the Address Based Population Registration System (ABPRS), and charges General Directorate of Civil Registration and Nationality (GDCRN) for updating and maintenance of the system. According to the Population Registration Law No. 5490, all addresses within the boundaries of the country were registered in the National Address Database (NAD), and by linking addresses of Turkish citizens living within the boundaries of the country with the Turkish identification number,

Address Based Population Registration System (ABPRS) was established in 2007, and the system was transferred to the Ministry of Interior General Directorate of Civil Registration and Nationality (GDCRN). Since the beginning of 2008, changes in the addresses are updated by municipalities and special administration of provinces and changes in the places of residences are updated by the population registration offices based on declaration of persons (TurkStat 2013).

According to the population law 5490, the registration of live birth is a right of every child. Births occurred in Turkey is obliged to register within thirty days from the birth where the birth happened or at any population directorate, and within 60 days if the birth occurred abroad. Notification of the birth is mandatory. The notification can be done by mother, father, guardian or trustee, in the absence these, the child's great parents, adult siblings or the keepers of the child can register the birth showing the official birth certificate or oral statement. Birth certificate is attached to newborn’s document if it is presented at the time of registration.

In Turkey, besides the civil registration system, nationwide sample surveys have been collecting information on birth. Starting from 1968, national demographic and health surveys have been conducted every five years by Hacettepe University Institute of Population Studies. Since 1993 Turkey Demographic and Health Survey, birth registration information of children less than 5 years old have been collected. The data on birth registration is collected continuously to 2013 Turkey Demographic and Health Survey Survey. The last two DHS collected birth registration information for children under 10 years old.

CHAPTER 3
DATA AND METHODOLOGY

In this chapter, the main two data sources of the study and the methods used for the analysis are explained. The two data sources used for the study are the total number of births and date of birth registration information of 2009 to 2015 gathered from the Central Civil Registration System and the birth registration information gathered from Turkish Demographic and Health Survey 2013. The distribution in registered and unregistered births in TDHS data is used to understand the birth registration gap information gathered from CCRS. In the Data Sources subsection, these two data sources will be introduced. In the Methodology subsection, the calculation steps are presented in detail as well as the meetings held by experts in Turkish Statistical Institution and Population and Citizenship Affairs.

3.1 DATA SOURCES

After the foundation of the Turkish Republic in 1923, the first census of the republic was conducted on 1927. Starting with the second census on 1935, census was taken for quinquennial periods until 1990 by TurkStat. The de facto population present in the geographic boundaries in Turkey enumerated on the day of census. In 1997, an enumeration was held for the decision of the population to give vote in the elections. The last census, 14^{th} census of Turkey, was taken in 2000. After 2000, with the introduction of The Central Civil Registration System, also known as MERNIS, information of the population gathered on central database. After the new central registration system, the new population law introduced in 2006, the 'National Address Database (NAD) that covers all addresses in the boundaries of the country was established and Turkish citizens living in these addresses were registered according to the 'Turkish Republic Identification Numbers'. In 2007, the Address Based Population

Registration System announced. ABPRS matches information of individuals from MERNIS to the addresses in the NAD. Starting from 2007, the total population of Turkey on December 31 has been announced by ABRPS on the preceding January. According to the latest announcement, the population of Turkey is calculated as 78,741,053 for December 31, 2015.

The history of the nationwide demographic and health surveys in Turkey is as old as the shift to anti-natalist policy in Turkey. Ten national surveys about demographic and health issues and other national and small scale surveys on demographic subjects are carried out by HUIPS throughout 50 years. Five Demographic and Health Surveys (DHS) were conducted by HUIPS in 1993, 1998, 2003, 2008 and 2013. DHS surveys in Turkey are the only nationwide surveys which provides information on demographic variables and fertility in general. TDHS-2013 was conducted in 81 provinces and 641 clusters which were selected in such fashion to represent the country, the urban – rural and regional levels. In the TDHS-2013, interviews were completed with 11,794 households and 9,746 women in 15-49 age group and the field study took place in September 2013 – January 2014.

Number of registered births respect to age group of mother, sex of the child is available in both data sources. Additionally, TDHS data provides information on current education and wealth status of mother, and CCRS data provides registration gap information for NUTS-3. In this thesis, Central Civil Birth Registration System (2009 – 2015) and 2013 Turkey Demographic Health Survey (2009 – 2013) data sets are used in order to evaluate the timeliness and the completeness of the birth registration information of children under five as of 31 December 2015.

3.1.1 Registration Data

In this study, the administrative birth registration data is gathered from Turkish Statistical Institute that compiled the data from Central Civil Registration

System, which is owned by General Directorate of Population and Citizenship Affairs, and Death Notification System (DNS), which is owned by Ministry of Health. Birth data is available in CCRS, starting from 2001, the establishment of the system. Addition to the total number of registered births, registered male and female births and total number of births according to age of mother are available from 2001 to 2015. However, the birth statistics for 2001-2008 published according to the place of birth occurred. It has been started to be published by the place of permanent residence of mother according to ABPRS since 2009. The date of birth registration information was available in MERNIS but starting from 2009, it was included to the existing information collected[1].

In addition to known registration dates grouped in data, we also have births with unknown registration dates. The birth data taken from CCRS has birth registration for all cases, but the data taken from DNS does not have registration dates for the births. Actually, these births have not registered to birth registration system but caught with DNS and added to related calculations for statistical purposes. They are also not registered even after caught by TurkStat. Therefore, in the following parts, these births with unknown registration dates will be treated as unregistered births and the remaining unknown unregistered births will be estimated with the help of this group.

The backbone of the birth registration information of this study consists of the time interval between the date of birth and date of the birth registration. The time gap between these two events will be regarded as the registration interval from now on. As mentioned in the literature review, the legal registration interval according to the Population Law is, 30 days in Turkey. Compatible with the according law, the registration interval of the birth data was divided in 5 main registration groups. First group is the legal time of 30 days starting from the event of birth. After the legal interval, second group is 31 to 90 days, third group is 91 to 180 days, fourth group is

[1] Turkstat experts.

181 days to 1 year, the fifth and the last group is births registered longer than 1 year. From 2009 to 2015, birth registration intervals are divided according to this categorization.

The registration gap information aforementioned is available for total registered number of births, male and female births individually, 81 districts of Turkey and age of mother. For this thesis, age of mother grouped into two; which are mothers younger than 18 and mothers 18 or older. The legal marriage age is 18 in Turkey so rather than using classic age groups in demography, "-18" and "18+" age groups are used in order to further evaluate the birth registration of children born to adolescent mothers. Apart from sex and age of mother, this registration group information is available for five regions of Turkey. Apart from the birth registration information according to registration groups, data of registration months were used to evaluate the late registration. The birth registration numbers were available until February 2016 for 84 months of birth cohort.

3.1.2. TDHS-2013 Data

The 2013 Turkey Demographic and Health Survey (TDHS-2013) is a nationally representative sample survey designed to provide information trends on fertility, infant mortality, family planning and mother and child health. Survey results are presented at the national level, by urban and rural areas, for five regions of Turkey, and for the 12 geographical regions (NUTS1) for some of the survey topics. Hacettepe University Institute of Population Studies (HUIPS) carried out the TDHS-2013 in collaboration with the Ministry of Development and the Ministry of Health. TDHS-2013 is the fifth survey conducted as a part of worldwide Demographic and Health Surveys program. TDHS–2013 is the latest in the series of demographic and health surveys carried out in Turkey by HUIPS. The field work of the survey was held between September 2013 and January 2014 and interviews were completed with 11,794 households and 9,746 women at ages 15-49. Women at ages 15-49, who

usually live in the interviewed household or who were present in the household on the night before the interview, were eligible for the survey.

The registration status data is collected directly from the mother of the children born in 2003 and after. In the Pregnancy and Fertility section of TDHS-2013 the questions of "Is … recorded in the population registry?" and "How much time elapsed between …'s birth and registration?" were asked to the women with children under 10. The aim of these questions were to collect both registration status and the registration interval of alive and dead children of women.

In TDHS-2013, women were asked if their child's birth has been registered, but were not asked if the child actually has a birth certificate or an identity card. The information was based on the declaration of the mother. While collecting the data from the women about the registration date of their children, women may have difficulty in remembering the exact month or year interval of registration of their children. For these situations "Don't know" answers are recorded as "98" for the interval. There were only eight unweighted cases with this answer so the results are unaffected. For this thesis, from birth history data, the children born between 2009 and 2015 are filtered and weighted with women weight.

In the next subsection, methods for analyzing completeness and timeliness of the birth registration system and the method used for evaluating the past and current situation of the birth registration system will be discussed.

3.2. METHODOLOGY

In this chapter, I will briefly explain the methods used in the analysis and explain the justifications for choosing this method. As I mentioned in data subchapter and in literature review, the birth registration information provided from registration systems can only be evaluated from outside sources by means of completeness especially when the civil registration systems are relatively new. Most of the works for completeness assessment, used outside data sources, such as censuses or full population surveys designed for data quality purposes regarding a specific area. Since this two options are not available for Turkey, the best option of the outsource is 2013 Turkey Demographic and Health Survey.

In order to calculate the birth registration completeness and timeliness, which was calculated simultaneously, there were some preparation and calculation steps. In the following subsections of this chapter, I will talk about the preparations first. The birth registration groups will be introduced. In the second part, I will explain the method used for calculating completeness and timeliness of the birth registration data.

3.2.1. Births Groups According to Registration Time and Status

The registration interval of the births is divided into 4 main categories in order to understand the completeness and timeliness patterns better. First group is the children with registration of births have been completed timely (within 30 days following birth). The second group consist of children who are registered late. Third group is the cases which came with Death Notification System, and the registration dates were missing (captured by TurkStat but not actually registered in CCRS). The fourth group is the children without a birth registration (not captured). The registration data consist of first three types of children and TDHS data has all 4 type of groups.

The first group of cases consist of the births, which are registered in 30 days. 30 days is a key time interval in Turkey as mentioned before, legally all live births must be registered in 30 days after the event. This group will be the key component of the analysis since it can be studied with both data sources and it allows further investigation of the characteristic of the births. This group will be viewed with an importance to understand the patterns. In addition, this group of children will be analyzed with respect to the age of mother at birth, sex of the children, and usual residence of place of mother. This procedure will be held for both registration data and TDHS data in order to see the similarities. The percentage of registrations in 30 days of birth gives the timeliness of the birth registration in a specific time interval.

The second group, which is the late registrations, have divided into 4 more branches in order to investigate the timeliness of the registration better. Registration interval with 31-90 days is the first branch of the late registration. I chose this interval for several reasons. It is important to understand the change in timeliness over years, so relatively small interval after the legal time allows me to observe the accumulated late registers. Another reason is that it makes the timeliness comparisons easier since the interval of 90 days is a legal boundary for some countries. It is also convenient that 90 days is almost a full season in Turkey. The second branch of the late registers are consisting of the registration made after 90 days to 180 days of birth and the third branch is composed of registrations made after 180 days to 1 year. The last branch of the late registration is the registrations made after 1 year. The last branch is chosen in order to explore the post-infancy registration.

The late registrations are very important to investigate as it has valuable information of the progress of the birth registration system and it is the core source for the timeliness of the registration. The changes in the late registration are examined with a focus on birth variables. The rates of changes are calculated with respect to sex of the child, age of mother at birth and usual place of residence of mother.

The third group is the births with unknown registration dates. As mentioned in data sources chapter, the missing information of registration dates exist in both data sources. The missing dates of birth registrations in TDHS data is evaluated in two groups. The first group of births with missing registration dates are alive children. Since the registration information is gathered from mother, they can have difficulty in remembering the exact dates of registration and state that they do not remember the registration dates precisely. Besides, registrations of births are made in General Director of Population and Citizenship Affairs, not in hospitals so women may not remember the dates. The second group is the children who are not alive at the time of survey. Infant deaths can be registered by hospitals and this can cause the lack of knowledge of the registration date. On the other hand, the large majority of the cases with unknown registration dates in the birth registration data are the infant deaths added to number of births of the corresponding year after the death of the infant. These cases are not registered in the registration system but TurkStat captured them by matching those missing cases from the Death Notification System.

Births with unknown registration dates in the registration system data are treated as they are unregistered since the information of these births are not collected from MERNIS and there is not any system to register these births. For this reason, these group of births in TDHS and registration system corresponds to different group of children. Births with unknown registration dates in TDHS are evaluated as registered children and births with unknown registration dates in registration data grouped with unregistered births. The data of birth registration system for this group of births was deficient for the year 2011 so the values for 2011 are interpolated in order to keep a steady trend. This interpolation is explained in the following steps.

The last group of births are the unregistered births. The unregistered births are evaluated in three categories;

- the births which are not registered at the time of reference but will be registered before the child turns five,
- the unregistered births of dead children captured with Death Notification System,
- the births will remain unregistered after five years of birth.

All three categories exist together as unregistered children in TDHS data. Since registration of a birth in Turkey, in other words, entry of a case in the system only happens upon notification, the unregistered births in TDHS cannot exist in MERNIS in the corresponding time reference. Thus, by definition, the unregistered children are absent in the MERNIS. The sum of these three categories makes the unregistered birth of a given time.

The first category of unregistered children exists partially in registration data, depending on the time reference, and can be projected for missing years. The second group of children are known for every year in registration data and number of these children are used to determine the number of total unregistered children. The last group of unregistered children doesn't exist in the registration data and estimated from calculations of the unregistered children from TDHS and separating the first two categories of unregistered births. The last group of unregistered child is only available in TDHS data because of the nature of the registration system.

By utilizing birth registration groups, a method for determining the completeness and timeliness is developed for this specific type of data. In the next subsection, this method will be introduced.

3.2.2. Calculating the Birth Registration Completeness and Timeliness

The nature of the birth registration data permit calculating the completeness and timeliness of the registration systems simultaneously. The analysis of the registration data has been carried out on three steps. The first step was rearranging the registration data in order to prepare it to compare and match it to the TDHS data of registration of birth. Second step was projecting the late registration numbers of births up to 60 months from birth, the first category of unregistered children. The last step was calculating the third category of unregistered births and calculating the completeness and timeliness. In the following part, I will explain these steps briefly.

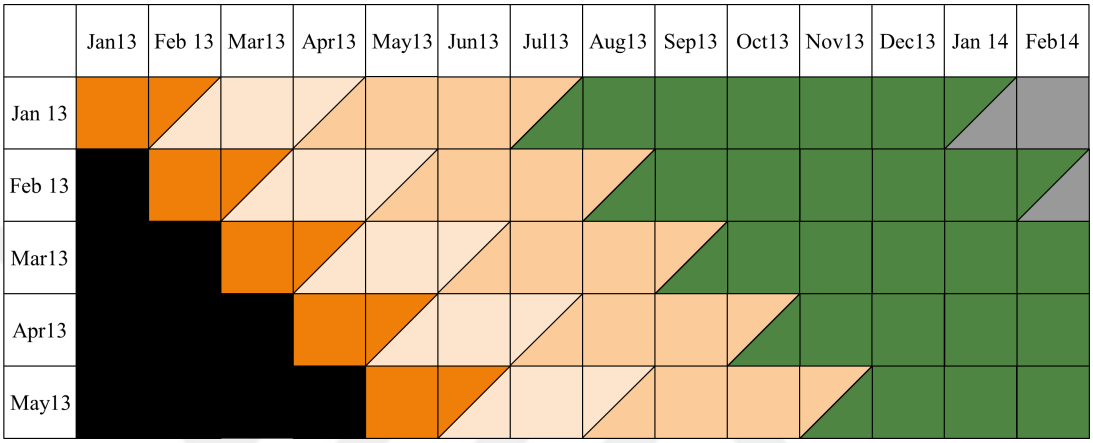
3.2.2.1 Rearranging Groups

The TDHS was carried out at the end of 2013 and in order to compare TDHS data with registration data, the time reference is taken as 31 December 2013. The reason is to compare TDHS with registration data since the period for TDHS covers the births until the end of 2013. The two types of the registration data, birth registration months and five registration groups, did not allow such rearrangement on their own, but comparing one to the other, it was possible to separate the time groups of registration and compute the end year registration numbers for any year.

Either the registration months falls into one of the five predetermined registration group or consist of two of these registration groups. If we give numbers to registration months starting from the birth month, first month obviously belongs to 0-30 days category since if a birth is registered in the birth month, time interval of registration cannot exceed 30 days. The the second month, consists of registrations made in 0-30 days and 31-90 days. The third month, only consist of 31-90 days group. The fourth month consists of 31-90 days group and 91-180 days group. Months five and six only consist of 91-180 days groups. Seventh month consist of 91-180 days group and 181-365 days group. Months eight, nine, ten, eleven and twelve are in 181-365 days group. The thirteenth month consist of 181-365 days group and plus 1 year

group. The months following the thirteenth month are all in plus 1-year group. The Figure 3.1 summarizes the process.

Figure 3.1 Separation of registration months



For example, if we demonstrate the separation of data for December 2013 births, 0-30 days of registration consists of complete registers in December 2013 and partial registrations of January of 2014, 31-90 days of registration consist of partial January, full February and partial March, 91-180 days of registration consists of partial March, full April, full May and partial June, 181-365 days of registration consist of partial June, full July, full August, full September, full October, full November and partial December, and plus 1 year consist of partial December and the months following it.

After this separation, number of birth registration were censored from the birth registration group if the registration made 2013. This separation was made for every year but it was easier for previous years since the registrations made in 2014 and later was all in “plus 1 year” category for 2009 to 2013. The same procedure has been applied for 2011-2015 period since the last birth month of the registration data was December 2015.

TDHS-2013 data was also prepared for the comparison. The registration information was collected for all births occurred after 2003 but the registration data of the MERNIS was starting from 2009. In order to fix the time reference, 2009 and later birth years have been filtered from the dataset. This procedure made two data sets comparable with each other.

3.2.2.2. Comparing Registration Data with TDHS

The second step was comparing the rearranged registration data with the TDHS data. The proportions of 0-30 days of registration and late registration categories to the total registered births in TDHS data were compared with the same proportions in the registration data. The similarities of the proportions of registered births gave the opportunity to an assumption that total number of unregistered births would be also similar between the two data sources.

The percentage of unregistered births is calculated from TDHS data. Confidence intervals were calculated for this percentage also. This percentage then used to estimate the total unregistered number of children in 2009 – 2013 period where the time reference was set to the end of 2013. At the end of this calculation, total number of estimated unregistered births were available for 2009-2013 period and without further calculation, the estimated registration completeness for 2009-2013 period was presented. These calculations are made for Turkey and other 8 groups of subpopulation; male and female births, births occurred to mothers younger than 18, and five statistical regions; West, South, Center, North and East.

The calculated number of unregistered children for the given period is the sum of three categories of unregistered birth group. This group consists of the births which are not registered at the selected time but will be registered before the child turns five, the unregistered births of dead children captured with Death Notification System, and

the births will remain unregistered after five years of birth. In the next subchapter, I will explain how I treated these separate groups.

3.2.2.3. Projecting Late Registrations

The third step of the method was projecting the late registration numbers. The majority of the unregistered births numbers are late registers. Specifying a time reference naturally gives unequal chances to different birth cohorts. While older children have more than one year to complete their registrations, infants have less than one year. Thus, calculating the registration completeness should also consider the late registration of younger cohorts.

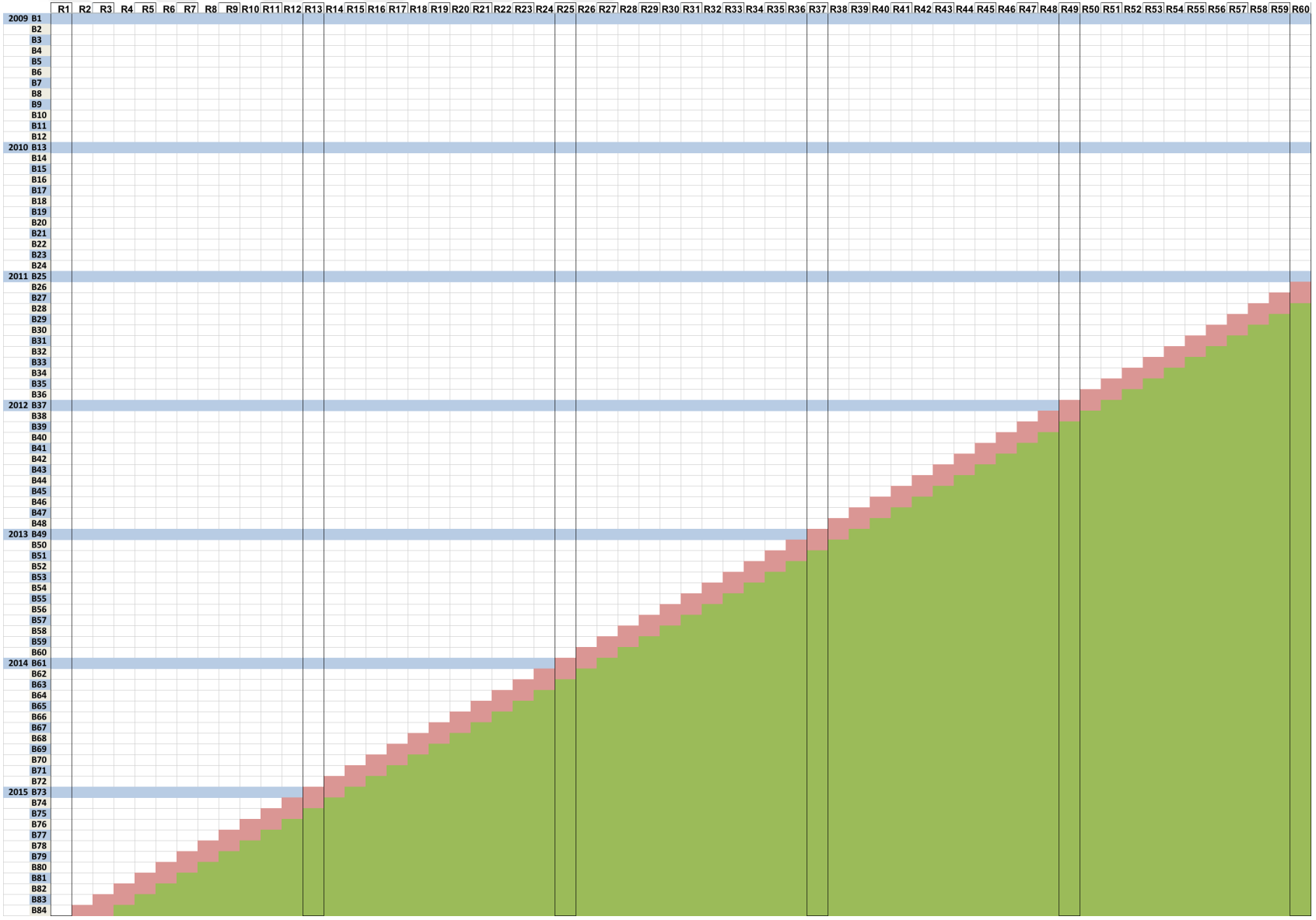
In order to understand the current trends and predict the late registration until 60 months, the data of registration by months have been analyzed. Without loss of generality, months have little differences from each other by the means of registration. With this generalization, there were 84 different birth cohorts according to birth months between 2009 - 2015 period. Since the reference point of the registration data was at the end of February 2016, all 72 cohorts have their first, second and third months of registration data completely. For 2009 and 2010, all cohorts have completed data of 60 months of registration, since 5 years have passed over the birth. For 2011 January, February and March, also 60 months of data was available. Starting from April 2011, with the increasing birth cohorts, the more registration data was missing for months. April 2011 was missing only the 60^{th} month registration, May 2011 was missing 59^{th} and 60^{th} months or registration and the last cohort, December 2015 was missing all data after 4^{th} months of registration, accumulates to 57 months of registration data missing for the last cohort.

Figure 3.2 summarizes the projection process. The white parts are the existing data, the red parts are the 2016 registrations and green parts are the estimates made from the existing data. The estimates are made using trends of registration downwards

for each R_n value where R_n denotes the n^{th} registration month. The B_n values represents the n^{th} birth cohort.

Despite the large missing data for recent cohorts, since the late registration projections made for registration months, the missing information for recent months are projected with more complete data and for fewer cohorts. The late registrations were projected with fewer data points for more cohorts, but the later registration numbers are so insignificant that the differences of projections could hardly make any difference to the result.

Figure 3.2. Estimating process of late registrations



In order to forecast missing late registration numbers, first, the known registrations are transformed into the ratios. Every number of registration starting from the second month was divided to the number of registration in the first month. These values represent the ratios of the number of births in a registration month to its corresponding first month registration number. These ratios will be called registration month ratios. As expected, the registration month ratios tend to decrease for both later registration months and children in higher birth cohorts. As birth cohorts increase, the registration system was improved due to time, therefore the timely registration percentages increased. As the time gap between the registration month and birth month increases, more births become registered and registration system became more complete for that birth month cohort which caused ratios to converge to zero.

Projections were made for each registration month order, starting from month four. The change of the aforementioned ratios was fitted to a curve using MS Excel's curve fitting and logarithmic trend lines were produced. The coefficients of the logarithmic trend lines were calculated for each month order and late registration numbers for missing months were generated from corresponding linear regression formulas.

The curve fitting and missing late registration number generation procedure was repeated for male and female births, births occurred to mothers under 18 and five regions of Turkey. While linear regression results for missing values of late registration months generated positive results for total, male and female births, and West, Center and South regions, for births occurred to mothers younger than 18 and East and North regions, last values of some month orders got negative values. As it is impossible to experience negative numbers for registered births, this values are accepted as zero. These corrections are specified under the related tables and calculations.

The sum of estimated numbers of late registrations formed the first category of unregistered children for corresponding years and subpopulations. Thus, this category was calculated for every year, also for 2009-2013 and 2011- 2015 period. These projected numbers with the registered numbers of births made the under-5 registration of corresponding births.

3.2.2.4. Calculating the Unregistered births which will remain unregistered after 5 years of birth

The last step of the method was combining all values and estimating the third category of unregistered births, the births which will remain unregistered after 5 years of birth, for 2011-2015 period. Thus far, the total number of unregistered births for 2009-2013 period and the first category of unregistered births, the late registers, were calculated. The second category of unregistered births were already available in the registration data. The missing values for 2011 were estimated with interpolation. For every calculation of completeness, this interpolation of missing values for 2011 has been repeated. Combining this information, the last missing piece of data, the births which will remain unregistered after 5 years of birth, is calculated for 2009-2013 period.

In order to calculate birth registration completeness and timeliness for 2011-2015 period, the three categories of unregistered births are needed. The estimation of late registration numbers was calculated among the previous time period. The unregistered births of infant deaths captured by Death Notification System was already available in the registration data. The last part of the puzzle, the births which will remain unregistered after five years of birth was calculated from the same value of 2009-2013 period.

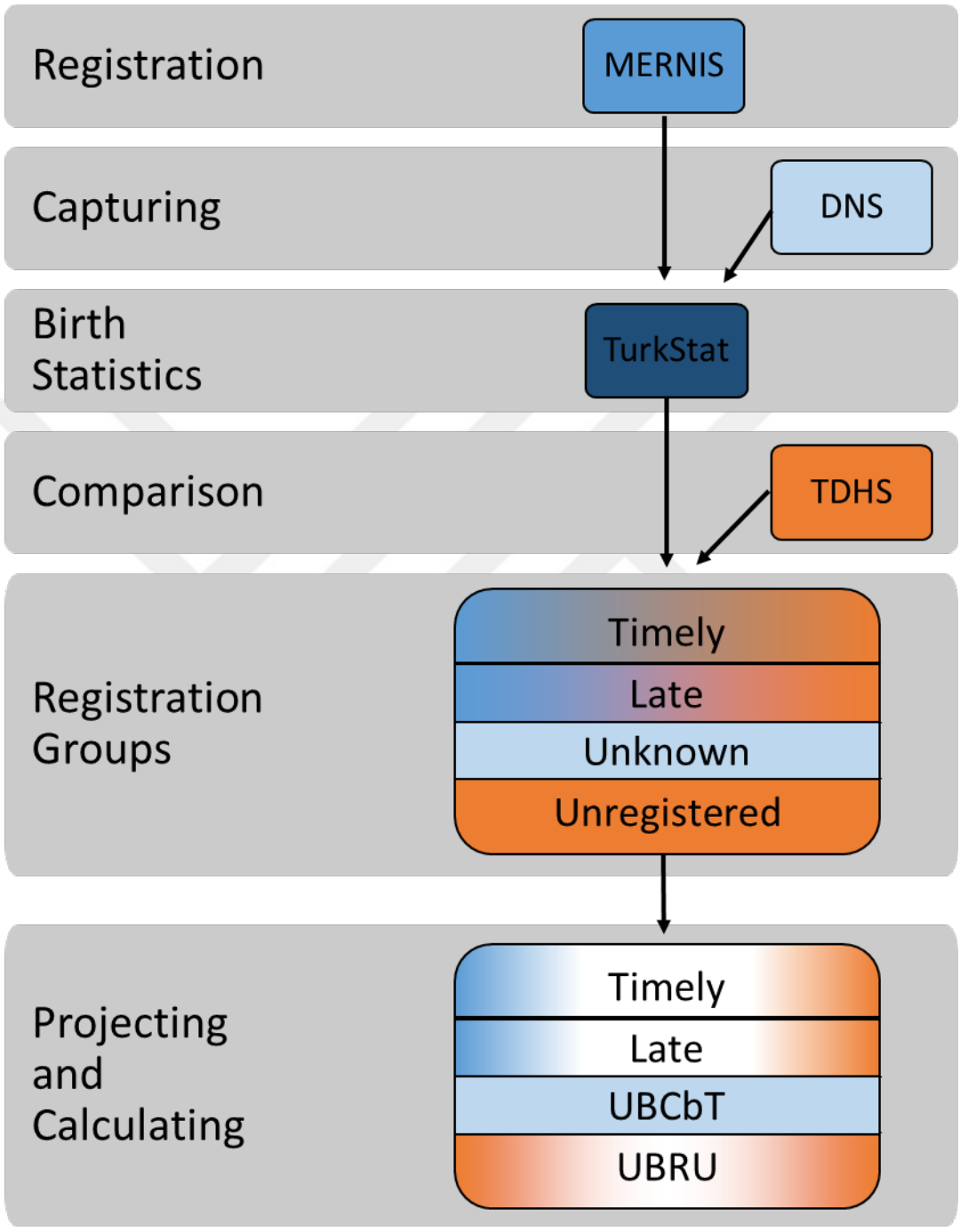
Rather than estimating the third category mentioned above as a whole, the number of estimated unregistered births which will remain unregistered after 5 years

of birth was distributed to each year. Since there were not enough cases of this category in TDHS data, the distribution was made with the help of the second category. First, the total number of unregistered births of third category distributed to years 2009 to 2013 using the percentage distribution of second category of unregistered births to same years. Second, the percentage distribution of second category was used to calculate the 2014 and 2015 values of unregistered births of third category. Thus, the total number of category three was calculated for 2011-2015 period.

The calculated total value of category three of unregistered births for 2009-2013 period was also distributed to subpopulations using the same logic above. This category was distributed for male and female births, births occurred to mothers younger than 18 and 5 regions. The separated values are redistributed to years for individual calculations of subpopulations.

In brief, the timely registrations and late registrations until the end of February 2016 was available in the data. The projections were carried out separately for total population and each subpopulation. The first category of unregistered births was calculated from these projections for required time intervals. The second category of unregistered births were also available in the registration data for total population and each subpopulation. The third category of unregistered births was calculated using TDHS data for total and distributed for subpopulations since the number of cases of the TDHS was insufficient for individual calculations. With all groups either rearranged, calculated or estimated, the timely registration, late registration and unregistered births are calculated for total, subpopulations of interest and each year. The completeness and timeliness of 2011-2015 period was presented in results based on this numbers. In Figure 3.3, methodological steps of the analysis can be found.

Figure 3.3. Summary of Methodology Steps



CHAPTER 4
THE VALUATION OF THE COMPLETENESS AND TIMELINESS OF THE BIRTH REGISTRATION SYSTEM

This chapter will present the results of the descriptive results and further analysis. The first subchapter will give descriptive information and draw a picture of the general registration pattern of Turkey. The statistics introduced in subchapter 4.1 are directly generated from the TurkStat's registration data. The subsequent subchapter presents the completeness and timeliness results for the analysis starting from total births. After that, results for male and female births, births occurred to mother younger than 18 and results for 5 regions are stated.

4.1 DESCRIPTIVE RESULTS

The number of births in Turkey have been almost remained same throughout the establishment of MERNIS. Table 4.1 shows the number of births from 2001 to 2015 by sex of the child. The minimum total number of births occurred in 2003 with 1,193,154 births and maximum total number of births occurred in 2014 with 1,345,286. However as mentioned in the previous chapter, every year birth registration numbers are revised 5 years retrospectively by TurkStat so the number of births will increase for years 2011 later with the revisions due to late birth registration.

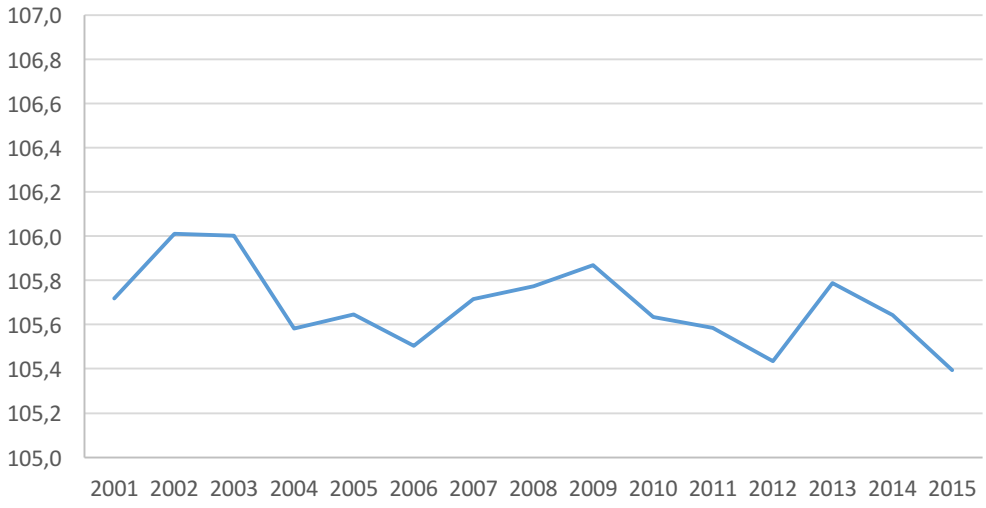
Table 4.1. Number of births in Turkey by sex, 2001-2015

Year	Male	Female	Total
2001	679,316	642,574	1,321,890
2002	631,212	595,429	1,226,641
2003	613,958	579,196	1,193,154
2004	623,250	590,295	1,213,545
2005	632,743	598,935	1,231,678
2006	635,950	602,775	1,238,725
2007	650,845	615,658	1,266,503
2008	648,875	613,458	1,262,333
2009	651,432	615,319	1,266,751
2010	647,859	613,310	1,261,169
2011	641,238	607,312	1,248,550
2012	663,283	629,097	1,292,380
2013	665,243	628,845	1,294,088
2014	691,100	654,186	1,345,286
2015	680,298	645,485	1,325,783

Source: TurkStat

The Figure 4.1 shows the sex ratio at birth in Turkey from 2001 to 2015. The sex ratio at birth should vary between 105 and 107 male births per 100 female births. The results show that the sex ratio at birth is almost stable around 106 in Turkey for the past 15 years.

Figure 4.1 Sex Ratio at Birth for Turkey, 2001-2015



The number of birth of adolescent mothers are almost reduced to half from 2009 to 2015 (Table 4.2). Despite the reduction, mothers younger than 18 years old have registered 18,033 births, making 1.36% of all births registered in 2015. This ratio was 2.57% in 2009.

Table 4.2 Number of births in Turkey by the age of mother, 2009-2015

Year	<18	18+	Unknown	Total
2009	32,556	1,225,759	8,436	1,266,751
2010	30,165	1,222,165	8,839	1,261,169
2011	26,804	1,212,126	9,620	1,248,550
2012	24,516	1,256,682	11,182	1,292,380
2013	22,181	1,259,665	12,242	1,294,088
2014	20,599	1,313,617	11,070	1,345,286
2015	18,033	1,297,312	10,438	1,325,783

Table 4.3 shows the number of births occurred in five regions of Turkey from 2009 to 2015. For each year between 2009 and 2015, West region has the most number of births registered since it has the most population. The East region follows the West, having the highest fertility rates and the North region has the least number of births registered.

Table 4.3 Number of births in Turkey by regions, 2009-2015

Year	West	South	Center	North	East	Total
2009	434,269	167,506	242,591	75,281	347,104	1,266,751
2010	435,758	166,123	237,330	72,317	349,641	1,261,169
2011	434,781	163,409	234,614	69,156	346,590	1,248,550
2012	459,986	169,747	238,446	69,162	355,039	1,292,380
2013	462,091	170,265	238,198	68,341	355,193	1,294,088
2014	484,868	176,561	245,686	68,354	369,817	1,345,286
2015	486,009	173,392	241,113	66,656	358,613	1,325,783

An increase can be observed in registered births for West, South and East regions. The number of births registered in Center region has remained nearly same

for 6 years. The North region has experienced a decline of registered births. The distribution of births registered in regions among years remained almost unchanged for the 2009-2015 period. The following parts will present the results of the analysis of birth registration completeness and timeliness.

Table 4.4 Birth registration in TDHS-2013

	Number	Percentage
Registered births	**3,200**	**98.64**
0-30 days	3,049	93.96
31-90 days	100	3.08
91-180 days	14	0.45
181-365 days	10	0.31
More than 1 year	19	0.59
Late registration	144	4.43
Missing	8	0.25
Unregistered births	**44**	**1.36**
Alive unregistered	22	0.66
Dead unregistered	23	0.70
Total	**3,245**	**100.00**

Table 4.4 shows the descriptive results of TDHS registration data. According to TDHS, 98.64% of the births between 2009 and 2013 are registered and 1.36% of all births are unregistered as the end of 2013. Almost half of the unregistered births belong to alive children while the other half of the unregistered births are no longer alive.

4.2 RESULTS OF ANALYSIS

For the analysis of the completeness and timeliness of the registration system, the steps explained in Methodology chapter are followed. Before giving results for completeness, first I will present the core data of registration in two different forms and explain the interpolation of the number of births with unknown registration dates for 2011.

4.2.1. Results for Turkey

The Table 4.5 shows the total registered births between 2009 and 2015 with age at birth registration groups of 0-30 days, 31-90 days, 91-180 days, 181-365 days, more than 1 year and unknown. The 0-30 days column shows the number of births in the corresponding year, which are registered in 30 days of birth. As expected, the majority of the births are registered in 30 days, as legally specified. The late registrations, the groups contain birth registrations happened in 31 days to 5 years, seem to decrease through the years. This reduction shows an improvement of the registration system but the revisions also must be kept in mind. The number of registered births in 0-30 days group will not change for any year but remaining groups of 2015 births will be updated in 2017 February. The "more than 1 year" group will be updated for years 2011 to 2015. With bearing in mind the revisions, the changes of first four groups can be interpreted for years 2009 to 2014. Each group of late registration has improved and a stabilization can be observed in groups of 31-90 days, 91-180 days and 181-365 days.

Table 4.5 Number of births registered by age at registration according to birth registration groups, 2009-2015

Year of birth	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 year	UBCbT*	Total
2009	1,133,523	62,341	20,148	16,419	27,645	6,675	1,266,751
2010	1,165,405	42,385	15,700	13,038	1,937	5,254	1,261,169
2011	1,180,305	35,065	11,300	9,047	12,449	384	1,248,550
2012	1,234,660	30,414	8,186	6,096	8,767	4,257	1,292,380
2013	1,246,367	24,920	6,765	5,142	5,953	4,941	1,294,088
2014	1,298,459	27,301	6,996	5,346	3,381	3,803	1,345,286
2015	1,292,971	22,067	4,874	2,062	120	3,689	1,325,783

*Unregistered births captured by TurkStat

The Table 4.6 shows the number of registered births by year, same registration data in previous table from different point of view. The late registrations can be followed easier on this form. With the passing years, the number of births which took

2 years or more to register, decreased noticeably. This table will also be updated after the next revision since the registration number column for 2016 only contains the January and February of 2016.

Table 4.6 Number of births in Turkey by registration year, 2009-2015

Birth Year	2009	2010	2011	2012	2013	2014	2015	2016	UBCbT*	Total
2009	1,190,578	50353	10,033	5,134	2,308	1,484	186	-	6,675	1,266,751
2010	-	1,199,643	43,084	7,021	3,003	1,680	1,311	173	5,254	1,261,169
2011	-	-	1,201,837	37,911	4,477	2,203	1,573	165	384	1,248,550
2012	-	-	-	1,251,637	30,678	3,399	2,167	242	4,257	1,292,380
2013	-	-	-	-	1,257,932	27,694	3,192	329	4,941	1,294,088
2014	-	-	-	-	-	1,312,240	28,527	716	3,803	1,345,286
2015	-	-	-	-	-	-	1,304,575	17,519	3,689	1,325,783

*Unregistered births captured by TurkStat

As observed in above tables, the 2011 births with unknown registration, which were the births captured by Death Notification System, dates are much fewer than the other years. There is no reason to have such stark decrease for a year. In order to fix the trend of the unknown registration numbers, the 2011 value for this group is estimated with interpolation. The remaining data fit into a curve of $y = -1408\ln(x) + 6511{,}7$ and $R^2 = 0{,}89$. From this curve, the 2011 value calculated as 4965 and the further computations made are based on this value. The Figure 4.3 shows the values of unknown registration numbers, the curve and the calculated value for 2011.

Figure 4.2 Interpolation of UBCbT for 2011

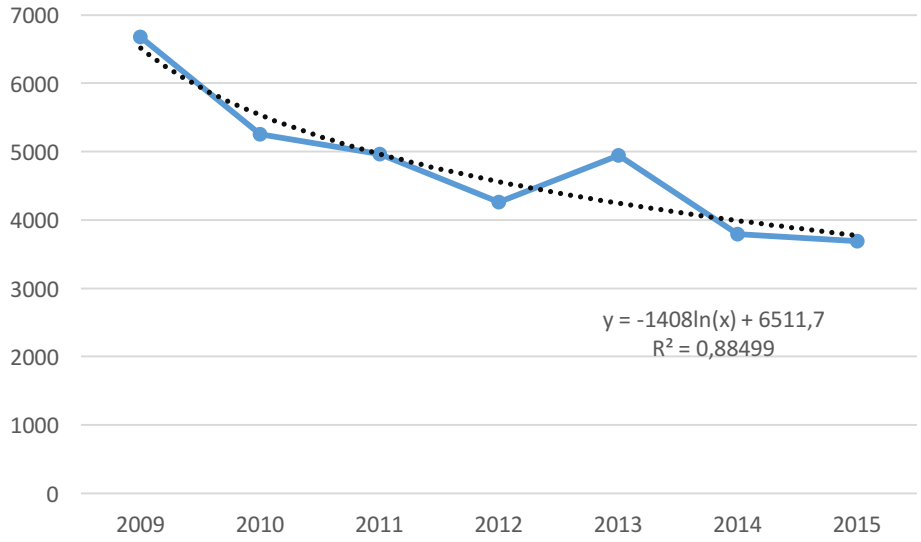


Table 4.7 Number of births registered as the end of 2013

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 year	UBCbT*	Total
2009	1133523	62341	20148	16419	25975	6675	1265081
2010	1165405	42385	15700	13038	16223	5254	1258005
2011	1180305	35065	11300	9047	8508	4965	1249190
2012	1234660	30414	8186	6096	2959	4257	1286572
2013	1230361	21803	4351	1417	0	4941	1262873
Total	5944254	192008	59685	46017	53665	26092	6321721

*Unregistered births captured by TurkStat

The aim was comparing two sources and we had 2009-2013 births in TDHS data. Therefore, we rearranged the registration data and censor out the post 2013 births for this purpose. After the rearrangement of the TurkStat data of registration, Table 4.7 shows the calculated values of the number of births registered as the end of 2013. The 2009-2015 births of TDHS-2013 are used for comparison. This rearranged values than distributed to birth registration groups. The Table 4.8 shows the numbers and percentages of this distribution. TDHS-2013 shows 95.26% of registered births are timely registered while according to TurkStat data, 94.42% of registered births were

timely registered. The late registration percentages are also compatible. The "31-90 days" group makes the 3.12% of the registered births in TDHS-2013 and 3.05% of TurkStat.

Table 4.8 Distribution of registered births, 2009 - 2013

	TDHS-2013		TurkStat (as of December 2013)	
Age at registration	Number	Percentage	Number	Percentage
0-30 days	3,049	95.26	5,944,254	94.42
31-90 days	100	3.12	192,008	3.05
91-180 days	14	0.45	59,685	0.95
181-365 days	10	0.32	46,017	0.73
More than 1 years	19	0.60	53,665	0.85
Missing	8	0.25	-	-
Total registered	3,200	100.00	6,295,629	100.00

Table 4.9 Distribution of 2009-2013 births as the end of 2013

	TDHS		TurkStat	
	Number	Percentage	Number	Percentage
Registered births	**3,200**	**98.64**	**6295,629**	**98.64**
0-30 days	3,049	93.96	5944,254	93.13
31-90 days	100	3.08	192,008	3.01
91-180 days	14	0.45	59,685	0.94
181-365 days	10	0.31	46,017	0.72
More than 1 year	19	0.59	53,665	0.84
Late registration	144	4.43	351,375	5.51
Missing	8	0.25	0	0.00
Unregistered births	**44**	**1.36**	**86,799**	**1.36**
UBCbT*	-	-	26,092	0.41
Not captured by any system	-	-	60,707	0.95
Total	**3,245**	**100.00**	**6,382,428**	**100.00**

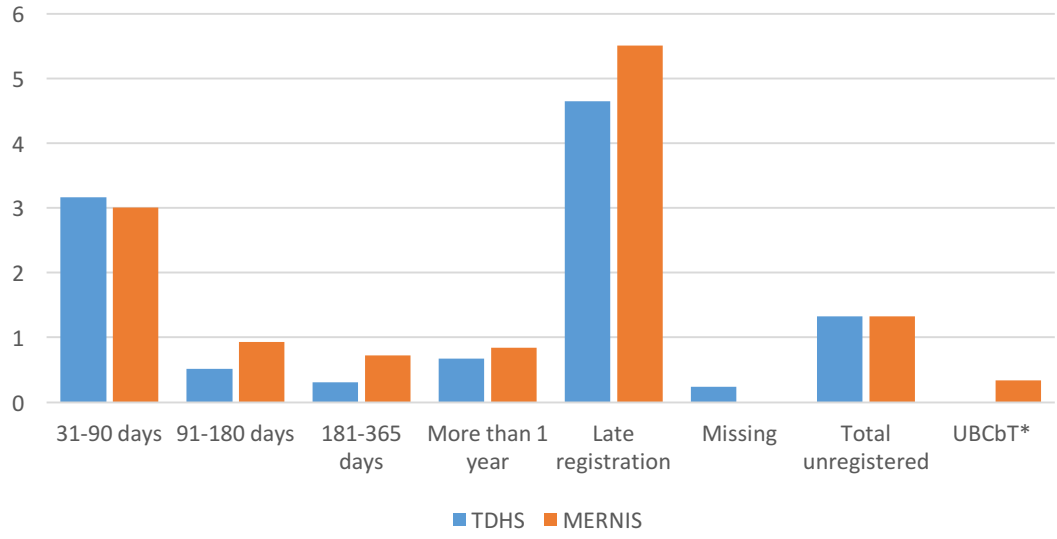
*Unregistered births captured by TurkStat

Table 4.9 shows the timely registrations, late registrations and unregistered births in TDHS and TurkStat. The percentage of unregistered births assumed to be same for two data sources and taken as 1.36% of total births. From this assumption,

the total number of unregistered births for 5 years has found 86,799. The confidence intervals for this estimate can be found at the Appendix.

The Figure 4.3 shows the distribution and comparison of the late, missing and unknown registrations and the unregistered percentages. The 31-90 days registrations make the 3% of all registrations, almost same for TDHS and TurkStat. The percentages of remaining late registration categories are higher for TurkStat. The unregistered percentages are same for two data sources because of our assumption.

Figure 4.3 The distribution of late registration and unregistered births of TDHS and Registration data, 2009-2013



*Unregistered births captured by TurkStat

The next step after we estimated the total unregistered births is projecting the late registrations. Figure 4.4 shows the 4-6 months of registration. Despite their previous peak values, R4 remained under 0.6 for the last 30 cohorts. R5 and R6 stayed under 0.3 in the same cohorts. Figure 4.5 shows the 7-12 months of registration. For more than 30 cohorts, R7 stayed under 0.2 and now fluctuating around 0.1 with R8,

R9, R10, R11 and R12. Figure 4.6 presents the second year of registration. R13-R24 group seems to became stable around 0.05. In Figure 4.7, the third year of registration shows that R25-R36 get values around 0.025. The Figure 4.8 and Figure 4.9 shows the fourth and fifth years of registration. In this figures R37-R48 get values around 0.02 and R49-60 get values under 0.02.

Logarithmic curves fitted for each registration month and missing values are calculated from the equation. The estimated registration month ratios and variables to each curve can be found in the Appendix. From estimated ratios, the late registrations are calculated. The following figures show the trend of registration month ratios with the corresponding birth cohorts.

Figure 4.4 Registration month ratios for 4-6 months

Ratio of 4-6 month of late birth registration numbers to the first month birth registration number

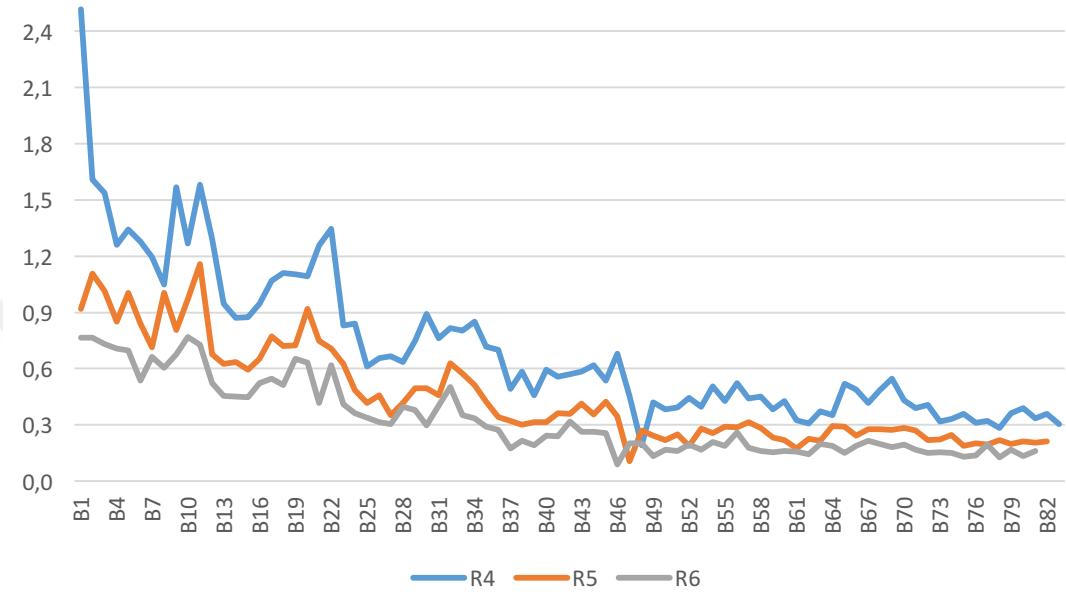


Figure 4.5 Registration month ratios for 7-12 months

Ratio of 7-12 month of late birth registration numbers to the first month birth registration number

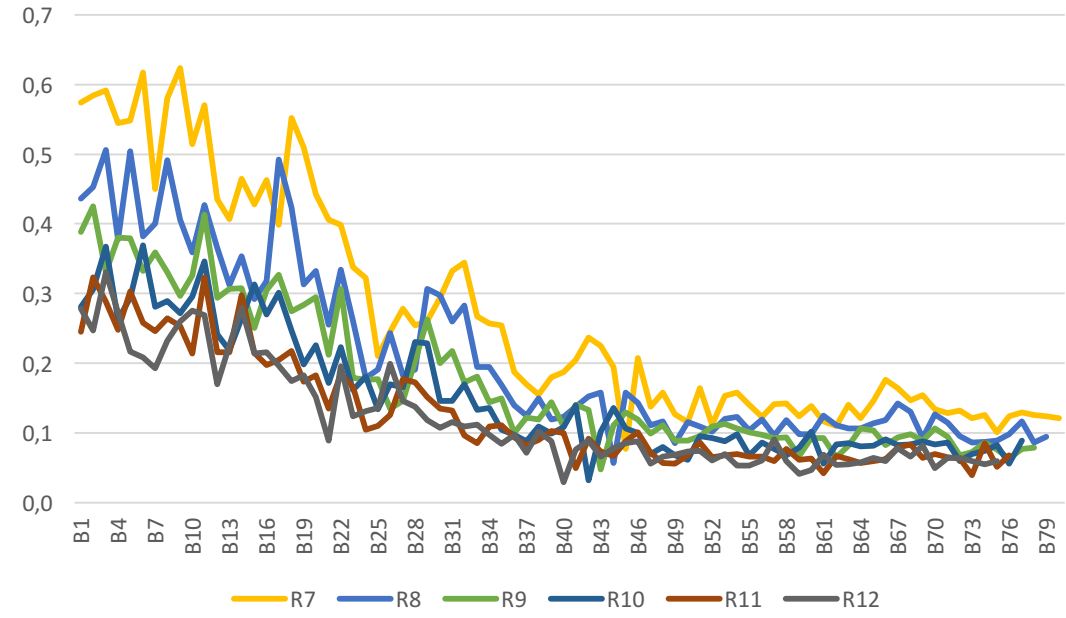


Figure 4.6 Registration month ratios for second year

Ratio of 13-24 month of late birth registration numbers to the first month birth registration number

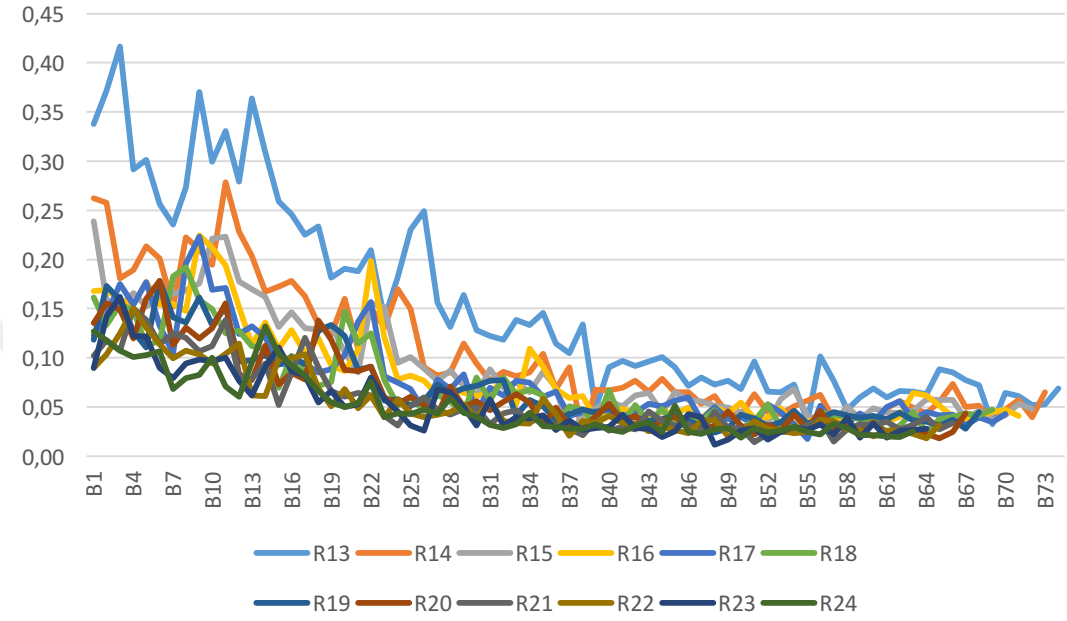


Figure 4.7 Registration month ratios for third year

Ratio of 25-36 month of late birth registration numbers to the first month birth registration number

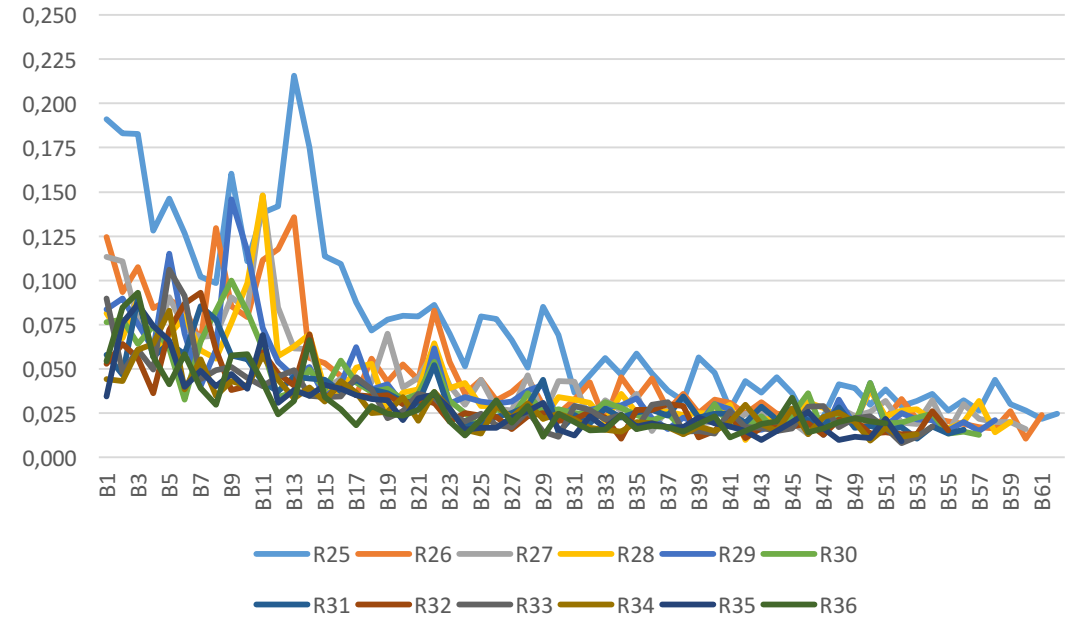


Figure 4.8 Registration month ratios for fourth year

Ratio of 37-48 month of late birth registration numbers to the first month birth registration number

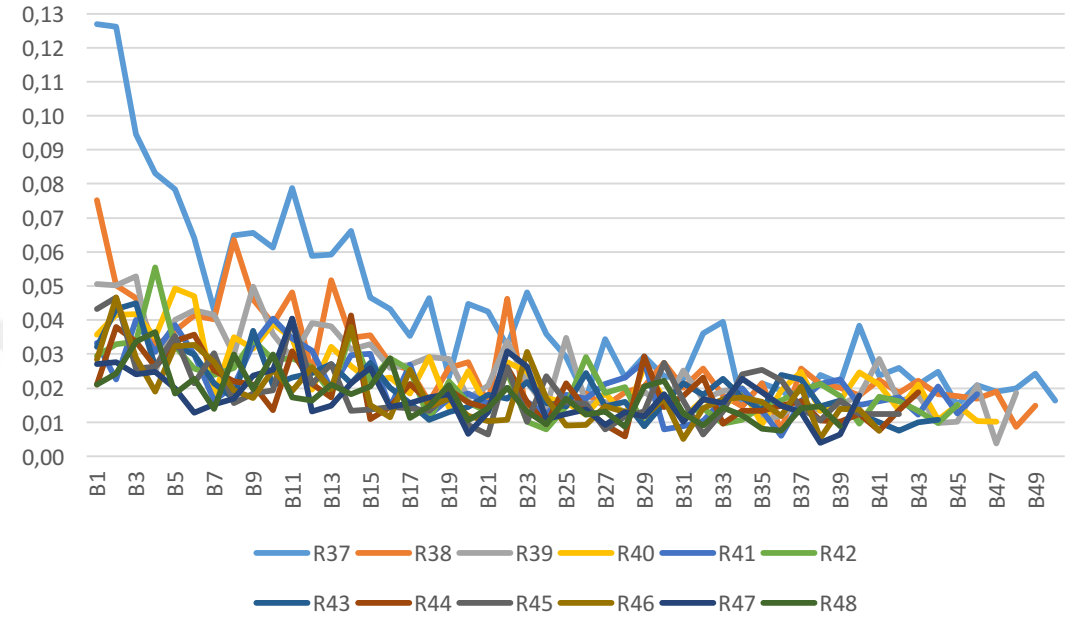
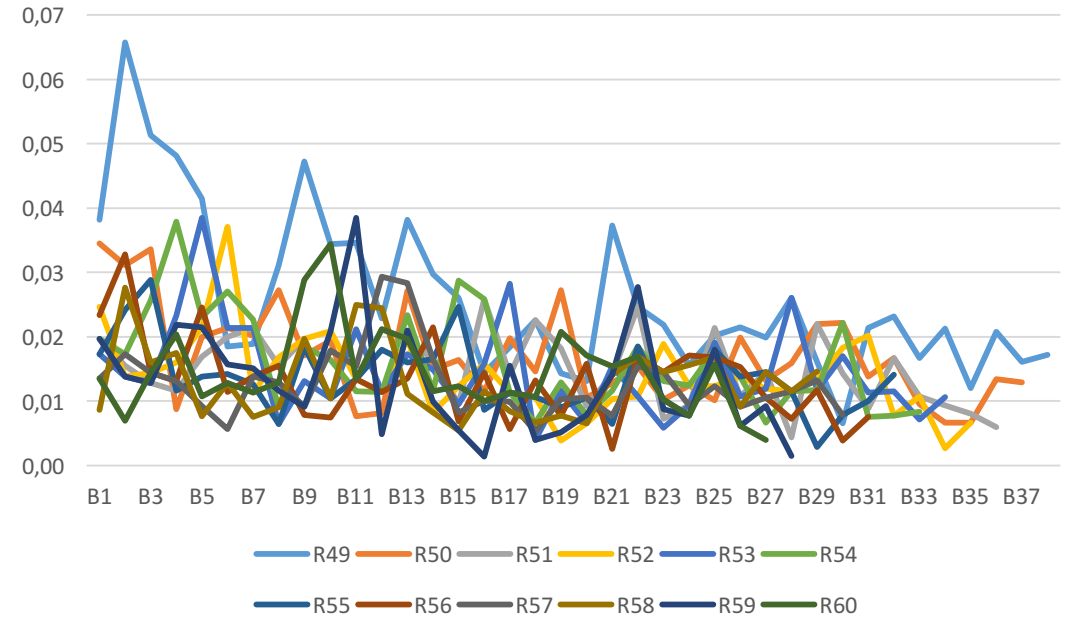


Figure 4.9 Registration month ratios for fifth year

Ratio of 49-60 month of late birth registration numbers to the first month birth registration number



The calculations showed that 51,021 births will be registered after 2013 and before five years of birth. 45,403 of these registrations are already available from current data. This leaves that, there will be 5,618 more birth registrations until every birth month cohort reaches 5 years old. Since there are 86,799 estimated unregistered total births, 9,686 of them will be remain unregistered after 5 years passed from their birth. Table 4.10 shows the registration completeness and timeliness of the birth registration system between 2009 and 2013 according to the above calculations.

Table 4.10. Registration completeness and timeliness for 2009-2013

	Number	Percentage
Registered births	6,295,629	**98.64**
0-30 days	5,944,254	93.13
31-90 days	192,008	3.01
91-180 days	59,685	0.94
181-365 days	46,017	0.72
More than 1 year	53,665	0.84
Late registration	351,375	5.51
Unregistered births	**86,799**	**1.36**
UBCbT*	26,092	0.41
Registered in 5 years	45,403	0.71
Will be registered in 5 years	5,618	0.09
UBRU**	9,686	0.15
Total	**6,382,428**	**100.00**

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

Results show that, the birth registration system was 98.64% complete as the end of 2013. From 6,382,428 births, which are under five at the end of 2013, 93.13% of them are registered in time and 5.51% of the births are registered lately. Until 2016 February, 45,403 of the late registrations are registered. 5,618 of the unregistered births estimated to be registered before 5 years passed from their births, which accumulates, to 0.09% of the total births. Estimations showed that 0.15% of the births (9,686) will remain unregistered after 5 years passed from their birth.

Table 4.11. Registered number of births as the end of 2015

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 years	UBCbT*	Total
2011	1180305	35065	11300	9047	12284	4965	1252966
2012	1234660	30414	8186	6096	8525	4257	1292138
2013	1246367	24920	6765	5142	5624	4941	1293759
2014	1298453	27301	6996	5346	2665	3803	1344570
2015	1279794	19634	3869	1278	0	3689	1308264
Total	6239579	137334	37116	26915	29098	21655	6491697

*Unregistered births captured by TurkStat

Table 4.11 shows the updated numbers of registered births between 2011 and 2015. The total registered number of births kept from the rearrangement of the registration data and the late registrations are combined from known registers in 2016 and previously projected numbers. The total unregistered number of births, which will stay unregistered after 5 years of birth, estimated from the 2009-2013 number. 9,686 births, which will remain unregistered, distributed to 5 years and missing values are calculated. Table 4.12 shows this distribution and number of births, which will remain unregistered.

Table 4.12 Distribution of UBRU according to UBCbT

	UBCbT*		UBRU**
	Number	Percentage	Number
2009	6,675	19.88	2,478
2010	5,254	15.64	1,950
2011	4,965	14.78	1,843
2012	4,257	12.68	1,580
2013	4,941	14.71	1,834
2009-2013	26,092	77.69	9,686
2014	3,803	11.32	1,412
2015	3,689	10.98	1,369
2011-2015	21,655	64.48	8,039
Total	**33,584**	**100.00**	**12,467**

*Unregistered births captured by TurkStat

** Unregistered births remained uncatched (after 5 years)

Table 4.13 Registration completeness and timeliness of 2011-2015

	Number	Percentage
Registered births	6,470,042	**98.94**
0-30 days	6,239,585	**95.42**
31-90 days	137,334	2.10
91-180 days	37,116	0.57
181-365 days	26,909	0.41
More than 1 year	29,098	0.44
Late registration	230,457	3.52
Unregistered births	**69,141**	**1.06**
UBCbT*	21,655	0.33
Registered in 5 years	18,935	0.29
Will be registered in 5 years	20,513	0.31
UBRU**	8,039	0.12
Total	**6,539,183**	**100.00**

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

Table 4.13 presents the results of the registration completeness and timeliness of the registration system between 2011 and 2015. According to the results, the 98.94% of the births between 2011 and 2015 were registered at the end of 2015. 95.42% of all births were registered in time and 3.52% of births are registered late. Estimated results show that 1.06% of all births (69,141) between 2011 and 2015 were unregistered at the end of 2015. While 0.29% of them (18,935) are registered in first two months of 2016 and 0.31% (20,513) of them will be registered before their fifth birthday, 0.12% (8,039) of them will remain unregistered.

As the results show, the deceased children are disadvantageous by the means of registration. Unregistered births of deceased captured via DNS and the percentage of unregistered births of deceased children in 2013-TDHS data indicates there is a considerable amount of cases in this group. Considering that these births are not registered even they are detected, their existence blur as the time passes.

Table 4.14 Number of births by registration groups, 2009-2015

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 year	UBRU**	UBCbT*	Total
2009	1,133,523	62,341	20,148	16,419	27,459	2,478	6,675	1,269,043
2010	1,165,405	42,385	15,700	13,038	19,214	1,950	5,254	1,262,946
2011	1,180,305	35,065	11,300	9,047	12,856	1,843	4,965	1,255,381
2012	1,234,660	30,414	8,186	6,096	10,616	1,580	4,257	1,295,809
2013	1,246,367	24,920	6,765	5,142	9,278	1,834	4,941	1,299,247
2014	1,298,459	27,301	6,996	5,346	8,485	1,412	3,803	1,351,802
2015	1,336,386	22,190	5,860	4,266	6,040	1,369	3,689	1,379,800

*Unregistered births captured by TurkStat

** Unregistered births remained uncatched (after 5 years)

Combining the calculations made so far we can construct the births of 2009-2015 period according to birth registration groups. Table 4.14 presents the number of births of Turkey between 2009 and 2015 with the estimations of unregistered number of births. The late registrations are calculated for 5 years. Table 4.15 shows the same results with percentages. Total registered births were not changed mostly but the registration interval was significantly improved.

Table 4.15 Percentages of births by registration groups, 2009-2015

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 year	UBRU**	Registered	UBCbT*	Total
2009	89.32	4.91	1.59	1.29	2.16	0.20	99.28	0.53	100.00
2010	92.28	3.36	1.24	1.03	1.52	0.15	99.43	0.42	100.00
2011	94.02	2.79	0.90	0.72	1.02	0.15	99.46	0.40	100.00
2012	95.28	2.35	0.63	0.47	0.82	0.12	99.55	0.33	100.00
2013	95.93	1.92	0.52	0.40	0.71	0.14	99.48	0.38	100.00
2014	96.05	2.02	0.52	0.40	0.63	0.10	99.61	0.28	100.00
2015	96.85	1.61	0.42	0.31	0.44	0.10	99.63	0.27	100.00

*Unregistered births captured by TurkStat

** Unregistered births remained uncatched (after 5 years)

Figure 4.10 shows the change of 0-30 days registration group. The timely registration increased from 89.32 in 2009 to 96.85 in 2015, which indicates a 7.53% improvement in the timeliness of birth registration. The improvements were sharper in early years but slowed as the system improved.

Figure 4.10. Change of timeliness of birth registration 2009-2015

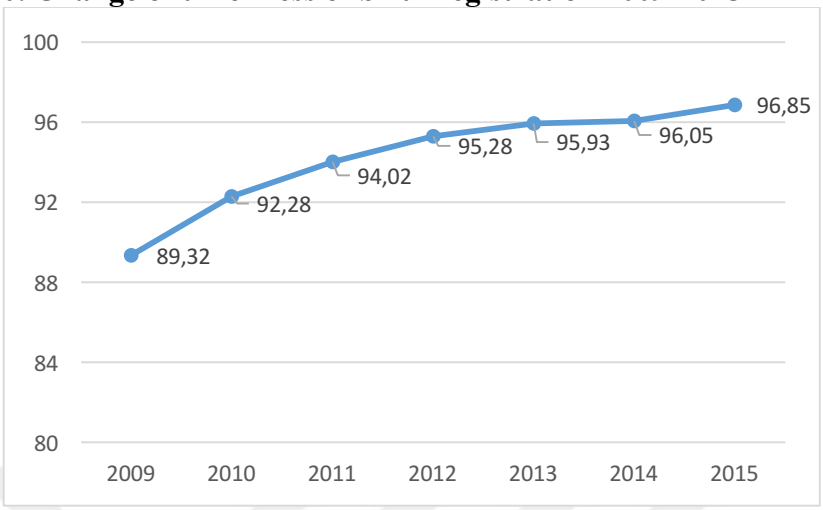
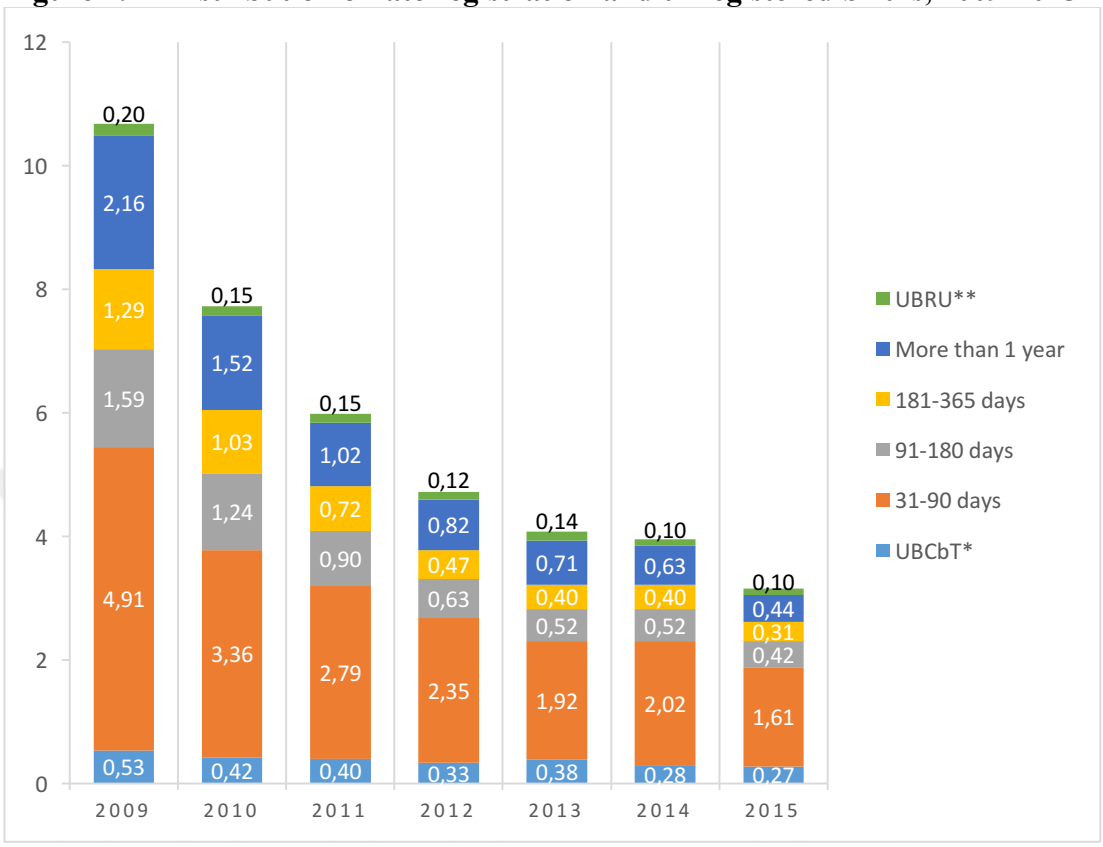


Figure 4.11 shows the distribution of late registration and unregistered births from 2009 to 2015 for Turkey. It is easily seen that the total of late registrations and unregistered births were more than 10% of the births in 2009 and dropped under 4% in 2015. The decrease in the late registration mostly originated from 31-90 days registration group. In 2009 4.91% of the births were registered between 31 and 90 days. This percentage decreased to 1.61% in 2015. The percent of unknown registration dates nearly declined to half of its value in 2009. The decrease in other late registration groups are also significant. The 91-180, 181-365 and 1+ year registration groups in 2015 have declined almost to quarter of their previous values of 2009.

Figure 4.11 Distribution of late registration and unregistered births, 2009-2015



4.2.2. Results for male and female births

Table 4.16 and Table 4.17 show the male and female births between 2009 and 2015 with birth registration groups of 0-30 days, 31-90 days, 91-180 days, 181-365 days, more than 1 year and unknown registration dates according to TurkStat data. The number of births timely registered increased with the total number of births. However, number of births in all late registration groups were decreased at least to one third in 7 years.

Table 4.16. Number of male births by birth registration groups, 2009-2015

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 Year	UBCbT*	Total
2009	584,866	31,338	9,973	8,176	13,353	3,726	**651,432**
2010	600,171	21,229	7,735	6,326	9,513	2,885	**647,859**
2011	607,478	17,426	5,595	4,487	6,059	193	**641,238**
2012	634,589	15,183	3,994	3,000	4,235	2,282	**663,283**
2013	641,321	12,372	3,318	2,555	2,966	2,711	**665,243**
2014	667,687	13,549	3,444	2,616	1,702	2,102	691,100
2015	663,909	10,822	2,457	1,040	48	2,022	**680,298**

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

Table 4.17. Number of female births by birth registration groups, 2009-2015

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 Year	UBCbT*	Total
2009	548,657	31,003	10,175	8,243	14,292	2,949	**615,319**
2010	565,234	21,156	7,965	6,712	9,874	2,369	**613,310**
2011	572,827	17,639	5,705	4,560	6,390	191	**607,312**
2012	600,071	15,231	4,192	3,096	4,532	1,975	**629,097**
2013	605,046	12,548	3,447	2,587	2,987	2,230	**628,845**
2014	630,772	13,752	3,552	2,730	1,679	1,701	654,186
2015	629,062	11,245	2,417	1,022	72	1,667	**645,485**

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

The number of births captured by TurkStat vary between male and female values. In fact, it is expected since the infant mortality is higher for males and captured values are coming from Death Notification System. Table 4.18 and Table 4.19 show the male and female births between 2009 and 2015 with birth registration years. The shift in late registration to timely registration can be observed through the table. The number of births registered in the following years of birth decreases for male and female births.

Table 4.18. Number of male births by registration year, 2009-2015

	2009	2010	2011	2012	2013	2014	2015	2016	UBCbT*	Total
2009	613,315	25,217	4,818	2,446	1,091	734	85	-	3,726	651,432
2010	-	617,207	21,336	3,353	1,491	846	654	87	2,885	647,859
2011	-	-	618,054	18,927	2,136	1,069	772	87	193	641,238
2012	-	-	-	642,937	15,252	1,641	1,048	123	2,282	663,283
2013	-	-	-	-	646,979	13,791	1,602	160	2,711	665,243
2014	-	-	-	-	-	674,375	14,247	376	2,102	691,100
2015	-	-	-	-	-	-	669,528	8,748	2,022	680,298

*Unregistered births captured by TurkStat

** Unregistered births remained uncatched (after 5 years)

Table 4.19. Number of female births by registration year, 2009-2015

	2009	2010	2011	2012	2013	2014	2015	2016	UBCbT*	Total
2009	577,263	25,136	5,215	2,688	1,217	750	101	-	2,949	615,319
2010	-	582,436	21,748	3,668	1,512	834	657	86	2,369	613,310
2011	-	-	583,783	18,984	2,341	1,134	801	78	191	607,312
2012	-	-	-	608,700	15,426	1,758	1,119	119	1,975	629,097
2013	-	-	-	-	610,953	13,903	1,590	169	2,230	628,845
2014	-	-	-	-	-	637,865	14,280	340	1,701	654,186
2015	-	-	-	-	-	-	635,047	8,771	1,667	645,485

*Unregistered births captured by TurkStat

** Unregistered births remained uncatched (after 5 years)

The missing value of births with unknown registration dates for male and female births in 2011 were interpolated separately. For male births, the remaining years fit into a curve of $y = -800.8\ln(x) + 3612.6$ and $R^2 = 0{,}88$. From this curve, the 2011 value calculated as 2733. For female births, the remaining years fit into a curve of $y = -606\ln(x) + 2898.6$ and $R^2 = 0{,}89$. From this curve, the 2011 value calculated as 2233 and the further computations are made based on this value. Figure 4.12 and Figure 4.13 show the values of years, the curve, interpolation and the calculated value for 2011.

Figure 4.12 Interpolation of 2011 UBCbT for males

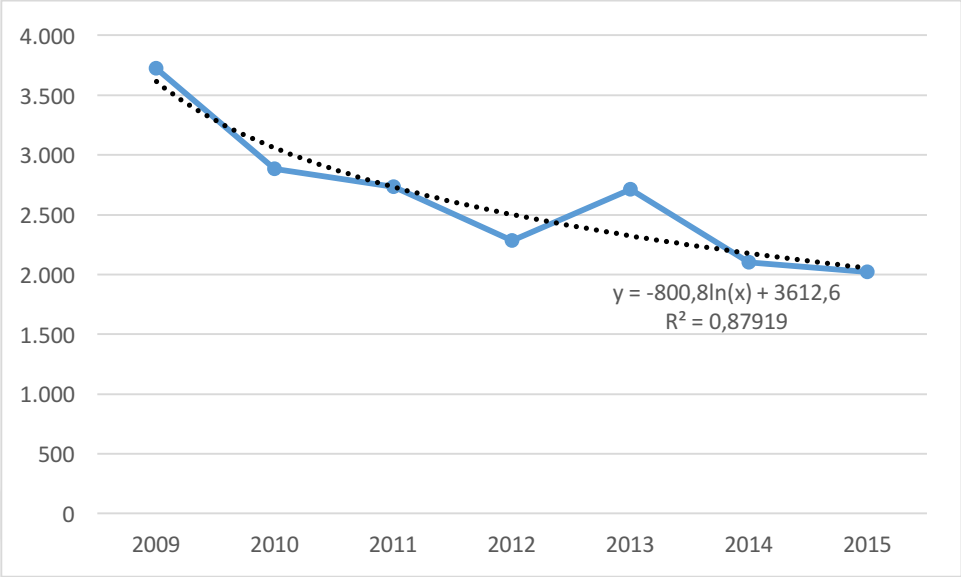


Figure 4.13 Interpolation of 2011 UBCbT for females

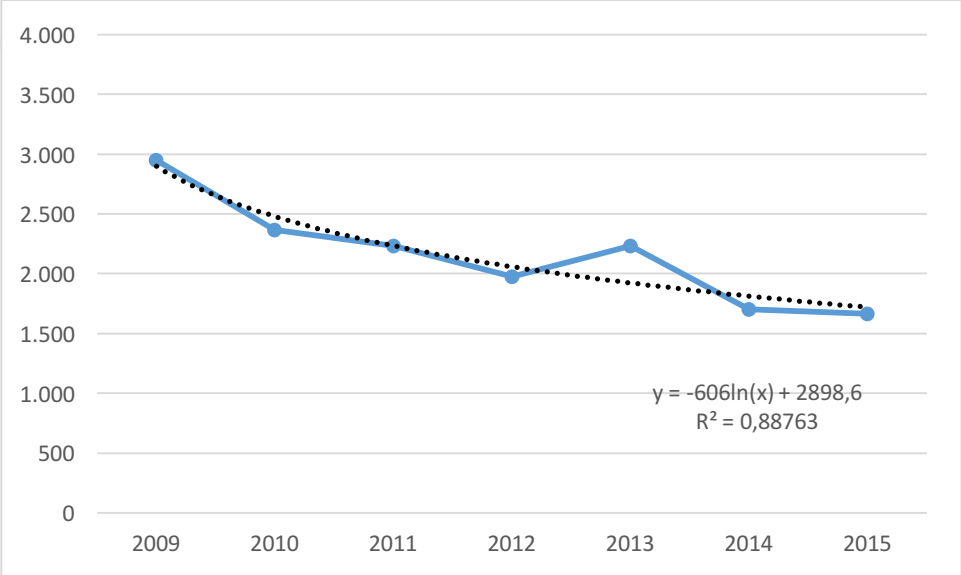


Table 4.20. Distribution of UBRU according to UBCbT

	UBCbT*			UBRU**		
	Male	Female	Total	Male	Female	Total
2009	3,726	2,949	6,675	1,383	1,095	2,478
2010	2,885	2,369	5,254	1,071	879	1,950
2011	2,733	2,233	4,966	1,014	829	1,843
2012	2,282	1,975	4,257	847	733	1,580
2013	2,711	2,230	4,941	1,006	828	1,834
2009-2013	14,337	11,756	26,093	5,322	4,364	9,686
2014	2,102	1,701	3,803	780	632	1,412
2015	2,022	1,667	3,689	750	619	1,369
2011-2015	11,850	9,806	21,656	4,399	3,640	8,039
Total	18,461	15,124	33,585	6,853	5,614	12,467

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

The distribution of births with unknown registration dates for male and female births in a year used for the distribution of births unregistered in five years. The percentage of male and female unknown values directly used to find the corresponding unregistered values. In Table 4.20 we can see the distribution of unknown and unregistered births according to sex and year.

Table 4.21. Registration completeness and timeliness of male and female births, 2011-2015

	Male		Female	
	Number	Percentage	Number	Percentage
Registered births	3,322,358	**98.93**	3,147,684	**98.96**
0-30 days	3,208,362	95.53	3,031,223	95.30
31-90 days	68,166	2.03	69,168	2.17
91-180 days	18,309	0.55	18,807	0.59
181-365 days	13,305	0.40	13,604	0.43
More than 1 year	14,216	0.42	14,882	0.47
Late registration	113,996	3.39	116,461	3.66
Unregistered births	36,014	**1.07**	33,121	**1.04**
UBCbT*	11,850	0.35	9,806	0.31
Registered in 5 years	9,469	0.28	9,466	0.30
Will be registered in 5 years	10,296	0.31	10,209	0.32
UBRU**	4,399	0.13	3,640	0.11
Total	**3,358,372**	**100.00**	**3,180,805**	**100.00**

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

Table 4.21 presents the results of the registration completeness and timeliness of the registration system between 2011 and 2015 for male and female births. According to the results, the 98.93% of the male births between 2011 and 2015 were registered at the end of 2015. 95.53% of male births were registered in time and 3.39% of births are registered late. Estimated results show that 1.07% of male births (36,014) between 2011 and 2015 were unregistered at the end of 2015. While 0.28% of them (9,469) are registered in first two months of 2016 and 0.31% (10,296) of them will be registered before their fifth birthday, 0.13% (4,399) of them will remain unregistered.

Results show that, the 98.96% of the female births between 2011 and 2015 were registered at the end of 2015. 95.30% of female births were registered in time and 3.66% of births are registered late. Estimated results show that 1.04% of female births (33,121) between 2011 and 2015 were unregistered at the end of 2015. While 0.31% of them (9,806) are registered in first two months of 2016 and 0.32% (10,209) of them will be registered before their fifth birthday, 0.11% (3,640) of them will remain unregistered. The results also show that male and female birth registration completeness are almost identical but male births are tended to register slightly more on time than the female births.

Table 4.22. Number of male births by birth groups, 2009-2015

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 year	UBRU**	UBCbT*	Total
2009	584,866	31,338	9,973	8,176	13,268	1,383	3,726	652,730
2010	600,171	21,229	7,735	6,326	9,426	1,071	2,885	648,843
2011	607,478	17,426	5,595	4,487	6,257	1,014	2,733	644,990
2012	634,589	15,183	3,994	3,000	5,164	847	2,282	665,059
2013	641,321	12,372	3,318	2,555	4,632	1,006	2,711	667,915
2014	667,687	13,549	3,444	2,616	4,279	780	2,102	694,458
2015	663,909	10,883	2,945	2,110	3,329	750	2,022	685,949

*Unregistered births captured by TurkStat

** Unregistered births remained uncatched (after 5 years)

Table 4.23. Percentage of male births by birth groups, 2009-2015

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 year	UBRU**	Registered	UBCbT*	Total
2009	89.60	4.80	1.53	1.25	2.03	0.21	99.22	0.57	100.00
2010	92.50	3.27	1.19	0.97	1.45	0.17	99.39	0.44	100.00
2011	94.18	2.70	0.87	0.70	0.97	0.16	99.42	0.42	100.00
2012	95.42	2.28	0.60	0.45	0.78	0.13	99.53	0.34	100.00
2013	96.02	1.85	0.50	0.38	0.69	0.15	99.44	0.41	100.00
2014	96.15	1.95	0.50	0.38	0.62	0.11	99.58	0.30	100.00
2015	96.79	1.59	0.43	0.31	0.49	0.11	99.60	0.29	100.00

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

Combining the calculations made so far we can construct the male births of 2009-2015 period according to birth registration groups. Table 4.22 presents the number of male births of Turkey between 2009 and 2015 with the estimations of unregistered number of births. The late registrations are calculated for 5 years. Table 4.23 shows the same results with percentages. Total registered births are increased but the improvement of late registration attracts notice more.

Table 4.24. Number of female births by birth groups, 2009-2015

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 year	UBRU**	UBCbT*	Total
2009	548,657	31,003	10,175	8,243	14,191	1,095	2,949	616,313
2010	565,234	21,156	7,965	6,712	9,788	879	2,369	614,103
2011	572,827	17,639	5,705	4,560	6,600	829	2,233	610,393
2012	600,071	15,231	4,192	3,096	5,452	733	1,975	630,750
2013	605,046	12,548	3,447	2,587	4,645	828	2,230	631,331
2014	630,772	13,752	3,552	2,730	4,202	632	1,701	657,341
2015	629,062	11,307	2,915	2,156	3,264	619	1,667	650,990

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

The similar calculations made for female births and we can construct the female births of 2009-2015 period according to birth registration groups. Table 4.24

presents the number of female births of Turkey between 2009 and 2015 with the estimations of unregistered number of births. The late registrations are calculated for 5 years. Table 4.25 shows the same results with percentages. The total improvement of the birth registration can be observed in every group.

Table 4.25. Percentage of female births by birth groups, 2009-2015

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 year	UBRU**	Registered	UBCbT*	Total
2009	89.02	5.03	1.65	1.34	2.30	0.18	99.34	0.48	100.00
2010	92.04	3.45	1.30	1.09	1.59	0.14	99.47	0.39	100.00
2011	93.85	2.89	0.93	0.75	1.08	0.14	99.50	0.37	100.00
2012	95.14	2.41	0.66	0.49	0.86	0.12	99.57	0.31	100.00
2013	95.84	1.99	0.55	0.41	0.74	0.13	99.52	0.35	100.00
2014	95.96	2.09	0.54	0.42	0.64	0.10	99.65	0.26	100.00
2015	96.63	1.74	0.45	0.33	0.50	0.10	99.65	0.26	100.00

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

Figure 4.14 Change of timeliness of birth registrations by sex, 2009-2015

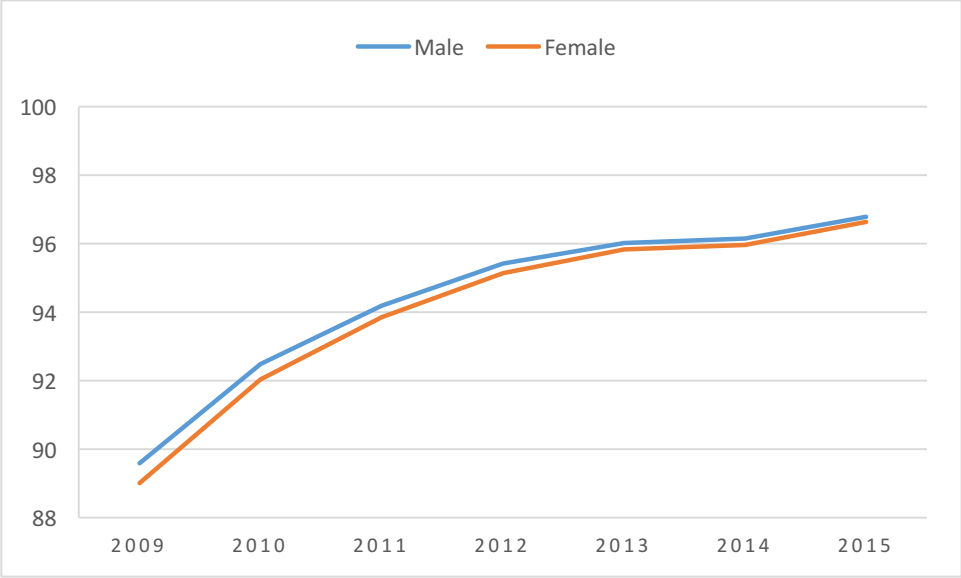


Figure 4.14 shows the change of 0-30 days registration group for males and females together. The timely registration increased for male and female births almost identical. The increase was sharper in early years for both sex, but slowed down with

the improvement of the registration system. Male births were registered more timely than the female births for 7 years. However, the gap has been closed in the last 2 years.

Figure 4.15 Distribution of late registration and unregistered births by sex, 2009-2015

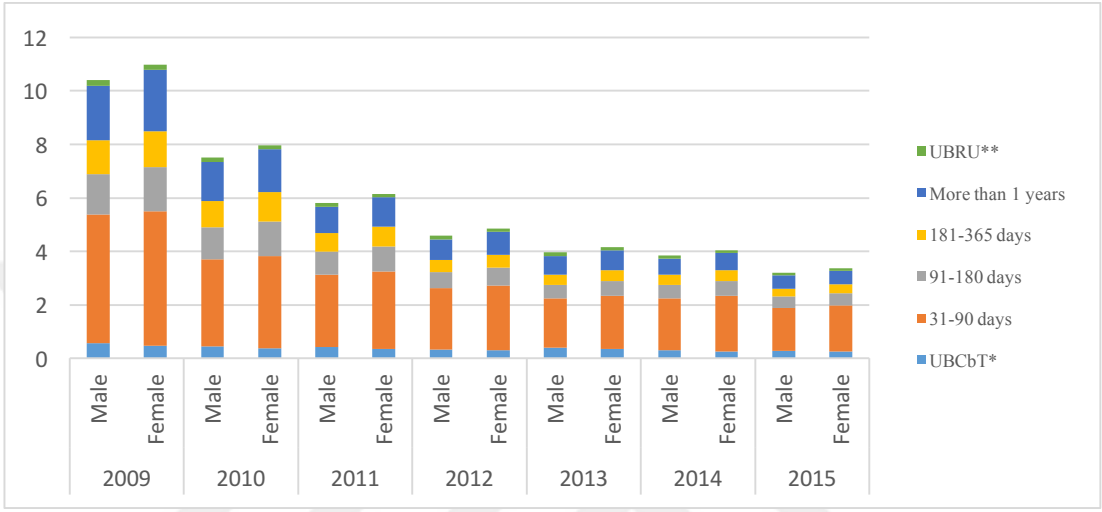


Figure 4.15 shows the distribution of late registration and unregistered births from 2009 to 2015 for Turkey. While the late registrations and unregistered male births are approximately 10% of the births in 2009 and dropped under 4% in 2015, the female late registration and unregistered births are more than the male ones. The decrease in the late registration mostly originated from 31-90 days registration group.

4.2.3. Results for births of adolescent mothers

Since the legal age for marriage is 18 in Turkey, the registered births of adolescent mothers are interesting to investigate. The important point to keep in mind when reading the results of this group is the mothers younger than 18 will pass 18 at some point. The region of birth or sex of the child will not change during the 60-month interval but the adolescent mothers will become adults in 5-year period. For this reason, the results of timeliness inform better than the completeness of the registration system for this population. The calculations are made only for adolescent mothers since the results for adult mothers were very similar to the total value.

Table 4.26. Number of adolescent mother's births by birth registration groups, 2009-2015

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 years	UBCbT*	Total
2009	19111	2127	1783	2871	6506	158	32556
2010	20337	1792	1594	2238	4082	122	30165
2011	19572	1845	1276	1601	2510	0	26804
2012	18880	1792	1052	1125	1585	82	24516
2013	17951	1516	880	804	943	87	22181
2014	17048	1571	769	678	451	82	20599
2015	15782	1391	547	242	14	57	18033

*Unregistered births captured by TurkStat

Table 4.26 shows the births of adolescent mothers between 2009 and 2015 with birth registration groups of 0-30 days, 31-90 days, 91-180 days, 181-365 days, more than 1 year and unknown registration dates according to TurkStat data. The number of births timely registered decreased but this is mostly due to reduction in the total adolescent births. The total number of births nearly halved between 2009 and 2015.

Table 4.27. Number of adolescent mother's births by birth registration year, 2009-2015

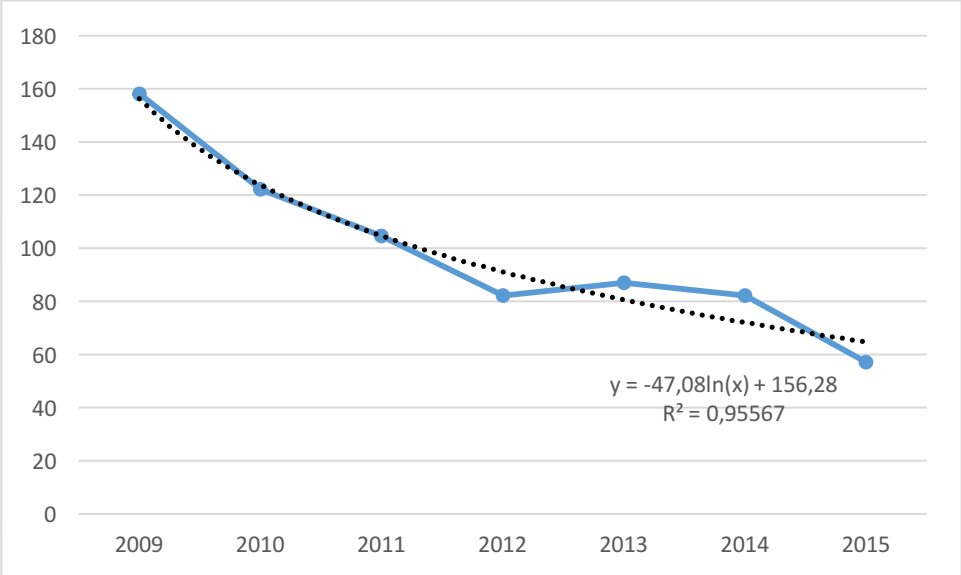
	2009	2010	2011	2012	2013	2014	2015	2016	UBCbT*	Total
2009	22,329	5,629	2,668	1,119	464	169	20	0	158	32,556
2010	0	23,013	4,333	1,709	653	208	116	11	122	30,165
2011	0	0	21,845	3,400	1,064	353	135	7	0	26,804
2012	0	0	0	21,015	2,519	656	221	23	82	24,516
2013	0	0	0	0	19,651	1,911	495	37	87	22,181
2014	0	0	0	0	0	18,793	1,618	106	82	20,599
2015	0	0	0	0	0	0	17,278	698	57	18,033

*Unregistered births captured by TurkStat

Table 4.27 presents the births of adolescent mothers between 2009 and 2015 with birth registration years. Although the shift in late registration to timely

registration can be observed through the table, in this group it is harder to detect a trend of improvement.

Figure 4.16. Interpolation of 2011 unknown registration birth numbers of adolescent mothers



The missing value of births with unknown registration dates for births of adolescent mothers in 2011 were interpolated from the known values. The values for 2009, 2010, 2012, 2013, 2014 and 2015, fit into a curve of $y = -47.08 \ln(x) + 156.28$ and $R^2 = 0.96$. From this curve, the 2011 value calculated as 105 and the further computations are made based on this value. Figure 4.16 shows the values of years, the curve, interpolation and the calculated value for 2011.

Table 4.28 Distribution of UBCbT and UBRU values

	UBCbT*				UBRU**			
	<18	18+	Unknown	Total	<18	18+	Unknown	Total
2009	158	5,622	895	6,675	59	2,087	332	2,478
2010	122	4,805	327	5,254	45	1,783	121	1,950
2011	105	4,012	849	4,965	39	1,489	315	1,843
2012	82	3,667	508	4,257	30	1,361	189	1,580
2013	87	3,837	1,017	4,941	32	1,424	377	1,834
2014	82	2,625	1,096	3,803	30	975	407	1,412
2015	57	2,129	1,503	3,689	21	790	558	1,369
Total	693	26,697	6195	33,584	257	9,909	2,299	12,466

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

The distribution of births with unknown registration dates for births of adolescent and adult mothers in a year used for the distribution of births unregistered in five years. The percentage of adolescent and adult unknown values used in order to find the corresponding unregistered values. In Table 4.28, we can see the distribution of unknown and unregistered births according to age of mother and year.

Table 4.29. Registration completeness and timeliness of adolescent mother's births, 2011-2015

	Number	Percentage
Registered births	110,954	**97.72**
0-30 days	89,023	78.40
31-90 days	8,001	7.05
91-180 days	4,365	3.84
181-365 days	4,248	3.74
More than 1 year	5,316	4.68
Late registration	21,931	19.31
Unregistered births	2,593	**2.28**
UBCbT*	413	0.36
Registered in 5 years	870	0.77
Will be registered in 5 years	1,157	1.02
UBRU**	153	0.13
Total	113,547	100.00

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

Table 4.29 presents the results of the registration completeness and timeliness of the registration system between 2011 and 2015 for births of adolescent mother. According to the results, the 97.72% of the adolescent births between 2011 and 2015 were registered at the end of 2015. 78.40% of adolescent births were registered in time and 19.31% of births are registered late. Estimated results show that 2.28% of adolescent births (2,593) between 2011 and 2015 were unregistered at the end of 2015. While 0.77% of them (870) are registered in first two months of 2016, 1.02% (1,157) of them estimated to be registered before their fifth birthday, 0.13% (153) of them will remain unregistered. The completeness of this group was high but the timeliness was conspicuously low than the total timeliness.

Table 4.30. Number of adolescent mother's births by birth registration groups

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 year	UBRU**	UBCbT*	Total
2009	19111	2127	1783	2871	6486	59	158	32536
2010	20337	1792	1594	2238	4071	45	122	30154
2011	19572	1845	1276	1601	2520	39	105	26919
2012	18880	1792	1052	1125	1631	30	82	24562
2013	17951	1516	880	804	1029	32	87	22267
2014	17048	1571	769	678	670	30	82	20818
2015	15782	1404	670	519	396	21	57	18828

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

We can construct the births of adolescent mothers of 2009-2015 period according to birth registration groups with the combination of the calculations so far. Table 4.30 presents the number of adolescent births of Turkey between 2009 and 2015 with the estimations of unregistered number of births. The late registrations are calculated for 5 years. Although the number of adolescent births are significantly decreased, the 31-90 days group of late registration was slow at this trend.

Table 4.31. Percentages of adolescent mother's births by registration groups

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 year	UBRU**	Registered	UBCbT*	Total
2009	58.63	6.53	5.47	8.81	19.90	0.18	99.33	0.48	100
2010	67.34	5.93	5.28	7.41	13.48	0.15	99.45	0.40	100
2011	72.60	6.84	4.73	5.94	9.35	0.14	99.47	0.39	100
2012	76.77	7.29	4.28	4.57	6.63	0.12	99.54	0.33	100
2013	80.50	6.80	3.95	3.61	4.61	0.14	99.47	0.39	100
2014	81.77	7.54	3.69	3.25	3.22	0.14	99.46	0.39	100
2015	83.73	7.45	3.55	2.76	2.10	0.11	99.59	0.30	100

*Unregistered births captured by TurkStat
** Unregistered births remained uncatched (after 5 years)

Table 4.31 shows the results of previous numbers with percentages. We can see the aforementioned anomaly easier with this table. The percentage of "31-90 days" group increased through 2009 to 2015. With the increase of percentage in timely registration group and visible improvements in registrations later one year, the situation of "31-90 days" group clearly grew with the shift in the late registration groups toward lesser intervals of registration.

Figure 4.17. Timeliness of adolescent mother's births by birth registration groups

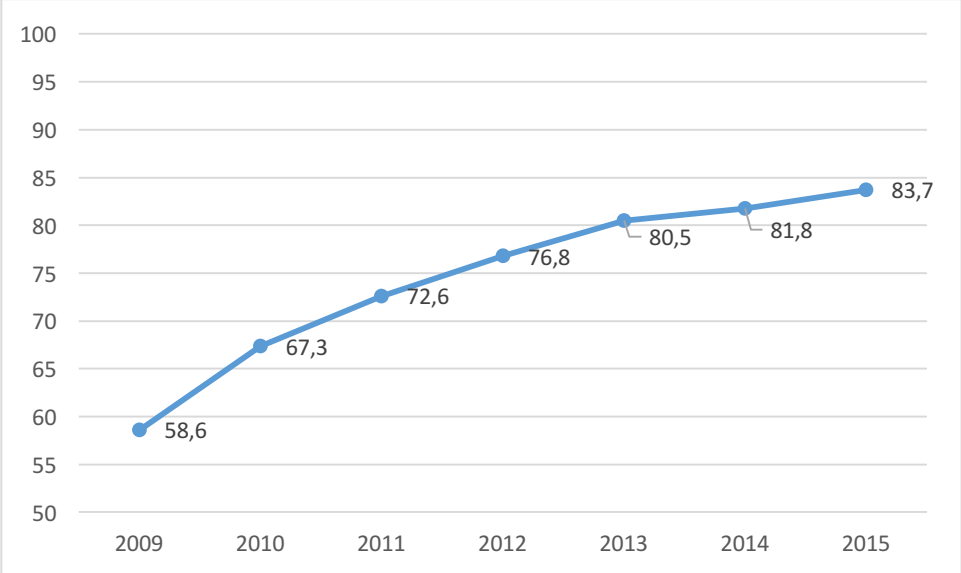


Figure 4.17 shows the improvement of 0-30 days registration group for adolescent mothers. The timely registration increased from 58.6% to 83.7% in 7 years. Although timeliness for this group increased for 25.1% in such a short time, it is still very far from the total birth registration timeliness.

Figure 4.18. Distribution of late registration and unregistered births of adolescent mother's, 2009-2015

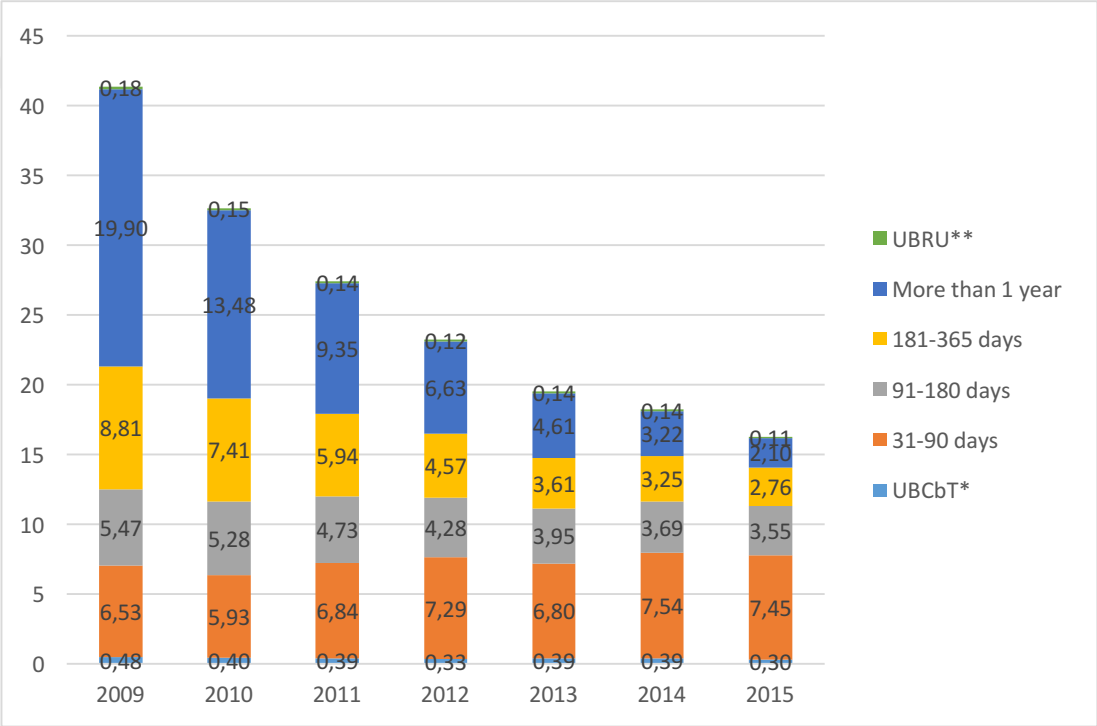


Figure 4.18 shows the distribution of late registration and unregistered births from 2009 to 2015 for adolescent births. The total of late registration and unregistered births was above 40% and nearly half of it were the late registrations made after 1 year in 2009. It dropped to almost 15% and every late registration group decreased except 31-90 days group because of aforementioned reasons.

4.2.4 Results for regions

The five regions in Turkey have different characteristic registrations both in timeliness and completeness of the registration system. The following 5 tables of births registered between 2009 and 2015 by five regions, summarize the current registration behavior of five regions.

Table 4.32. Number of births in West region by registration groups

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 years	UBCbT*	Total
2009	392,209	24,314	6,274	3,890	5,634	1,948	**434,269**
2010	405,182	17,404	4,496	3,079	4,203	1,394	**435,758**
2011	415,436	11,992	2,682	1,778	2,691	202	**434,781**
2012	442,468	10,576	2,203	1,496	2,106	1,137	**459,986**
2013	447,617	8,642	1,870	1,359	1,531	1,072	**462,091**
2014	470,794	9,007	1,864	1,440	822	941	**484,868**
2015	475,876	7,221	1,388	528	27	969	**486,009**

*Unregistered births captured by TurkStat

Table 4.33. Number of births in South region by registration groups

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 years	UBCbT*	Total
2009	153,833	6,637	2,099	1,668	2,455	814	**167,506**
2010	156,391	4,495	1,669	1,179	1,747	642	**166,123**
2011	156,294	3,893	1,148	851	1,167	56	**163,409**
2012	163,530	3,322	822	617	902	554	**169,747**
2013	164,719	2,910	765	567	668	636	**170,265**
2014	170,999	3,184	841	640	475	422	**176,561**
2015	169,404	2,638	606	305	30	409	**173,392**

*Unregistered births captured by TurkStat

Table 4.34. Number of births in Center region by registration groups

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 years	UBCbT*	Total
2009	223,346	9,869	2,985	2,231	2,999	1,161	**242,591**
2010	223,729	6,813	2,152	1,600	2,186	850	**237,330**
2011	225,328	4,965	1,498	1,116	1,609	98	**234,614**
2012	230,299	4,158	1,087	794	1,296	812	**238,446**
2013	231,374	3,219	945	735	954	971	**238,198**
2014	239,113	3,398	1,000	893	563	719	**245,686**
2015	236,482	2,732	759	328	11	801	**241,113**

*Unregistered births captured by TurkStat

Table 4.35. Number of births in North region by registration groups

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 years	UBCbT*	Total
2009	71,411	2,062	572	422	578	236	**75,281**
2010	69,653	1,341	397	299	428	199	**72,317**
2011	67,291	1,016	281	232	324	12	**69,156**
2012	67,626	787	202	143	239	165	**69,162**
2013	66,976	613	183	172	195	202	**68,341**
2014	66,991	728	223	172	119	121	**68,354**
2015	65,685	552	153	66	0	200	**66,656**

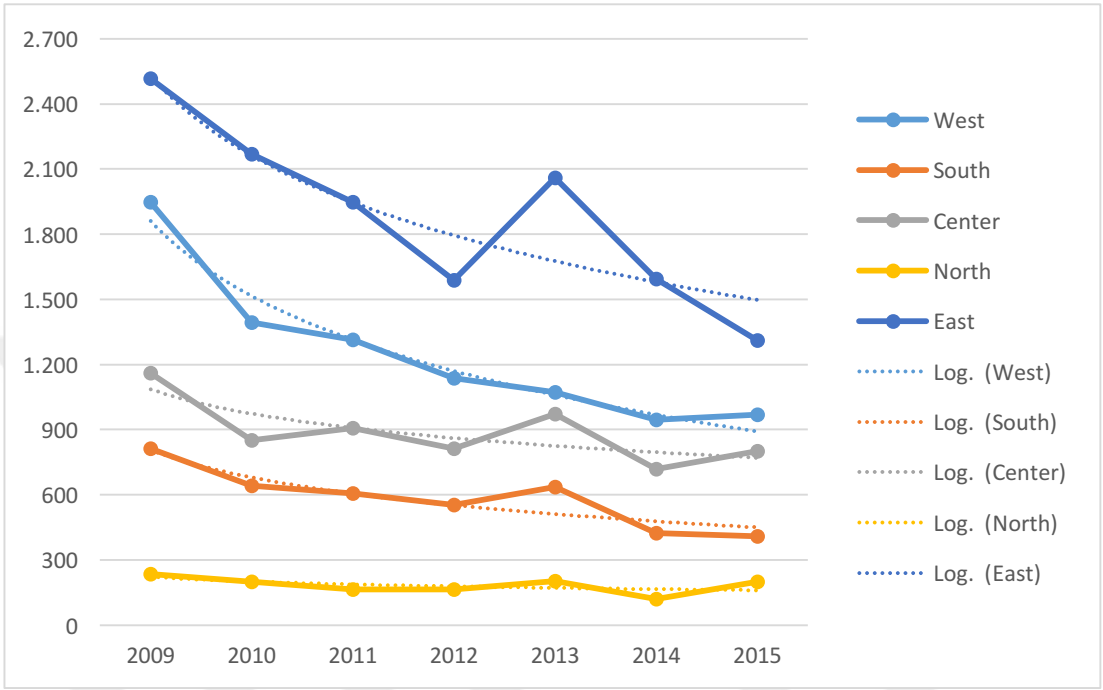
*Unregistered births captured by TurkStat

Table 4.36. Number of births in East region by registration groups

	0-30 days	31-90 days	91-180 days	181-365 days	More than 1 years	UBCbT*	Total
2009	292,724	19,459	8,218	8,208	15,979	2,516	**347,104**
2010	310,450	12,332	6,986	6,881	10,823	2,169	**349,641**
2011	315,956	13,199	5,691	5,070	6,658	16	**346,590**
2012	330,737	11,571	3,872	3,046	4,224	1,589	**355,039**
2013	335,681	9,536	3,002	2,309	2,605	2,060	**355,193**
2014	350,562	10,984	3,068	2,207	1,402	1,594	**369,817**
2015	345,524	8,924	1,968	835	52	1,310	**358,613**

*Unregistered births captured by TurkStat

Figure 4.19. Interpolation of 2011 UBCbT for five regions



The missing value of births with unknown registration dates for regions in 2011 were interpolated from the known values. The known values fit into a curve for five regions separately. Figure 4.19 shows the values of years, the curve, interpolation and the calculated value for 2011. Table 4.37 shows the equation for the curves and R^2 values.

Table 4.37 Trend equations and R^2 values for regions

Regions	Equations	R^2
West	y = -498,1ln(x) + 1860,7	0,95854
South	y = -183,7ln(x) + 807,27	0,81508
Center	y = -161,9ln(x) + 1086,1	0,58928
North	y = -31,77ln(x) + 222,46	0,34373
East	y = -530,2ln(x) + 2529,2	0,77833

Table 4.38. Distribution of UBCbT values for regions, 2009-2015

	West	South	Center	North	East	Total	Total*
2009	1,948	814	1,161	236	2,516	6,675	6,675
2010	1,394	642	850	199	2,169	5,254	5,254
2011	1,313	605	908	163	1,947	4,937	4,965
2012	1,137	554	812	165	1,589	4,257	4,257
2013	1,072	636	971	202	2,060	4,941	4,941
2014	945	424	719	121	1,594	3,803	3,803
2015	969	409	801	200	1,310	3,689	3,689
Total	8,778	4,084	6,222	1,286	13,185	33,556	33,584

* Values in the last coloumn came from total calculation

Table 4.38 shows the distribution of unknown registration values by regions and years. The sum of the interpolated values for 2011 is slightly different from the calculated interpolation of 2011 total unregistered number, which can be seen at the last column of the above table.

Table 4.39. Distribution of UBRU values for regions, 2009-2015

	West	South	Center	North	East	Total
2009	723	302	431	88	934	2478
2010	517	238	315	74	805	1950
2011	490	226	339	61	727	1843
2012	422	206	301	61	590	1580
2013	398	236	360	75	765	1834
2014	351	157	267	45	592	1412
2015	360	152	297	74	486	1369
Total	360	152	297	74	486	1369

The distribution of births with unknown registration dates for births of five regions in a year, used for the distribution of births unregistered in five years. The percentage distribution of the unknown birth registration dates used to distribute the unregistered number of births to five regions. In Table 4.39, we can see the distribution unregistered births according to five regions and years.

Table 4.40. Registration Completeness and Timeliness of Five Regions, 2011-2015

	West		South		Center		North		East		Total*	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Registered births	2,316,979	**99.16**	848,745	**98.98**	1,191,947	**98.97**	340229	**99.23**	1772146	**98,58**	6470046	**98.95**
0-30 days	2,247,342	96.18	823,254	96.01	1,160,709	96.38	333,980	97.40	1674300	93,14	6239585	95.42
31-90 days	46,671	2.00	15,653	1.83	18,163	1.51	3631	1.06	53216	2,96	137334	2.10
91-180 days	9,736	0.42	4,032	0.47	5,133	0.43	1014	0.30	17201	0,96	37116	0.57
181-365 days	6,410	0.27	2,832	0.33	3,748	0.31	767	0.22	13156	0,73	26913	0.41
More than 1 year	6,820	0.29	2,974	0.35	4,194	0.35	837	0.24	14273	0,79	29098	0.45
Late registration	69,637	2.98	25,491	2.97	31,238	2.59	6249	1.82	97846	5,44	230461	3.52
Unregistered births	19,562	**0.84**	8,719	**1.02**	12,350	**1.03**	2652	**0.77**	25511	**1,42**	68794	**1.05**
UBCbT*	5,436	0.23	2,628	0.31	4,211	0.35	851	0.25	8500	0,47	21627	0.33
Registered in 5 years	6,426	0.28	2,546	0.30	2,701	0.22	740	0.22	6522	0,36	18935	0.29
Will be registered in 5 years	5,678	0.24	2,568	0.30	3,873	0.32	744	0.22	7331	0,41	20193	0.31
UBRU**	2,021	0.09	977	0.11	1,565	0.13	316	0.09	3,159	0,18	8038	0.12
Total	2,336,541	100.00	857,464	100.00	1,204,297	100.00	342881	100.00	1797657	100,00	6538840	100.00

*Unregistered births captured by TurkStat

** Unregistered births remained uncatched (after 5 years)

Table 4.40 presents the results of the registration completeness and timeliness of the registration system between 2011 and 2015 for five regions. According to the results, with the 99.23% of the all births registered, North region has the most complete registration system between 2011 and 2015. East region has 98.58% completeness, which is the region with least complete birth registration. There are minor differences between birth registration completeness of regions. The timeliness of the birth registration clearly differs among the regions. East has 93.14% of their births registered timely where North has 97.4% of the births registered in 30 days. All regions have better timeliness and completeness than the total except East.

The majority of the births which will remain unregistered after five years are in East region. Estimates show that there will be 3,159 births which will remain unregistered making 39% of the total births that will remain unregistered. North region will have 0.09% of their births unregistered after 5 years while East will have the 0.18% of their births unregistered after 5 years of birth. Late registration is again has the highest late registration percentage with 5.44% while North has 1.82% of their births are registered later than 30 days.

Figure 4.20. Timely registration of five regions, 2009-2015

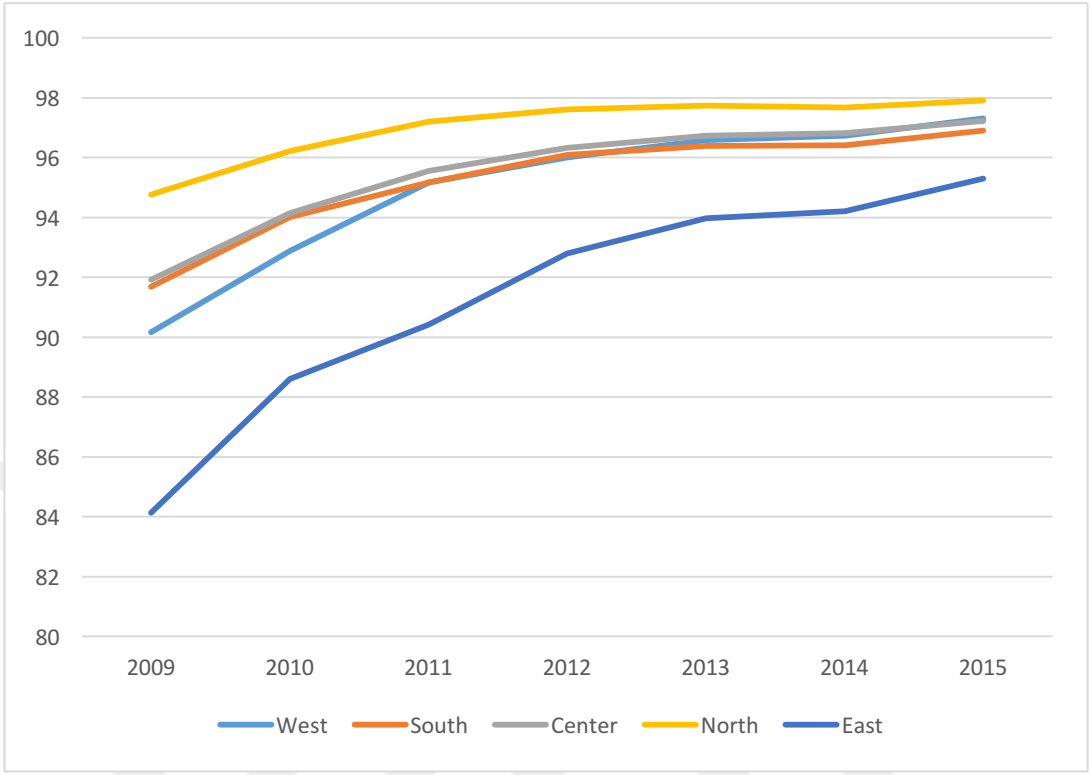


Figure 4.20 shows the change of timely registration of births from 2009 to 2015 for five regions. The timeliness for West, Center and South regions are similar for early years and almost identical for the last four years. The North region is higher than the other four regions for every year. The timeliness in East region is significantly lower than the other regions. The 2009 timeliness value of the North region and 2015 timeliness value of the East region is very similar which indicates that there is more than five-year difference between North and East regions by the means of timely birth registration.

Figure 4.21. Late registration and unregistered distribution of five regions, 2011-2015

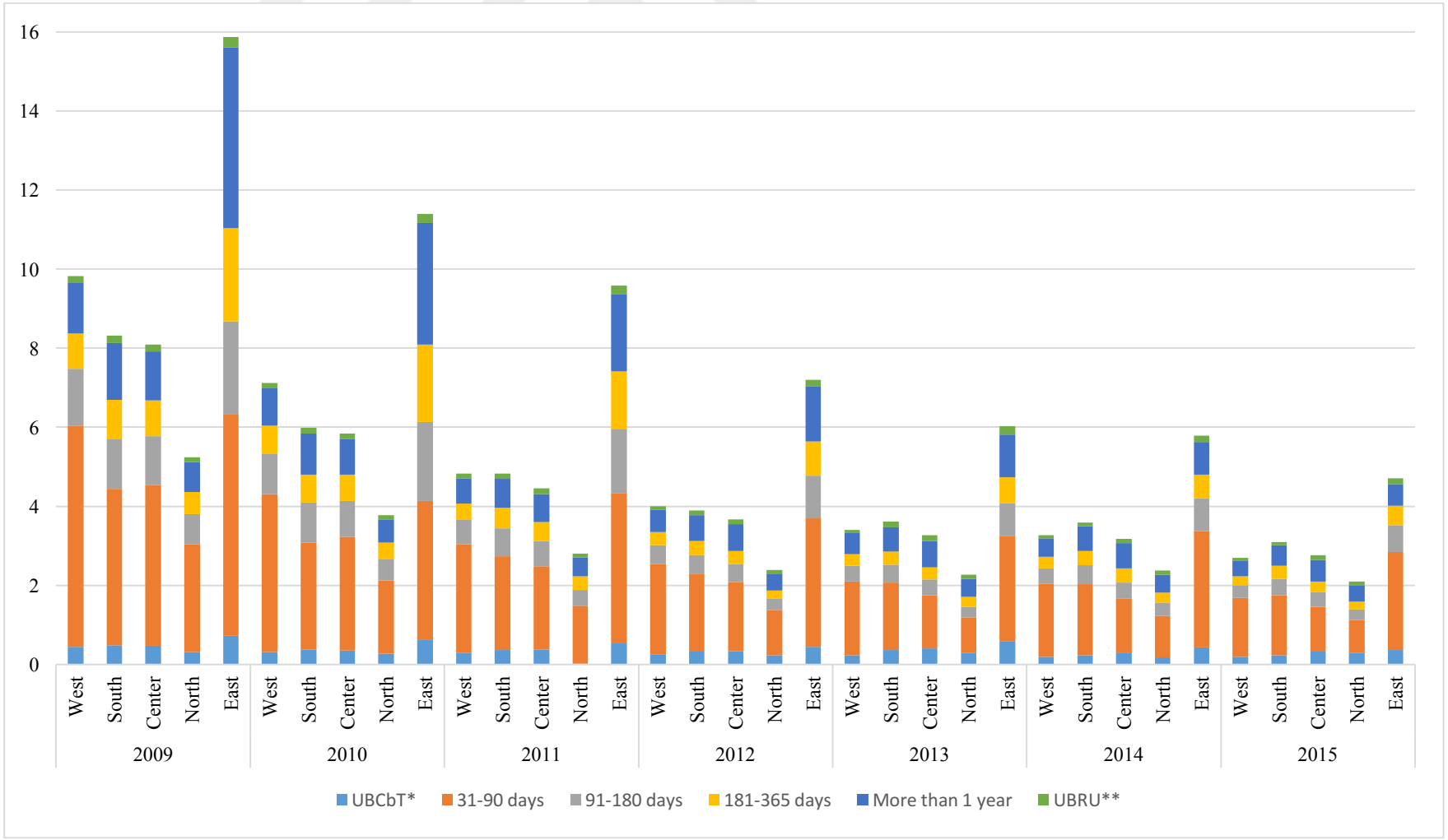
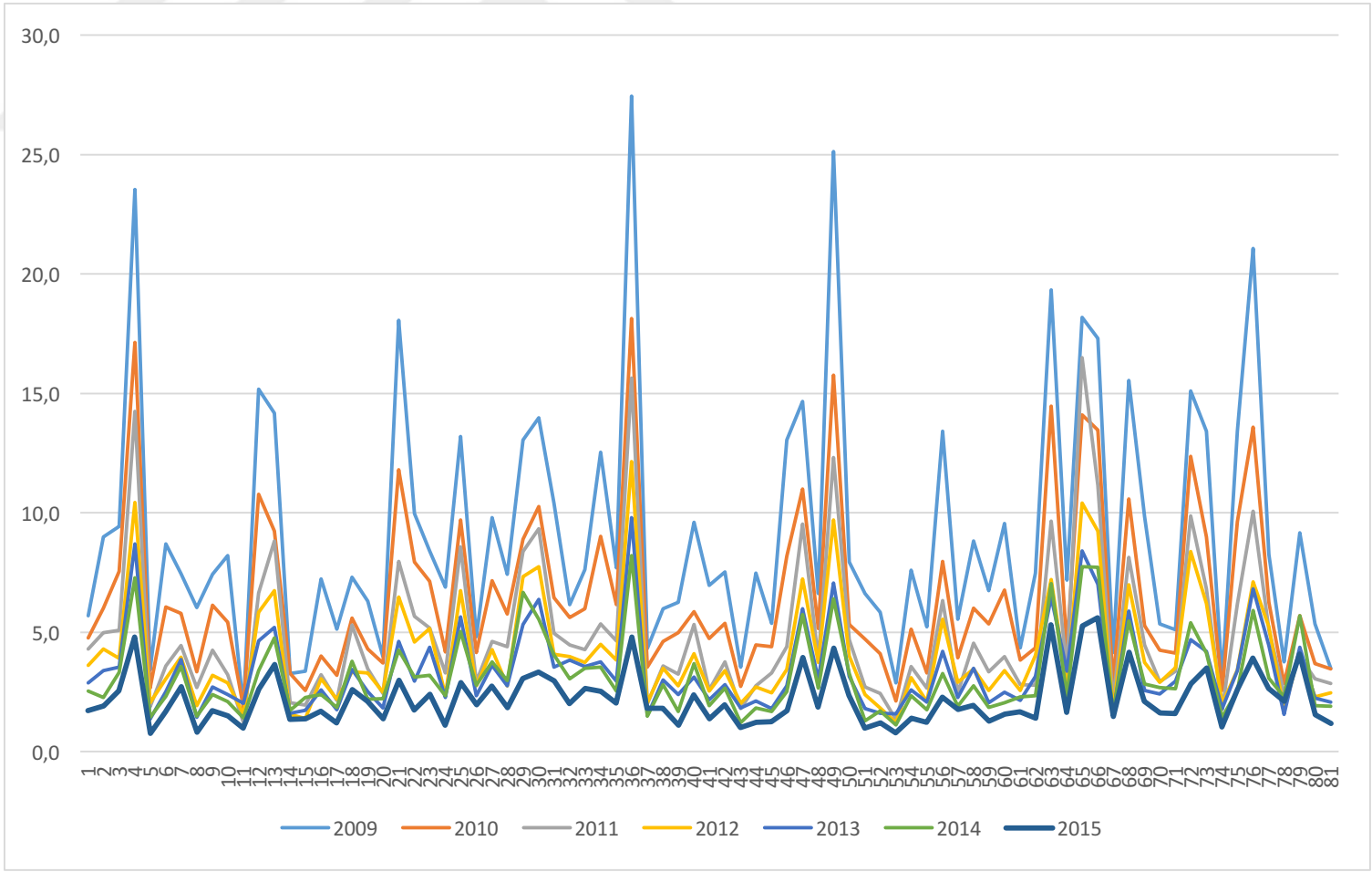


Figure 4.21 shows the late registration distribution of five regions through the years. The improvement of the registration system in different regions has different trends. In the East region, where birth registration completeness was low, the significant improvements can be observed in the "More than 1 year" group. The decrease from 16% to 4% was mainly caused by the latest late registrations. However, the progress was different in the North region, where the birth registration system was better than other regions. The "31-90 days" group initiated the decrease in late registrations, which is the earliest late registration group. It can be concluded that, the completion of birth registration system started from the latest late registration systems and after that the timely registers started to increase. The second latest registrations were observed in West in 2009, but after 7 years, South has the second place for late registrations. The status of late registration in North in 2009 was better than the late registration status of East in 2015.

Figure 4.22 shows the results of late registration of 81 provinces. The late birth registration percentages are given for provinces sorted by their provincial traffic codes. Overall, improvements can be seen at all provinces through 2009 to 2015. Almost every province with high late registration number belongs to East region. The decrease in late registrations also occurred in East regions mainly. The only exception is Yozgat, with 66 province traffic code, the only province out of East region and has higher than 5% late registration in 2015.

Figure 4.22. Total late registration distribution for provinces, 2009-2015



CHAPTER 5
CONCLUSION AND DISCUSSION

The quality of the demographic information of populations has an increased focus since the international economic and social goals are pursued seriously by more countries. This increased focus had quite effect on quality of population data, especially on birth and death registration. The coverage, completeness and timeliness of registration systems are aroused interest. The birth registration completeness became 2030 Sustainable Developments Goals indicator. Obtaining a name and nationality is a right for every child, yet recently, every one of four births remain unregistered around the world (UNICEF 2014). Apart from developed regions with complete registration systems, for developing and under developed regions, level of birth registration is questioned through surveys, mainly with special questions in Demography and Health Survey and Multiple Indicator Cluster Survey programs.

Although Turkey has a rather old registration system, with the establishment of Central Civil Registration System (MERNIS) and Address Based Population Registration System (ABPRS), the birth registration details are newly become available for studying completeness and timeliness. In the light of increasing importance to birth registration, the main purpose of this thesis is calculating up-to-date birth registration completeness and timeliness of Turkey as the end of 2015. In addition to this, determining the completeness and timeliness of male and female births registrations and births occurred to mothers younger than 18 were points of interest. The five regions are also investigated for birth registration completeness and timeliness in order to understand how different regions register their births differently.

The primary source of birth registrations information between 2009 and 2015 was gathered from TurkStat. The birth registration information contained the distribution of births in each month by registration months. This data is available for total, male and female, adolescent and adult mothers, and five regions. Registration data have Death Notification System (DNS) based information as well as MERNIS based known registrations.

In order to determine the completeness and timeliness of the birth registration system in Turkey, first we needed a secondary source of unregistered births to approximate the total number of births. We used TDHS-2013 for estimating the total unregistered births for 2009-2013 period. The available data allowed a categorization of unregistered births as; 1) known late registrations available in birth registration data, 2) late registrations estimated from known registration behaviors and 3) births remain unregistered for five years. The second group was calculated from the first group, and the third group was estimated with the help of births with unknown registration dates. The calculated data, then gathered to form a complete birth registration groups with registered births and unregistered births. Completeness and timeliness values are created from these groups.

The main results showed that Turkey has a 99% under-5 birth registration completeness in 2011-2015 period. Also 95% of all births are registered in the legal interval of 30 days from the birth in this period. Estimations show that 1% of births are unregistered and 0.1% of the all births will remain unregistered and uncaptured by any system for five years. The majority of the births with late registration are in “31-90 days” group with 2% of births. When we look at the progress of the birth registration system, we can see that birth registration completeness remained almost same but the timeliness is increased from 89% to 97% between 2009 and 2015. Registration completeness and timeliness results of the male and female births were almost same for the last years with 99% completeness and 95% timeliness between 2009 and 2015. Results of adolescent mothers showed that birth registration completeness was slightly

lower than the average with 98% but the difference in timeliness was more significant with 78% timeliness of the late adolescent birth registration. The late registration of adolescent births was improved nicely through the inspected period but the “31-90 days” group of late registrations was increased. This gives some hint on waiting period of adolescent mothers to become 18 and register their births. The results of the five regions show that the North has the most complete birth registration system with 99% and East has the least with 96%. The three other regions, West, South and North has completeness values around the average.

In overall, we can state that birth registration system is complete for Turkey and for every subpopulation studied, but timeliness was lower for East region and adolescent births. Deceased infants have a higher risk of remaining unregistered. Unregistered and deceased infants are mostly captured by Death Notification System but they are not registered in MERNIS, making them a statistical number. In subpopulations, North, male and adult births have more complete birth registrations and register earlier than the East, female and adolescent births. Adolescent completeness seems to have no problem but since the timeliness was low, births registered late cause adolescent births to live without identity longer than other children did. Adolescent births seem to decrease in numbers but we can only identify the adolescent births if they are registered before their mother turn 18. As mentioned, a life without identity have many disadvantages, unregistered children with adolescent mothers would be victimized even more. Differences between female and male birth registration completeness and timeliness is negligible which shows the gender of the child is irrelevant in the birth registration. The late registration in East can be explained with the regional conditions. Seasonal workers are residing mostly in East region and bad weather conditions almost cause transportation problems especially in winter.

This thesis not only showed the contemporary completeness and timeliness results of Turkey and selected subpopulations, but also developed a method to constantly check the subpopulations and total registration trends. This research also

helped to determine the groups and regions where the birth registration is more problematic. There are more aspects to look in order to understand the birth registration behavior better but mostly because of data absence, analyses are limited with current detail. Rather than comparing urban and rural registration rates, we investigated for 5 regions and gave a picture of the completeness numbers of the provinces, since the urban rural definition was changed recently in Turkey which made the comparison impossible with previous data. In addition, social and economic characteristics of parents could not be examined, because the available data did not contain such detail. Apart from the lack of details, the sampling frame of TDHS was chosen from ABPRS and the households uncovered by the ABPRS can stay out of coverage in TDHS. Although listing operation of TDHS minimized coverage problems. Hence, the total numbers represented here could not give information on coverage of the registration system but the completeness and timeliness in a period. It is also important to keep in mind that the coverage of ABPRS is very high.

To address the future problems of birth registration system, adolescent births should be studied in detail. Of course, in order to study birth registration with more determinants, birth registration information should contain social and economic background of the parents. As mentioned in the literature, the recommended information of the child and parents to collect by UN should be kept in mind. More information that is detailed can be collected if the birth registration is done by health personnel and in hospital. 97.2% of births occur in a health facility in Turkey according to TDHS-2013. Coverage, completeness and timeliness would increase if the newborns registered in hospitals. This would also help with the information collected about newborns about the health of the newborn such as birth weight and height. Although the births commonly done in a hospital in Turkey, system should be designed to catch the births happening outside the health facilities. Unique birth certificates documented by health personnel or village headman when there are no health personnel attending the birth, for the births outside the health facilities can increase the timeliness. In addition to the current registration custom, registering births in hospitals for a period could help to overcome this obstacle and give opportunity to compare the

results. To achieve this goal, the ongoing project of Birth Registration System, led by Ministry of Health, Ministry of Health, General Directorate of Population and Citizenship Affairs and Turkish Statistical Institute, which aim to register births in the hospitals where the birth has occurred, is a major step of registering births in the hospitals.

The implemented policies in order to improve the system must target the most disadvantage populations. East is the only region under the average and the most second region births are occurring in this region. East region and adolescent births should be the first target for the policies of birth registration and improvements should start from here. These subpopulations with low registration completeness and timeliness should be investigated more. Only after uncovering the unregistered births, we will have an opportunity to register them. Long term implementations of a working system must be targeted rather than daily solutions. Apart from system improvements, in order to determine the system completeness and coverage, full population census should be done. In the long term, future researches may investigate the school enrollment and birth registration relation. With the increasing population of Syrian refugees in Turkey, birth registration of the migrated population will become an important issue for registration system. Immediate steps should be taken about the birth registration of refugees since they are the most vulnerable population. To overcome the birth registration of infant deaths, funeral records should be matched with the records of Death Notification System (DNS) in order to detect the unregistered. The results of these matches must be registered to MERNIS as well as the infant deaths caught with DNS so all births could have an identity number. Births occurred to foreigners should also be followed with caution and must be registered to the system accordingly.

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APPENDIX A

Table A.1. Registration rates of registration moths for Turkey, 2009-2015

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
B1	100	####	###	2,517	0,919	0,764	0,574	0,436	0,388	0,281	0,245	0,279
B2	100	####	###	1,610	1,106	0,764	0,584	0,453	0,425	0,306	0,323	0,247
B3	100	####	###	1,537	1,015	0,732	0,591	0,506	0,330	0,367	0,289	0,330
B4	100	####	###	1,260	0,849	0,708	0,545	0,377	0,380	0,262	0,248	0,272
B5	100	####	###	1,344	1,005	0,696	0,549	0,504	0,380	0,294	0,303	0,217
B6	100	####	###	1,276	0,840	0,537	0,617	0,382	0,332	0,369	0,258	0,208
B7	100	####	###	1,194	0,713	0,661	0,450	0,400	0,359	0,281	0,246	0,193
B8	100	####	###	1,049	1,005	0,606	0,580	0,491	0,330	0,289	0,264	0,232
B9	100	####	###	1,568	0,805	0,677	0,624	0,406	0,297	0,272	0,253	0,260
B10	100	####	###	1,266	0,969	0,770	0,514	0,359	0,326	0,296	0,214	0,275
B11	100	####	###	1,580	1,157	0,728	0,571	0,427	0,413	0,346	0,323	0,269
B12	100	####	###	1,293	0,676	0,522	0,436	0,366	0,294	0,242	0,215	0,170
B13	100	####	###	0,948	0,625	0,455	0,407	0,312	0,307	0,218	0,216	0,226
B14	100	####	###	0,872	0,635	0,450	0,465	0,354	0,308	0,265	0,298	0,280
B15	100	####	###	0,873	0,595	0,449	0,428	0,292	0,250	0,313	0,215	0,214
B16	100	####	###	0,945	0,651	0,523	0,463	0,318	0,305	0,270	0,197	0,216
B17	100	####	###	1,069	0,772	0,547	0,399	0,492	0,327	0,301	0,205	0,197
B18	100	####	###	1,111	0,722	0,511	0,552	0,423	0,275	0,247	0,218	0,174
B19	100	####	###	1,102	0,723	0,651	0,510	0,313	0,284	0,199	0,174	0,183
B20	100	####	###	1,093	0,919	0,632	0,443	0,332	0,294	0,226	0,183	0,151
B21	100	####	###	1,255	0,748	0,416	0,406	0,255	0,212	0,171	0,135	0,089
B22	100	####	###	1,347	0,706	0,619	0,399	0,334	0,306	0,223	0,185	0,195
B23	100	####	###	0,830	0,626	0,411	0,338	0,261	0,179	0,162	0,166	0,124
B24	100	####	###	0,842	0,485	0,363	0,323	0,179	0,176	0,181	0,104	0,131
B25	100	####	###	0,612	0,418	0,338	0,210	0,191	0,177	0,134	0,110	0,136
B26	100	####	###	0,655	0,458	0,315	0,245	0,243	0,135	0,170	0,126	0,199
B27	100	####	###	0,667	0,352	0,303	0,278	0,183	0,145	0,165	0,177	0,145
B28	100	####	###	0,634	0,415	0,398	0,255	0,191	0,203	0,230	0,172	0,137
B29	100	####	###	0,749	0,497	0,381	0,261	0,306	0,262	0,229	0,151	0,119
B30	100	####	###	0,891	0,496	0,298	0,294	0,298	0,200	0,146	0,135	0,107
B31	100	####	###	0,761	0,457	0,404	0,333	0,260	0,218	0,146	0,132	0,116
B32	100	####	###	0,818	0,627	0,503	0,344	0,283	0,172	0,170	0,096	0,109
B33	100	####	###	0,802	0,576	0,351	0,268	0,195	0,180	0,133	0,085	0,112
B34	100	####	###	0,851	0,511	0,336	0,257	0,194	0,144	0,136	0,109	0,097
B35	100	####	###	0,716	0,425	0,291	0,254	0,168	0,150	0,104	0,111	0,084
B36	100	####	###	0,701	0,342	0,274	0,187	0,140	0,100	0,097	0,094	0,097
B37	100	####	###	0,493	0,321	0,175	0,170	0,125	0,122	0,088	0,083	0,071
B38	100	####	###	0,584	0,299	0,217	0,155	0,150	0,119	0,109	0,090	0,102
B39	100	####	###	0,457	0,316	0,191	0,179	0,119	0,144	0,099	0,103	0,088
B40	100	####	###	0,596	0,314	0,242	0,187	0,123	0,109	0,108	0,100	0,029
B41	100	####	###	0,556	0,364	0,239	0,205	0,138	0,140	0,139	0,050	0,076
B42	100	####	###	0,572	0,359	0,319	0,237	0,152	0,133	0,032	0,091	0,089
B43	100	####	###	0,586	0,415	0,263	0,225	0,158	0,048	0,102	0,073	0,065
B44	100	####	###	0,619	0,357	0,265	0,195	0,057	0,111	0,136	0,067	0,077
B45	100	####	###	0,536	0,423	0,256	0,077	0,158	0,129	0,107	0,088	0,085
B46	100	####	###	0,679	0,346	0,091	0,208	0,143	0,119	0,100	0,101	0,088
B47	100	####	###	0,454	0,105	0,203	0,137	0,111	0,099	0,070	0,071	0,056
B48	100	####	###	0,191	0,270	0,201	0,158	0,117	0,111	0,080	0,057	0,065

Table A.1. Registration rates of registration moths for Turkey, 2009-2015 (continued)

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12
B49	100	21.121	0.968	0.420	0.243	0.134	0.127	0.085	0.089	0.068	0.056	0.069
B50	100	25.054	1.049	0.384	0.218	0.169	0.116	0.116	0.088	0.061	0.068	0.073
B51	100	27.465	1.025	0.393	0.249	0.162	0.164	0.109	0.095	0.095	0.086	0.074
B52	100	23.961	0.931	0.444	0.190	0.195	0.112	0.102	0.109	0.092	0.065	0.061
B53	100	22.484	1.141	0.397	0.280	0.168	0.153	0.120	0.113	0.088	0.068	0.070
B54	100	31.757	0.994	0.504	0.258	0.209	0.157	0.123	0.107	0.098	0.069	0.053
B55	100	23.049	1.195	0.428	0.291	0.188	0.141	0.104	0.101	0.068	0.066	0.053
B56	100	31.623	1.133	0.523	0.286	0.259	0.123	0.120	0.097	0.086	0.066	0.060
B57	100	25.499	1.267	0.442	0.316	0.179	0.141	0.096	0.093	0.077	0.060	0.091
B58	100	26.859	1.085	0.451	0.285	0.161	0.142	0.118	0.093	0.067	0.077	0.059
B59	100	26.799	1.058	0.384	0.233	0.155	0.124	0.098	0.066	0.079	0.061	0.041
B60	100	22.452	0.915	0.427	0.218	0.161	0.139	0.098	0.093	0.102	0.063	0.046
B61	100	18.112	0.822	0.324	0.174	0.157	0.117	0.125	0.093	0.056	0.042	0.069
B62	100	23.080	0.933	0.307	0.226	0.145	0.110	0.111	0.065	0.084	0.067	0.054
B63	100	24.330	0.863	0.372	0.214	0.197	0.140	0.107	0.081	0.085	0.062	0.054
B64	100	23.854	0.993	0.351	0.293	0.188	0.121	0.106	0.106	0.081	0.057	0.058
B65	100	25.145	1.052	0.521	0.289	0.151	0.146	0.114	0.103	0.081	0.060	0.064
B66	100	25.408	1.344	0.489	0.243	0.188	0.177	0.118	0.083	0.091	0.063	0.059
B67	100	30.923	1.278	0.418	0.278	0.216	0.165	0.142	0.094	0.082	0.079	0.078
B68	100	27.543	1.153	0.485	0.276	0.198	0.147	0.130	0.098	0.083	0.083	0.066
B69	100	23.505	1.283	0.547	0.273	0.183	0.154	0.092	0.089	0.088	0.064	0.081
B70	100	24.872	1.333	0.430	0.283	0.196	0.134	0.127	0.106	0.083	0.069	0.050
B71	100	30.628	1.149	0.391	0.270	0.168	0.129	0.115	0.094	0.087	0.065	0.064
B72	100	21.255	0.960	0.407	0.219	0.150	0.133	0.095	0.068	0.059	0.063	0.064
B73	100	20.595	0.880	0.317	0.221	0.154	0.121	0.086	0.072	0.070	0.039	0.060
B74	100	26.063	0.861	0.333	0.247	0.151	0.125	0.087	0.086	0.074	0.085	0.055
B75	100	21.958	0.865	0.360	0.188	0.129	0.101	0.089	0.076	0.083	0.051	0.059
B76	100	21.799	1.003	0.311	0.203	0.137	0.124	0.098	0.063	0.056	0.068	0.050
B77	100	25.854	0.820	0.322	0.196	0.195	0.129	0.117	0.077	0.088	0.053	0.049
B78	100	20.495	0.882	0.283	0.219	0.128	0.126	0.087	0.079	0.069	0.051	0.048
B79	100	18.333	0.735	0.363	0.198	0.167	0.124	0.094	0.073	0.067	0.051	0.047
B80	100	18.865	1.064	0.390	0.211	0.134	0.121	0.088	0.071	0.066	0.050	0.046
B81	100	27.288	1.066	0.335	0.204	0.163	0.109	0.086	0.070	0.065	0.049	0.045
B82	100	31.801	0.863	0.360	0.214	0.139	0.107	0.085	0.069	0.064	0.048	0.045
B83	100	19.938	0.725	0.303	0.200	0.137	0.105	0.083	0.068	0.063	0.047	0.044
B84	100	17.069	0.913	0.301	0.197	0.134	0.104	0.082	0.066	0.062	0.046	0.043
Variables of trend			**c**	-0.41870	-0.25707	-0.19570	-0.16191	-0.12446	-0.10475	-0.08603	-0.07817	-0.07412
			b	2.15657	1.33602	1.00127	0.82092	0.63310	0.53050	0.44331	0.39207	0.37116

Table A.1. Registration rates of registration moths for Turkey, 2009-2015 (continued)

	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23	R24
B1	0.338	0.263	0.239	0.168	0.123	0.161	0.118	0.136	0.102	0.090	0.090	0.127
B2	0.372	0.258	0.159	0.169	0.143	0.133	0.173	0.156	0.118	0.104	0.142	0.118
B3	0.417	0.181	0.152	0.159	0.175	0.154	0.159	0.149	0.107	0.125	0.162	0.107
B4	0.291	0.189	0.166	0.154	0.154	0.149	0.127	0.119	0.150	0.150	0.122	0.101
B5	0.301	0.214	0.152	0.177	0.177	0.112	0.111	0.160	0.138	0.131	0.121	0.103
B6	0.257	0.201	0.160	0.154	0.133	0.117	0.178	0.178	0.114	0.114	0.090	0.107
B7	0.236	0.152	0.165	0.155	0.105	0.183	0.141	0.113	0.125	0.099	0.079	0.068
B8	0.273	0.223	0.168	0.148	0.196	0.192	0.136	0.131	0.120	0.108	0.095	0.079
B9	0.370	0.210	0.176	0.225	0.223	0.159	0.161	0.119	0.106	0.104	0.098	0.083
B10	0.299	0.194	0.221	0.212	0.169	0.150	0.133	0.130	0.112	0.094	0.097	0.100
B11	0.331	0.279	0.223	0.194	0.171	0.125	0.152	0.156	0.138	0.104	0.100	0.071
B12	0.279	0.228	0.178	0.152	0.124	0.127	0.096	0.083	0.082	0.114	0.077	0.060
B13	0.364	0.203	0.170	0.113	0.132	0.112	0.097	0.078	0.079	0.062	0.062	0.095
B14	0.309	0.167	0.162	0.136	0.121	0.109	0.103	0.112	0.094	0.061	0.091	0.132
B15	0.259	0.172	0.131	0.109	0.094	0.070	0.093	0.073	0.052	0.099	0.111	0.104
B16	0.246	0.178	0.147	0.128	0.092	0.102	0.101	0.085	0.085	0.099	0.086	0.092
B17	0.225	0.163	0.130	0.105	0.093	0.085	0.093	0.078	0.120	0.103	0.082	0.082
B18	0.234	0.134	0.129	0.119	0.085	0.072	0.127	0.138	0.090	0.069	0.054	0.066
B19	0.182	0.123	0.134	0.092	0.088	0.075	0.134	0.118	0.066	0.051	0.066	0.054
B20	0.191	0.160	0.105	0.087	0.103	0.147	0.122	0.088	0.060	0.068	0.050	0.050
B21	0.188	0.109	0.085	0.108	0.136	0.115	0.088	0.086	0.064	0.049	0.053	0.054
B22	0.209	0.151	0.155	0.199	0.157	0.125	0.091	0.091	0.062	0.062	0.080	0.075
B23	0.140	0.131	0.151	0.121	0.082	0.077	0.057	0.060	0.041	0.039	0.058	0.039
B24	0.182	0.170	0.095	0.078	0.075	0.051	0.058	0.053	0.031	0.058	0.045	0.044
B25	0.230	0.149	0.101	0.082	0.068	0.060	0.052	0.061	0.052	0.044	0.031	0.043
B26	0.250	0.090	0.089	0.077	0.046	0.046	0.057	0.052	0.060	0.040	0.026	0.047
B27	0.156	0.082	0.077	0.062	0.078	0.062	0.073	0.042	0.048	0.042	0.067	0.044
B28	0.132	0.085	0.087	0.069	0.068	0.055	0.064	0.071	0.042	0.045	0.065	0.059
B29	0.164	0.114	0.072	0.064	0.084	0.044	0.069	0.050	0.048	0.053	0.050	0.044
B30	0.128	0.094	0.063	0.061	0.044	0.080	0.072	0.056	0.050	0.039	0.031	0.040
B31	0.122	0.077	0.088	0.064	0.069	0.057	0.077	0.047	0.033	0.057	0.058	0.031
B32	0.118	0.086	0.069	0.077	0.062	0.080	0.077	0.055	0.044	0.036	0.031	0.028
B33	0.139	0.081	0.075	0.053	0.076	0.063	0.042	0.063	0.047	0.033	0.039	0.032
B34	0.133	0.085	0.065	0.109	0.075	0.068	0.057	0.055	0.035	0.033	0.039	0.044
B35	0.146	0.104	0.086	0.091	0.060	0.061	0.051	0.032	0.040	0.059	0.041	0.031
B36	0.115	0.068	0.070	0.068	0.065	0.031	0.037	0.049	0.031	0.043	0.027	0.030
B37	0.104	0.090	0.022	0.059	0.041	0.051	0.043	0.031	0.028	0.020	0.037	0.028
B38	0.134	0.021	0.042	0.061	0.045	0.048	0.048	0.029	0.021	0.036	0.026	0.028
B39	0.049	0.068	0.049	0.038	0.045	0.031	0.044	0.040	0.035	0.034	0.029	0.033
B40	0.090	0.067	0.056	0.045	0.046	0.067	0.049	0.053	0.026	0.041	0.030	0.027
B41	0.097	0.069	0.051	0.048	0.041	0.034	0.038	0.035	0.030	0.034	0.042	0.025
B42	0.091	0.077	0.062	0.044	0.044	0.052	0.040	0.041	0.027	0.033	0.028	0.031
B43	0.097	0.065	0.064	0.038	0.053	0.034	0.036	0.029	0.045	0.026	0.028	0.034
B44	0.101	0.079	0.044	0.046	0.051	0.048	0.038	0.035	0.035	0.030	0.019	0.025
B45	0.090	0.065	0.065	0.043	0.056	0.033	0.041	0.040	0.031	0.026	0.025	0.051
B46	0.071	0.065	0.057	0.049	0.060	0.042	0.036	0.029	0.032	0.023	0.043	0.025
B47	0.080	0.053	0.056	0.038	0.037	0.036	0.030	0.027	0.024	0.036	0.039	0.023
B48	0.073	0.061	0.051	0.050	0.050	0.047	0.024	0.031	0.046	0.037	0.011	0.027

Table A.1. Registration rates of registration moths for Turkey, 2009-2015 (continued)

	R13	R14	R15	R16	R17	R18	R19	R20	R21	R22	R23	R24
B49	0.077	0.042	0.050	0.043	0.038	0.027	0.028	0.045	0.028	0.020	0.017	0.028
B50	0.068	0.042	0.045	0.054	0.039	0.029	0.042	0.031	0.029	0.023	0.026	0.019
B51	0.096	0.063	0.037	0.038	0.033	0.036	0.038	0.022	0.014	0.036	0.028	0.028
B52	0.066	0.045	0.033	0.040	0.053	0.053	0.030	0.032	0.022	0.028	0.017	0.024
B53	0.065	0.043	0.058	0.049	0.045	0.030	0.034	0.026	0.025	0.026	0.025	0.026
B54	0.073	0.051	0.068	0.032	0.032	0.030	0.046	0.042	0.025	0.024	0.030	0.030
B55	0.036	0.056	0.041	0.036	0.017	0.027	0.033	0.028	0.032	0.025	0.027	0.025
B56	0.102	0.063	0.037	0.037	0.051	0.045	0.038	0.046	0.037	0.037	0.032	0.022
B57	0.077	0.037	0.033	0.039	0.033	0.041	0.045	0.026	0.015	0.036	0.022	0.033
B58	0.047	0.041	0.051	0.039	0.033	0.040	0.041	0.031	0.027	0.027	0.039	0.028
B59	0.060	0.038	0.038	0.041	0.044	0.038	0.039	0.026	0.033	0.026	0.019	0.021
B60	0.069	0.034	0.049	0.037	0.034	0.036	0.041	0.034	0.032	0.020	0.033	0.021
B61	0.060	0.049	0.044	0.035	0.050	0.025	0.038	0.023	0.035	0.026	0.019	0.020
B62	0.067	0.056	0.044	0.040	0.056	0.031	0.044	0.025	0.027	0.026	0.026	0.020
B63	0.065	0.050	0.046	0.064	0.038	0.045	0.036	0.028	0.031	0.023	0.027	0.025
B64	0.063	0.043	0.058	0.062	0.045	0.024	0.035	0.023	0.040	0.018	0.028	0.021
B65	0.088	0.055	0.057	0.052	0.041	0.038	0.031	0.018	0.028	0.032	0.021	0.021
B66	0.085	0.074	0.057	0.040	0.042	0.040	0.037	0.025	0.034	0.023	0.020	0.020
B67	0.077	0.050	0.038	0.038	0.031	0.044	0.028	0.044	0.023	0.022	0.020	0.020
B68	0.072	0.051	0.046	0.041	0.040	0.042	0.045	0.024	0.022	0.022	0.019	0.019
B69	0.032	0.034	0.036	0.045	0.034	0.047	0.031	0.023	0.022	0.021	0.019	0.019
B70	0.065	0.047	0.042	0.047	0.043	0.030	0.031	0.023	0.021	0.021	0.018	0.018
B71	0.061	0.057	0.053	0.041	0.035	0.030	0.030	0.022	0.021	0.020	0.018	0.018
B72	0.052	0.040	0.048	0.036	0.035	0.029	0.030	0.022	0.020	0.020	0.018	0.017
B73	0.052	0.065	0.039	0.036	0.034	0.029	0.029	0.021	0.020	0.019	0.017	0.017
B74	0.069	0.041	0.038	0.035	0.034	0.028	0.028	0.020	0.019	0.019	0.017	0.017
B75	0.054	0.040	0.037	0.034	0.033	0.028	0.028	0.020	0.019	0.019	0.016	0.016
B76	0.053	0.039	0.036	0.034	0.032	0.027	0.027	0.019	0.018	0.018	0.016	0.016
B77	0.052	0.038	0.036	0.033	0.032	0.027	0.027	0.019	0.018	0.018	0.015	0.015
B78	0.050	0.037	0.035	0.033	0.031	0.026	0.026	0.018	0.017	0.017	0.015	0.015
B79	0.049	0.037	0.034	0.032	0.031	0.025	0.026	0.018	0.017	0.017	0.014	0.015
B80	0.048	0.036	0.034	0.031	0.030	0.025	0.025	0.017	0.016	0.016	0.014	0.014
B81	0.047	0.035	0.033	0.031	0.030	0.024	0.025	0.017	0.016	0.016	0.014	0.014
B82	0.046	0.034	0.033	0.030	0.029	0.024	0.024	0.016	0.016	0.016	0.013	0.013
B83	0.044	0.033	0.032	0.030	0.029	0.023	0.024	0.016	0.015	0.015	0.013	0.013
B84	0.043	0.033	0.031	0.029	0.028	0.023	0.023	0.015	0.015	0.015	0.012	0.013
c	-0.09904	-0.06484	-0.05213	-0.04792	-0.04288	-0.04169	-0.04041	-0.04179	-0.03426	-0.03231	-0.03308	-0.03098
b	0.48195	0.31990	0.26226	0.24134	0.21817	0.20762	0.20239	0.20026	0.16661	0.15803	0.15903	0.14986

Table A.1. Registration rates of registration moths for Turkey, 2009-2015 (continued)

	R25	R26	R27	R28	R29	R30	R31	R32	R33	R34	R35	R36
B1	0.191	0.124	0.113	0.081	0.084	0.076	0.058	0.053	0.090	0.044	0.035	0.054
B2	0.183	0.093	0.111	0.067	0.090	0.078	0.047	0.064	0.048	0.043	0.076	0.085
B3	0.183	0.107	0.077	0.090	0.075	0.064	0.090	0.056	0.061	0.061	0.087	0.093
B4	0.128	0.085	0.063	0.058	0.061	0.074	0.057	0.036	0.050	0.064	0.074	0.057
B5	0.146	0.089	0.091	0.069	0.115	0.061	0.065	0.072	0.106	0.083	0.066	0.042
B6	0.127	0.084	0.073	0.080	0.070	0.033	0.058	0.087	0.091	0.038	0.040	0.058
B7	0.102	0.065	0.068	0.060	0.040	0.065	0.086	0.093	0.044	0.055	0.049	0.039
B8	0.098	0.130	0.069	0.056	0.061	0.083	0.078	0.061	0.049	0.035	0.040	0.030
B9	0.160	0.085	0.091	0.076	0.146	0.100	0.058	0.038	0.051	0.043	0.047	0.058
B10	0.111	0.079	0.084	0.099	0.117	0.082	0.055	0.040	0.045	0.040	0.039	0.058
B11	0.138	0.111	0.148	0.148	0.073	0.061	0.042	0.060	0.040	0.058	0.069	0.042
B12	0.142	0.118	0.085	0.057	0.054	0.034	0.038	0.047	0.046	0.044	0.031	0.024
B13	0.216	0.136	0.062	0.063	0.046	0.037	0.046	0.041	0.049	0.033	0.038	0.032
B14	0.175	0.056	0.061	0.069	0.051	0.050	0.045	0.069	0.035	0.040	0.035	0.066
B15	0.114	0.053	0.038	0.038	0.034	0.038	0.044	0.033	0.034	0.031	0.041	0.034
B16	0.109	0.046	0.045	0.036	0.042	0.055	0.037	0.042	0.035	0.043	0.039	0.027
B17	0.088	0.035	0.042	0.051	0.062	0.042	0.044	0.035	0.045	0.037	0.035	0.018
B18	0.072	0.056	0.042	0.053	0.038	0.037	0.038	0.035	0.038	0.025	0.033	0.029
B19	0.078	0.043	0.070	0.026	0.042	0.039	0.036	0.035	0.022	0.026	0.032	0.025
B20	0.080	0.053	0.039	0.037	0.030	0.033	0.032	0.030	0.026	0.034	0.021	0.024
B21	0.080	0.044	0.045	0.039	0.028	0.036	0.031	0.032	0.036	0.021	0.033	0.027
B22	0.086	0.083	0.060	0.065	0.062	0.054	0.052	0.031	0.034	0.037	0.035	0.037
B23	0.070	0.054	0.041	0.039	0.031	0.032	0.026	0.020	0.025	0.028	0.028	0.020
B24	0.051	0.036	0.030	0.042	0.034	0.025	0.019	0.025	0.020	0.016	0.016	0.012
B25	0.080	0.044	0.044	0.029	0.031	0.017	0.019	0.024	0.025	0.013	0.017	0.021
B26	0.078	0.032	0.028	0.029	0.031	0.028	0.023	0.023	0.018	0.029	0.017	0.032
B27	0.066	0.037	0.026	0.022	0.032	0.022	0.025	0.016	0.017	0.022	0.022	0.020
B28	0.051	0.045	0.046	0.033	0.038	0.036	0.029	0.023	0.026	0.030	0.026	0.029
B29	0.085	0.029	0.023	0.022	0.041	0.025	0.044	0.025	0.015	0.022	0.031	0.012
B30	0.069	0.025	0.043	0.034	0.021	0.027	0.014	0.021	0.012	0.025	0.016	0.025
B31	0.037	0.033	0.043	0.033	0.029	0.025	0.024	0.021	0.029	0.021	0.013	0.020
B32	0.046	0.042	0.021	0.031	0.027	0.024	0.019	0.026	0.027	0.017	0.023	0.015
B33	0.056	0.020	0.032	0.020	0.029	0.031	0.027	0.023	0.022	0.016	0.017	0.016
B34	0.047	0.045	0.027	0.036	0.029	0.028	0.023	0.011	0.024	0.015	0.024	0.024
B35	0.059	0.033	0.036	0.025	0.033	0.024	0.025	0.027	0.016	0.020	0.017	0.016
B36	0.048	0.045	0.015	0.027	0.022	0.021	0.027	0.027	0.030	0.019	0.019	0.018
B37	0.038	0.027	0.028	0.026	0.016	0.025	0.024	0.030	0.031	0.017	0.017	0.017
B38	0.032	0.036	0.013	0.024	0.023	0.016	0.034	0.029	0.015	0.013	0.017	0.015
B39	0.056	0.025	0.019	0.025	0.019	0.016	0.023	0.011	0.015	0.018	0.023	0.019
B40	0.048	0.033	0.021	0.025	0.030	0.030	0.025	0.015	0.014	0.015	0.019	0.023
B41	0.027	0.031	0.017	0.030	0.027	0.017	0.025	0.025	0.026	0.020	0.017	0.011
B42	0.043	0.025	0.025	0.010	0.015	0.017	0.020	0.011	0.017	0.030	0.015	0.015
B43	0.037	0.031	0.026	0.021	0.016	0.023	0.029	0.017	0.017	0.019	0.010	0.019
B44	0.045	0.025	0.015	0.023	0.018	0.015	0.022	0.017	0.015	0.015	0.015	0.020
B45	0.036	0.024	0.020	0.019	0.021	0.024	0.028	0.018	0.016	0.028	0.020	0.034
B46	0.019	0.023	0.013	0.031	0.025	0.036	0.021	0.019	0.029	0.013	0.026	0.014
B47	0.023	0.020	0.022	0.028	0.013	0.014	0.018	0.013	0.029	0.023	0.017	0.017
B48	0.041	0.026	0.028	0.023	0.033	0.023	0.028	0.021	0.017	0.026	0.010	0.020

Table A.1. Registration rates of registration moths for Turkey, 2009-2015 (continued)

	R25	R26	R27	R28	R29	R30	R31	R32	R33	R34	R35	R36
B49	0.039	0.018	0.023	0.020	0.018	0.019	0.017	0.021	0.022	0.020	0.012	0.022
B50	0.030	0.018	0.026	0.038	0.042	0.042	0.018	0.014	0.023	0.010	0.011	0.020
B51	0.038	0.022	0.032	0.023	0.018	0.019	0.015	0.014	0.017	0.017	0.022	0.019
B52	0.029	0.033	0.020	0.026	0.025	0.020	0.017	0.013	0.008	0.012	0.009	0.014
B53	0.032	0.021	0.019	0.027	0.021	0.023	0.011	0.013	0.012	0.013	0.014	0.014
B54	0.036	0.022	0.032	0.021	0.021	0.025	0.017	0.026	0.017	0.016	0.013	0.013
B55	0.027	0.021	0.014	0.016	0.015	0.013	0.013	0.015	0.014	0.016	0.013	0.013
B56	0.032	0.019	0.030	0.020	0.020	0.015	0.016	0.015	0.013	0.015	0.013	0.013
B57	0.026	0.017	0.022	0.032	0.015	0.013	0.018	0.015	0.013	0.015	0.012	0.012
B58	0.044	0.017	0.020	0.014	0.021	0.017	0.017	0.015	0.013	0.015	0.012	0.012
B59	0.030	0.026	0.020	0.020	0.017	0.017	0.017	0.015	0.013	0.015	0.012	0.012
B60	0.026	0.011	0.016	0.020	0.017	0.017	0.017	0.014	0.012	0.014	0.012	0.012
B61	0.022	0.024	0.017	0.020	0.017	0.016	0.017	0.014	0.012	0.014	0.011	0.011
B62	0.025	0.018	0.016	0.019	0.016	0.016	0.016	0.014	0.012	0.014	0.011	0.011
B63	0.026	0.018	0.016	0.019	0.016	0.016	0.016	0.013	0.011	0.014	0.011	0.011
B64	0.025	0.017	0.015	0.019	0.015	0.016	0.016	0.013	0.011	0.014	0.010	0.010
B65	0.024	0.017	0.015	0.018	0.015	0.015	0.016	0.013	0.011	0.013	0.010	0.010
B66	0.024	0.016	0.015	0.018	0.015	0.015	0.015	0.013	0.010	0.013	0.010	0.010
B67	0.023	0.016	0.014	0.018	0.014	0.015	0.015	0.012	0.010	0.013	0.010	0.010
B68	0.022	0.016	0.014	0.017	0.014	0.014	0.015	0.012	0.010	0.013	0.009	0.009
B69	0.022	0.015	0.013	0.017	0.014	0.014	0.015	0.012	0.010	0.012	0.009	0.009
B70	0.021	0.015	0.013	0.017	0.013	0.014	0.014	0.012	0.009	0.012	0.009	0.009
B71	0.020	0.014	0.013	0.017	0.013	0.014	0.014	0.011	0.009	0.012	0.009	0.009
B72	0.019	0.014	0.012	0.016	0.013	0.013	0.014	0.011	0.009	0.012	0.009	0.008
B73	0.019	0.013	0.012	0.016	0.012	0.013	0.014	0.011	0.009	0.012	0.008	0.008
B74	0.018	0.013	0.011	0.016	0.012	0.013	0.013	0.011	0.008	0.012	0.008	0.008
B75	0.017	0.013	0.011	0.015	0.012	0.013	0.013	0.010	0.008	0.011	0.008	0.008
B76	0.017	0.012	0.011	0.015	0.011	0.012	0.013	0.010	0.008	0.011	0.008	0.008
B77	0.016	0.012	0.010	0.015	0.011	0.012	0.013	0.010	0.008	0.011	0.007	0.007
B78	0.016	0.011	0.010	0.015	0.011	0.012	0.013	0.010	0.007	0.011	0.007	0.007
B79	0.015	0.011	0.010	0.014	0.010	0.012	0.012	0.010	0.007	0.011	0.007	0.007
B80	0.014	0.011	0.009	0.014	0.010	0.011	0.012	0.009	0.007	0.010	0.007	0.007
B81	0.014	0.010	0.009	0.014	0.010	0.011	0.012	0.009	0.007	0.010	0.007	0.007
B82	0.013	0.010	0.009	0.014	0.010	0.011	0.012	0.009	0.006	0.010	0.006	0.006
B83	0.013	0.010	0.008	0.013	0.009	0.011	0.011	0.009	0.006	0.010	0.006	0.006
B84	0.012	0.009	0.008	0.013	0.009	0.010	0.011	0.009	0.006	0.010	0.006	0.006
c	-0.04870	-0.03006	-0.02677	-0.02100	-0.02350	-0.01911	-0.01674	-0.01689	-0.01871	-0.01367	-0.01663	-0.01666
b	0.22773	0.14237	0.12668	0.10609	0.11313	0.09501	0.08543	0.08343	0.08880	0.07036	0.07966	0.07970

Table A.1. Registration rates of registration moths for Turkey, 2009-2015 (continued)

	R37	R38	R39	R40	R41	R42	R43	R44	R45	R46	R47	R48
B1	0.127	0.075	0.051	0.036	0.033	0.030	0.032	0.021	0.043	0.028	0.027	0.021
B2	0.126	0.050	0.050	0.041	0.022	0.033	0.043	0.038	0.047	0.047	0.028	0.024
B3	0.095	0.046	0.053	0.042	0.040	0.034	0.045	0.034	0.026	0.029	0.024	0.034
B4	0.083	0.032	0.025	0.035	0.031	0.055	0.026	0.026	0.026	0.019	0.025	0.036
B5	0.078	0.037	0.040	0.049	0.038	0.032	0.032	0.034	0.035	0.032	0.020	0.018
B6	0.064	0.041	0.043	0.047	0.030	0.026	0.030	0.036	0.021	0.033	0.013	0.023
B7	0.043	0.040	0.042	0.018	0.016	0.024	0.021	0.025	0.030	0.028	0.015	0.014
B8	0.065	0.063	0.030	0.035	0.021	0.026	0.017	0.022	0.016	0.019	0.017	0.030
B9	0.066	0.046	0.050	0.032	0.033	0.034	0.037	0.021	0.018	0.017	0.024	0.020
B10	0.061	0.039	0.036	0.039	0.040	0.028	0.021	0.013	0.019	0.025	0.025	0.030
B11	0.079	0.048	0.029	0.035	0.035	0.029	0.023	0.031	0.040	0.019	0.040	0.017
B12	0.059	0.024	0.039	0.020	0.031	0.026	0.024	0.021	0.021	0.026	0.013	0.016
B13	0.059	0.052	0.038	0.032	0.020	0.018	0.027	0.017	0.027	0.020	0.015	0.021
B14	0.066	0.035	0.031	0.026	0.030	0.036	0.022	0.041	0.013	0.038	0.022	0.018
B15	0.047	0.036	0.033	0.022	0.030	0.022	0.027	0.011	0.014	0.015	0.026	0.021
B16	0.043	0.027	0.026	0.023	0.014	0.029	0.020	0.014	0.014	0.012	0.014	0.029
B17	0.035	0.025	0.027	0.018	0.027	0.025	0.016	0.021	0.014	0.025	0.016	0.011
B18	0.046	0.016	0.029	0.029	0.012	0.011	0.011	0.016	0.013	0.015	0.017	0.015
B19	0.023	0.026	0.029	0.014	0.017	0.022	0.013	0.019	0.018	0.017	0.018	0.021
B20	0.045	0.028	0.017	0.025	0.018	0.016	0.014	0.016	0.009	0.012	0.007	0.011
B21	0.042	0.015	0.021	0.014	0.015	0.013	0.018	0.014	0.006	0.010	0.013	0.014
B22	0.032	0.046	0.034	0.028	0.020	0.025	0.017	0.026	0.026	0.011	0.031	0.020
B23	0.048	0.012	0.022	0.025	0.016	0.010	0.022	0.016	0.010	0.031	0.026	0.013
B24	0.036	0.016	0.014	0.017	0.012	0.008	0.016	0.009	0.023	0.017	0.011	0.009
B25	0.029	0.015	0.035	0.016	0.018	0.015	0.015	0.021	0.016	0.009	0.012	0.017
B26	0.017	0.018	0.015	0.012	0.017	0.029	0.024	0.014	0.015	0.009	0.014	0.012
B27	0.034	0.015	0.016	0.019	0.021	0.019	0.015	0.009	0.008	0.015	0.009	0.013
B28	0.023	0.019	0.013	0.012	0.023	0.020	0.016	0.006	0.012	0.013	0.013	0.009
B29	0.029	0.021	0.019	0.026	0.028	0.009	0.009	0.029	0.013	0.012	0.012	0.021
B30	0.024	0.027	0.014	0.017	0.008	0.017	0.016	0.014	0.027	0.017	0.018	0.022
B31	0.023	0.020	0.025	0.011	0.009	0.013	0.021	0.018	0.016	0.005	0.010	0.013
B32	0.036	0.026	0.017	0.017	0.010	0.014	0.018	0.023	0.006	0.014	0.017	0.009
B33	0.039	0.018	0.019	0.014	0.017	0.010	0.023	0.010	0.013	0.017	0.016	0.014
B34	0.015	0.015	0.020	0.020	0.020	0.011	0.017	0.013	0.024	0.017	0.023	0.012
B35	0.021	0.021	0.011	0.009	0.013	0.015	0.013	0.013	0.025	0.016	0.019	0.008
B36	0.019	0.007	0.012	0.019	0.006	0.016	0.024	0.015	0.022	0.012	0.015	0.007
B37	0.015	0.026	0.016	0.025	0.016	0.019	0.023	0.016	0.014	0.020	0.013	0.014
B38	0.024	0.021	0.013	0.013	0.021	0.021	0.015	0.011	0.011	0.005	0.004	0.015
B39	0.021	0.020	0.015	0.016	0.023	0.018	0.016	0.010	0.016	0.014	0.006	0.009
B40	0.038	0.018	0.018	0.025	0.015	0.010	0.012	0.012	0.012	0.014	0.018	0.012
B41	0.024	0.022	0.029	0.021	0.016	0.017	0.010	0.007	0.012	0.007	0.014	0.012
B42	0.026	0.019	0.016	0.014	0.017	0.016	0.007	0.014	0.012	0.012	0.014	0.012
B43	0.021	0.022	0.018	0.021	0.012	0.013	0.010	0.019	0.012	0.011	0.013	0.012
B44	0.025	0.018	0.010	0.011	0.020	0.010	0.011	0.013	0.012	0.011	0.013	0.012
B45	0.015	0.018	0.010	0.015	0.013	0.015	0.013	0.013	0.012	0.011	0.013	0.012
B46	0.021	0.017	0.021	0.010	0.018	0.013	0.013	0.013	0.012	0.011	0.013	0.012
B47	0.019	0.019	0.004	0.010	0.015	0.013	0.013	0.013	0.011	0.011	0.013	0.012
B48	0.020	0.009	0.018	0.014	0.015	0.013	0.013	0.013	0.011	0.011	0.013	0.011

Table A.1. Registration rates of registration moths for Turkey, 2009-2015 (continued)

	R37	R38	R39	R40	R41	R42	R43	R44	R45	R46	R47	R48
B49	0.024	0.015	0.014	0.014	0.015	0.013	0.012	0.013	0.011	0.011	0.013	0.011
B50	0.016	0.015	0.014	0.014	0.014	0.013	0.012	0.012	0.011	0.010	0.013	0.011
B51	0.015	0.014	0.014	0.014	0.014	0.013	0.012	0.012	0.011	0.010	0.013	0.011
B52	0.014	0.014	0.013	0.013	0.014	0.013	0.012	0.012	0.011	0.010	0.013	0.011
B53	0.014	0.014	0.013	0.013	0.014	0.012	0.012	0.012	0.011	0.010	0.013	0.011
B54	0.013	0.014	0.013	0.013	0.014	0.012	0.012	0.012	0.010	0.010	0.013	0.011
B55	0.012	0.013	0.013	0.013	0.014	0.012	0.012	0.012	0.010	0.010	0.012	0.011
B56	0.012	0.013	0.013	0.013	0.014	0.012	0.011	0.012	0.010	0.010	0.012	0.011
B57	0.011	0.013	0.012	0.013	0.014	0.012	0.011	0.012	0.010	0.009	0.012	0.011
B58	0.011	0.013	0.012	0.012	0.014	0.012	0.011	0.011	0.010	0.009	0.012	0.010
B59	0.011	0.012	0.012	0.012	0.013	0.012	0.011	0.011	0.010	0.009	0.012	0.010
B60	0.010	0.012	0.012	0.012	0.013	0.011	0.011	0.011	0.010	0.009	0.012	0.010
B61	0.010	0.012	0.012	0.012	0.013	0.011	0.011	0.011	0.009	0.009	0.012	0.010
B62	0.009	0.012	0.011	0.012	0.013	0.011	0.011	0.011	0.009	0.009	0.012	0.010
B63	0.009	0.012	0.011	0.012	0.013	0.011	0.011	0.011	0.009	0.009	0.012	0.010
B64	0.008	0.011	0.011	0.012	0.013	0.011	0.010	0.011	0.009	0.009	0.012	0.010
B65	0.008	0.011	0.011	0.011	0.013	0.011	0.010	0.011	0.009	0.008	0.012	0.010
B66	0.007	0.011	0.011	0.011	0.013	0.011	0.010	0.011	0.009	0.008	0.012	0.010
B67	0.007	0.011	0.011	0.011	0.013	0.011	0.010	0.011	0.009	0.008	0.012	0.010
B68	0.007	0.011	0.010	0.011	0.013	0.010	0.010	0.011	0.009	0.008	0.012	0.010
B69	0.006	0.010	0.010	0.011	0.012	0.010	0.010	0.010	0.009	0.008	0.012	0.009
B70	0.006	0.010	0.010	0.011	0.012	0.010	0.010	0.010	0.008	0.008	0.011	0.009
B71	0.005	0.010	0.010	0.011	0.012	0.010	0.010	0.010	0.008	0.008	0.011	0.009
B72	0.005	0.010	0.010	0.011	0.012	0.010	0.010	0.010	0.008	0.008	0.011	0.009
B73	0.005	0.010	0.010	0.010	0.012	0.010	0.009	0.010	0.008	0.008	0.011	0.009
B74	0.004	0.009	0.009	0.010	0.012	0.010	0.009	0.010	0.008	0.008	0.011	0.009
B75	0.004	0.009	0.009	0.010	0.012	0.010	0.009	0.010	0.008	0.007	0.011	0.009
B76	0.003	0.009	0.009	0.010	0.012	0.010	0.009	0.010	0.008	0.007	0.011	0.009
B77	0.003	0.009	0.009	0.010	0.012	0.009	0.009	0.010	0.008	0.007	0.011	0.009
B78	0.003	0.009	0.009	0.010	0.012	0.009	0.009	0.010	0.008	0.007	0.011	0.009
B79	0.002	0.009	0.009	0.010	0.012	0.009	0.009	0.010	0.008	0.007	0.011	0.009
B80	0.002	0.008	0.009	0.010	0.012	0.009	0.009	0.010	0.007	0.007	0.011	0.009
B81	0.002	0.008	0.008	0.009	0.011	0.009	0.009	0.009	0.007	0.007	0.011	0.009
B82	0.001	0.008	0.008	0.009	0.011	0.009	0.009	0.009	0.007	0.007	0.011	0.009
B83	0.001	0.008	0.008	0.009	0.011	0.009	0.009	0.009	0.007	0.007	0.011	0.009
B84	0.001	0.008	0.008	0.009	0.011	0.009	0.008	0.009	0.007	0.007	0.011	0.008
c	-0.02821	-0.01325	-0.01151	-0.00903	-0.00634	-0.00768	-0.00744	-0.00613	-0.00750	-0.00723	-0.00410	-0.00529
b	0.12553	0.06644	0.05893	0.04914	0.03928	0.04287	0.04138	0.03636	0.04030	0.03866	0.02891	0.03191

Table A.1. Registration rates of registration moths for Turkey, 2009-2015 (continued)

	R49	R50	R51	R52	R53	R54	R55	R56	R57	R58	R59	R60
B1	0.038	0.035	0.020	0.025	0.017	0.020	0.017	0.023	0.014	0.009	0.020	0.014
B2	0.066	0.031	0.016	0.014	0.014	0.017	0.024	0.033	0.017	0.028	0.014	0.007
B3	0.051	0.034	0.013	0.014	0.013	0.026	0.029	0.014	0.014	0.016	0.013	0.014
B4	0.048	0.009	0.012	0.016	0.023	0.038	0.012	0.013	0.013	0.017	0.022	0.020
B5	0.042	0.020	0.017	0.022	0.038	0.023	0.014	0.025	0.009	0.008	0.022	0.011
B6	0.019	0.021	0.020	0.037	0.021	0.027	0.014	0.011	0.006	0.013	0.016	0.013
B7	0.019	0.020	0.021	0.011	0.021	0.023	0.013	0.014	0.014	0.008	0.015	0.011
B8	0.031	0.027	0.016	0.017	0.006	0.009	0.006	0.016	0.013	0.009	0.012	0.013
B9	0.047	0.017	0.020	0.020	0.013	0.018	0.018	0.008	0.009	0.020	0.009	0.029
B10	0.034	0.019	0.010	0.021	0.010	0.016	0.010	0.007	0.018	0.010	0.021	0.034
B11	0.035	0.008	0.013	0.013	0.021	0.012	0.013	0.013	0.015	0.025	0.038	0.013
B12	0.023	0.008	0.021	0.011	0.011	0.011	0.018	0.011	0.029	0.024	0.005	0.021
B13	0.038	0.027	0.020	0.020	0.017	0.023	0.016	0.014	0.028	0.011	0.021	0.020
B14	0.030	0.015	0.017	0.008	0.015	0.012	0.017	0.022	0.017	0.008	0.010	0.012
B15	0.026	0.016	0.010	0.012	0.010	0.029	0.025	0.007	0.008	0.005	0.005	0.012
B16	0.014	0.012	0.026	0.016	0.016	0.026	0.009	0.014	0.010	0.012	0.001	0.010
B17	0.018	0.020	0.014	0.011	0.028	0.011	0.011	0.006	0.010	0.008	0.016	0.011
B18	0.023	0.015	0.023	0.011	0.004	0.007	0.011	0.013	0.005	0.007	0.004	0.011
B19	0.014	0.027	0.018	0.004	0.012	0.013	0.009	0.008	0.010	0.008	0.005	0.021
B20	0.013	0.011	0.009	0.007	0.007	0.008	0.011	0.016	0.011	0.007	0.008	0.017
B21	0.037	0.013	0.014	0.010	0.015	0.012	0.006	0.003	0.008	0.014	0.014	0.015
B22	0.025	0.015	0.025	0.011	0.011	0.018	0.018	0.017	0.015	0.017	0.028	0.017
B23	0.022	0.010	0.007	0.019	0.006	0.013	0.010	0.015	0.015	0.015	0.009	0.010
B24	0.016	0.012	0.009	0.012	0.009	0.012	0.008	0.017	0.009	0.016	0.008	0.008
B25	0.020	0.010	0.021	0.012	0.019	0.018	0.018	0.017	0.012	0.017	0.018	0.016
B26	0.021	0.020	0.011	0.014	0.011	0.014	0.014	0.015	0.009	0.009	0.006	0.006
B27	0.020	0.013	0.015	0.012	0.012	0.007	0.015	0.011	0.011	0.015	0.009	0.004
B28	0.026	0.016	0.004	0.012	0.026	0.012	0.012	0.007	0.012	0.012	0.001	0.014
B29	0.016	0.022	0.022	0.013	0.012	0.012	0.003	0.012	0.013	0.015	0.010	0.014
B30	0.007	0.022	0.014	0.018	0.017	0.022	0.008	0.004	0.008	0.012	0.010	0.014
B31	0.021	0.014	0.009	0.020	0.011	0.008	0.010	0.008	0.012	0.012	0.010	0.014
B32	0.023	0.017	0.017	0.008	0.012	0.008	0.014	0.009	0.012	0.012	0.010	0.014
B33	0.017	0.010	0.011	0.011	0.007	0.008	0.011	0.009	0.012	0.012	0.010	0.014
B34	0.021	0.007	0.009	0.003	0.011	0.012	0.010	0.009	0.012	0.012	0.009	0.014
B35	0.012	0.007	0.008	0.007	0.012	0.012	0.010	0.009	0.012	0.012	0.009	0.014
B36	0.021	0.013	0.006	0.011	0.012	0.011	0.010	0.009	0.012	0.012	0.009	0.014
B37	0.016	0.013	0.013	0.010	0.012	0.011	0.010	0.009	0.011	0.012	0.009	0.014
B38	0.017	0.012	0.013	0.010	0.012	0.011	0.010	0.009	0.011	0.012	0.009	0.014
B39	0.016	0.012	0.013	0.010	0.012	0.011	0.010	0.009	0.011	0.012	0.009	0.014
B40	0.015	0.012	0.013	0.010	0.012	0.011	0.010	0.008	0.011	0.012	0.009	0.014
B41	0.015	0.011	0.013	0.010	0.012	0.011	0.010	0.008	0.011	0.012	0.009	0.014
B42	0.015	0.011	0.013	0.010	0.012	0.011	0.010	0.008	0.011	0.012	0.009	0.014
B43	0.015	0.011	0.013	0.010	0.012	0.011	0.010	0.008	0.011	0.012	0.009	0.014
B44	0.014	0.011	0.013	0.010	0.012	0.011	0.010	0.008	0.011	0.012	0.009	0.014
B45	0.014	0.011	0.013	0.010	0.011	0.010	0.010	0.008	0.011	0.012	0.009	0.014
B46	0.014	0.011	0.013	0.010	0.011	0.010	0.009	0.008	0.011	0.012	0.008	0.014
B47	0.014	0.011	0.013	0.010	0.011	0.010	0.009	0.008	0.011	0.012	0.008	0.014
B48	0.014	0.011	0.013	0.010	0.011	0.010	0.009	0.008	0.011	0.011	0.008	0.014

Table A.1. Registration rates of registration moths for Turkey, 2009-2015 (continued)

	R49	R50	R51	R52	R53	R54	R55	R56	R57	R58	R59	R60
B49	0.013	0.011	0.013	0.009	0.011	0.010	0.009	0.008	0.011	0.011	0.008	0.014
B50	0.013	0.010	0.013	0.009	0.011	0.010	0.009	0.007	0.011	0.011	0.008	0.014
B51	0.013	0.010	0.013	0.009	0.011	0.010	0.009	0.007	0.011	0.011	0.008	0.014
B52	0.013	0.010	0.013	0.009	0.011	0.010	0.009	0.007	0.011	0.011	0.008	0.014
B53	0.012	0.010	0.012	0.009	0.011	0.010	0.009	0.007	0.011	0.011	0.008	0.014
B54	0.012	0.010	0.012	0.009	0.011	0.010	0.009	0.007	0.011	0.011	0.008	0.013
B55	0.012	0.010	0.012	0.009	0.011	0.010	0.009	0.007	0.011	0.011	0.008	0.013
B56	0.012	0.010	0.012	0.009	0.011	0.009	0.009	0.007	0.011	0.011	0.008	0.013
B57	0.012	0.010	0.012	0.009	0.011	0.009	0.009	0.007	0.011	0.011	0.008	0.013
B58	0.011	0.010	0.012	0.009	0.011	0.009	0.009	0.007	0.011	0.011	0.008	0.013
B59	0.011	0.010	0.012	0.009	0.011	0.009	0.009	0.007	0.011	0.011	0.008	0.013
B60	0.011	0.009	0.012	0.009	0.011	0.009	0.009	0.007	0.011	0.011	0.008	0.013
B61	0.011	0.009	0.012	0.009	0.011	0.009	0.009	0.007	0.011	0.011	0.007	0.013
B62	0.011	0.009	0.012	0.009	0.011	0.009	0.009	0.007	0.011	0.011	0.007	0.013
B63	0.011	0.009	0.012	0.009	0.011	0.009	0.009	0.007	0.011	0.011	0.007	0.013
B64	0.010	0.009	0.012	0.008	0.011	0.009	0.008	0.006	0.011	0.011	0.007	0.013
B65	0.010	0.009	0.012	0.008	0.010	0.009	0.008	0.006	0.011	0.011	0.007	0.013
B66	0.010	0.009	0.012	0.008	0.010	0.009	0.008	0.006	0.011	0.011	0.007	0.013
B67	0.010	0.009	0.012	0.008	0.010	0.009	0.008	0.006	0.011	0.011	0.007	0.013
B68	0.010	0.009	0.012	0.008	0.010	0.009	0.008	0.006	0.011	0.011	0.007	0.013
B69	0.010	0.009	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B70	0.009	0.009	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B71	0.009	0.009	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B72	0.009	0.009	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B73	0.009	0.008	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B74	0.009	0.008	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B75	0.009	0.008	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B76	0.009	0.008	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B77	0.008	0.008	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B78	0.008	0.008	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B79	0.008	0.008	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B80	0.008	0.008	0.012	0.008	0.010	0.008	0.008	0.006	0.011	0.011	0.007	0.013
B81	0.008	0.008	0.012	0.008	0.010	0.008	0.008	0.005	0.011	0.011	0.007	0.013
B82	0.008	0.008	0.012	0.008	0.010	0.008	0.008	0.005	0.011	0.011	0.007	0.013
B83	0.008	0.008	0.012	0.008	0.010	0.008	0.008	0.005	0.011	0.011	0.006	0.013
B84	0.008	0.008	0.012	0.007	0.010	0.008	0.008	0.005	0.011	0.011	0.006	0.013
c	-0.01074	-0.00527	-0.00186	-0.00365	-0.00265	-0.00461	-0.00314	-0.00419	-0.00115	-0.00116	-0.00337	-0.00061
b	0.05509	0.03104	0.01984	0.02364	0.02154	0.02798	0.02152	0.02386	0.01564	0.01596	0.02137	0.01594

APPENDIX B

Table B.1 Confidence Interval of Unregistered Births

		Estimate	Standard Error	95% Confidence Interval Lower	95% Confidence Interval Upper	Unweighted Count
Population Size	0-30 days	3049	81.070	2889	3208	3307
	31-90 days	100	14.054	72	127	116
	91-180 days	14	3.189	8	21	22
	181-365 days	10	3.734	3	17	12
	More than 1 year	19	5.377	9	30	23
	Missing	8	1.936	4	12	11
	Unregistered	44	7.721	29	59	47
	Total	3245	88.985	3069	3420	3538
% of Total	0-30 days	93.96%	0.50%	92.90%	94.88%	3307
	31-90 days	3.08%	0.41%	2.37%	3.99%	116
	91-180 days	0.45%	0.10%	0.29%	0.68%	22
	181-365 days	0.31%	0.11%	0.15%	0.64%	12
	More than 1 year	0.59%	0.16%	0.35%	1.02%	23
	Missing	0.25%	0.06%	0.15%	0.40%	11
	Unregistered	1.36%	0.23%	0.97%	1.90%	47
	Total	100%	0.00%	100%	100%	3538

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ESTIMATING THE COMPLETENESS OF BIRTH REGISTRATION SYSTEM IN TURKEY: COMPARISON BETWEEN MERNIS AND TURKEY DEMOGRAPHIC AND HEALTH SURVEY

by Faruk Keskin

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