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GRADUATE SCHOOL OF SOCIAL SCIENCES AND HUMANITIES

Essays on Gender Inequality and Child Development

BY

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ABSTRACT

Turkey is an interesting country to study as it is an upper middle income country and is perceived to be a very patriarchal society. Chapter 1 questions if systematic patterns of discrimination against girls exist, it should be reflected in household expenditure patterns. I estimate Engel curves for child goods and adult goods using Household Budget Survey of Turkey. Despite the widespread impression of a patriarchal culture in Turkey, the expenditure patterns of Turkish families show little evidence of discrimination against girls. The pattern of spending on adult goods indicates that girls are favored, in the sense of capturing a larger share of household resources. For child goods, a more mixed pattern of both boy and girl bias is revealed.

Patriarchal nature of the society is also reflected in family size. Families tend to reproduce until the male child is conceived. Hence increased family size may lead to lower per capita allocation of household resources of each child. This in turn, would have direct negative effects on the long term quality indicators such as educational attainment as well as health measures of children. In the light of such dilemma, due to aging population, the government has changed policy incentives to increase family size. Therefore, it is critical to have evidence of quantity-quality tradeoff that the children face. Chapter 2 develops secondary infertility, as an exogenous source of variation in family size. Using the Demographic and Health Survey of Turkey, I investigate the possible tradeoff in education outcomes that the first born child faces. I find a negative and significant relationship between the quantity (family size) and quality (education) of the first born child in rural Turkey. I show that urban households are significantly smaller than rural households. Particularly in single adult households, the child-care needs of younger siblings may lead first born children to be sent to school. In urban Turkey, supervision of mandatory education is easier compared to Rural Turkey. These information supports the results of the positive and significant relation in family size and child educational outcomes that the first born child face in urban Turkey.

Chapter 3 examines the effects of family size on child health outcomes in Turkey. I also study the consequence of having relatively more sisters than brothers. I find that family size has significant negative effects on child health outcomes both in urban and rural Turkey. Furthermore, I also find that in rural Turkey, having more sisters substantially reduces the health status of children. While the impacts are large, the results do not differ significantly by gender, i.e., both boys and girls are affected negatively by having more sisters. Results are more pronounced for poorer households and low educated mothers.

TEZ ÖZETİ

Türkiye, orta-üst gelirli ülke olması yanı sıra ataerkil bir toplum olması itibarı ile çalışılması ilginç bir ülkedir. Birinci bölüm, kız çocuklarına sistematik olarak negatif ayrımcılık mevcut ise, bunun hane halkı harcamalarında yansımalarının olacağını sorgulamaktadır. Bu bölümde, Türkiye'nin Hane Halkı Bütçe Anketleri kullanarak çocuk malları ve yetişkin malları için Engel eğrilerinin tahminleri yapılmıştır. Sonuçlar, yaygın ataerkil kültür anlayışına rağmen, Türk ailelerinin tüketim düzenlerinde kız çocuğuna yönelik ayrımcılığın az olduğunu göstermektedir. Yetişkin mallarındaki tüketim düzeni incelendiğinde hane halkı kaynaklarından tasarruf edilerek bu kaynakların kızların ihtiyaçları için kullanılarak kız çocukların belirgin bir biçimde kayrıldığı, gözlemlenmektedir. Çocuk mallarında yapılan harcamalarda ise hem kız çocuklarının hem de erkek çocuklarının kayrıldığı, dolayısıyla karışık bir düzen olduğu görülmüştür.

Ataerkil toplum yapısı aile büyüklüğünde de etkisini göstermektedir. Aileler, bu tür toplumlarda erkek çocuk doğana kadar doğum yapmaya meyillidirler. Aile ferdi sayısındaki artış, kişi başına düşen hane halkı kaynaklarına erişimin azalmasına sebep olabilir. Uzun dönemde ise bunun çocuklarda eğitim ve sağlık gibi kalite göstergelerinde direkt etkileri görülebilir. Bu etkinin tartışmaları literatürde devam ederken, devlet aile büyüklüğünü arttırmaya yönelik politika teşviklerini değiştirmiştir. Bu bilgiler doğrultusunda, çocukların maruz kaldığı nitel-nicel ödünleşim ile ilgili kanıtların bulunması önemli hale gelmiştir. İkinci bölüm, aile büyüklüğündeki dışsal değişimi ölçümleyen, ikincil kısırlık durumunu enstrüman olarak geliştirmiştir. Türkiye'nin Demografik ve Sağlık Anketleri kullanarak, aile büyüklüğündeki artışın ve ilk doğan çocuğun eğitim durumuna olan etkilerini araştırmaktadır. Kırsal alanda bulunan sonuçlar ilk doğan çocuğun nicel (aile büyüklüğü) ve nitel (eğitim) ilişkisinde negatif ve anlamlı ilgileşim olduğunu göstermektedir. Bu çalışma, kentsel alanda yaşayan aile büyüklüğünün kırsal alanda yaşayan ailelere göre anlamlı ölçüde küçük olduğunu göstermektedir. Dolayısıyla, vakit kısıtı yaşayan anneler, göreceli olarak daha küçük olan çocuklarına vakit ayırabilmek için büyük olan çocuklarını okula göndermektedir. Bunun yanısıra, kentsel alanda zorunlu eğitime olan katılımın takibi de kırsal alanlara göre daha verimli yapılabilmektedir. Bu bilgiler, kentsel alanda ilk doğan çocuğun aile sayısı ve eğitim durumu arasında bulduğum pozitif ve anlamlı sonuçları destekler niteliktedir.

Üçüncü bölüm, aile büyüklüğünün çocukların sağlık durumlarına olan etkilerini incelemektedir. Bu çalışma aynı zamanda aile içerisinde niceliksel olarak kız kardeşlerin sayısının erkek kardeşlerin sayısından fazla olması durumunun etkilerini de incelemektedir. Sonuçlar, kırsal ve kentsel alanlarda aile büyüklüğündeki artışın çocukların sağlık durumlarını anlamlı ölçüde negatif olarak etkilediğini göstermektedir. Bu sonuçlara ek olarak, kırsal alanda aile içinde daha fazla kız kardeşlerin olması, çocukların sağlık durumlarını anlamlı ölçüde negatif olarak etkilediğini göstermektedir. Etkiler büyük olsa bile, sonuçlar cinsiyetler arası farklılıklar göstermemektedir (hem kız çocuklar hem de erkek çocuklar aile içinde daha fazla kız kardeşlerinin olmasından eşit olarak etkilenmektedir). Sonuçlar daha yoksul ve düşük eğitimli annelerin bulunduğu ailelerde daha fazla belirginlik göstermektedir.

To my loving family...

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Contents

List of Figures

List of Tables

ABBREVIATIONS

AIDS	Almost Ideal Demand System
CASS	Chinese Academy of Social Science
CLSS	China Standards of Living Survey
DHS	Demographic and Health Survey
HBS	Household Budget Survey
HIPS	Hacettepe Institute of Population Studies
IHDS	Indian Human Development Survey
IV	Instrumental Variable
MDG	Millennium Development Goals
NCAER	National Council of Applied Economic Research
NSS	National Sample Survey
OECD	Organization for Economic Co-operation and Development
OER	Outlay Equivalent Ratio
OLS	Ordinary Least Squares
SSB	State Statistic Bureau of China
TurkStat	Turkish Statistical Institute
UNDP	United Nations Development Programme
UNFPA	United Nations Population Fund
USAID	U.S. Agency for International Development
WHO	World Health Organization

CHAPTER 1

Are Boys Really Favored in Patriarchal Societies? Evidence From Household Expenditure Patterns, Turkey

Abstract

Gender biases in expenditure patterns have been subject to research over the last two decades, starting with the pioneering work of Deaton and Subramanian (1991). The main argument is that if systematic patterns of discrimination exist, they should be reflected in household expenditure patterns. Early studies focused on low income and lower middle income countries. This literature is motivated by higher child mortality among girls and the "missing girl" phenomena in those countries. However, most studies have failed to find significant evidence in household spending of discrimination against girls. This study differs from previous papers by investigating expenditure patterns in an upper middle income country – Turkey. Turkey is an interesting country as it is perceived to be a very patriarchal society. Household level data obtained from the Turkish Statistical Institute Household Budget Survey for 2003 through 2005 are used to investigate intrahousehold gender discrimination among children in rural and urban Turkey. Following the existing literature, I estimate Engel curves for child goods and adult goods. Despite the widespread impression of a patriarchal culture in Turkey, the expenditure patterns of Turkish families show little evidence of discrimination against girls. The pattern of spending on adult goods indicates that girls are favored, in the sense of capturing a larger share of household resources. For child goods, a more mixed pattern of both boy and girl bias is revealed. The results are shown to be robust to parametric and semi parametric estimation of the Engel curves.

Keywords: Intrahousehold resource allocation, gender bias, Engel curve, Engel approach, Rothbarth approach, outlay equivalent ratios.

JEL Classification: C11, C14, C51, D13, D31

1 Introduction

Turkey, since its foundation as a nation state in 1923, despite its modernization efforts which are characterized by expansion of capitalist relations, industrialization, urbanization, individuation and improvements in civil and human rights, still carries patriarchal characteristics. This controversy is most evident when one realizes the fact that although Turkey was a pioneering country in the world to give right to vote and be elected to women as early as in 1931, there still exists an unequal status between men and women. The unequal treatment of women is mostly observed in the practice of arranged marriages; existence of dowry practices; their rather low labor market participation; and relatively lower educational attainment. It is often claimed that in patriarchal societies, the roots of gender discrimination is sown within the family where male child is favored when it comes to allocation of family resources. In fact, a recent United Nations Development Programme (UNDP) report (2008) on Turkey states under the title “What is worse than nonexistence? Being a nonexistent young woman”attracts our attention to discriminatory practices for adolescents as:

> “The situation of adolescents in Turkey is complicated by gender disparities that still reflect and emphasize frequently the traditional preference of men and boys over women and girls” (p. 60).

However, with the rapid urbanization and the related transformation in the economy as experienced recently in Turkey, one would expect erosion of this gender discrimination among the children over time. Furthermore, in recent years, the Turkish government enhanced its efforts regarding elimination of gender discrimination among children by increasing the number of years compulsory primary school education from five to eight years. This policy by itself reduced the existing 8% gender gap in primary education in 2001, to 4% in 2007; and 17% gender gap in secondary education in 2001 to 8% in 2007. Governmental campaigns promoting girl schooling such as "Come on girls you are going to school" have also contributed to this positive development.

The objective of this study is to investigate intrahousehold gender discrimination among children in rural and urban Turkey by using household expenditures obtained from Turkish Statistical Institute (TurkStat) Household Budget Survey for 2003 through 2005. Following, Deaton and Subramanian (1991) who state that :

> "If systematic patterns of discrimination exist, one should expect them to leave traces in the household consumption pattern" (p. 1)

I resort to Engel Curve method to detect how household expenditure on a particular good changes with household gender composition. As the proceeding literature review will reveal, this study improves upon the existing literature on the following grounds. To my knowledge, this is the only study in Turkey which applies Engel Curve approach to examine the differential treatment by age and sex, concentrating on the intrahousehold distribution of of expenditures. Second, merger of three consecutive Household Budget Surveys for the years 2003, 2004 and 2005 allows me to work with 42,867 observations which is comparably higher than the number of observations used in related studies in the literature. This further enhanced efficiency of the parameter estimates, and hence the precision of the hypothesis tests conducted. Third, the Turkish Household Budget Survey not only allows to examine a broad range of expenditure categories such as: health, education, milk, meat, fruit and vegetable, clothing, toys, books, personal care, jewelery and watch, cultural activities, restaurants and hotels, alcohol and tobacco, but also lets to differentiate between those expenditures pertaining to adults and to children separately for goods such as clothing and footwear which the previous literature failed to identify. Fourth, although the Engel curve method for detecting discrimination among children has been applied to lower middle income countries, upper middle income countries seem to be neglected. This study expands the range of countries for which child discrimination is sought by including Turkey, which is classified among upper middle income class. Last of all, I believe that this study puts considerably more effort on testing the robustness of its results as compared to the previous studies.

The combined effect of traditional values, modernization initiatives and government policies to eradicate the alleged gender discrimination among siblings by the parents make Turkey an interesting laboratory to test the existence of gender discrimination among children. Extensive literature survey revealed that there exist no study which adopts the Engel curve method to the Turkish data. Existing studies on gender discrimination in Turkey have either concentrated on labor markets examining the significance of gender wage gap as in Palaz (2002) and Aktas and Uysal (2012) or the impact of women's labor force participation, especially in unpaid family labor in small holder agriculture on the well being of girl child as in Berik and Bilginsoy (2000). The latter study is particularly important in showing mothers' participation in labor force as an unpaid agricultural family labor increases relative survival chances of girls. This is because more equitable health care and nutrition is provided to girls, "as they come to be seen as valuable in the household" (p. 874).

There are also studies which examine the differences in medicare provision to girls and boys as in Aksit (1989), Cerit and Unalan (1988), none of which suggest significant gender difference. In a similar vein, Hancıoğlu's (1994) work with Turkish Demographic and Health Survey of 1993 on infant child mortality and morbidity is also inconclusive on the existence of gender bias.

Aytaç and Rankin (2003) on the other hand, using a nationally representative sample focus on the impact of modernity and traditionality on junior high school attainment of children in Turkey, concentrating on the factors that may explain gender inequality in education. Using a logistic regression approach to estimate the likelihood of graduating from high school for boys and girls, they find that modernization in fact is a key element in alleviating gender differences among boys and girls in the attainment of education. Their findings indicate that while there exists a persistent gender difference in educational attainment for those adolescents who live in rural areas or less developed regions with less educated parents, with extremely religious fathers as well as for girls with working mothers and with younger siblings. This gender difference in educational attainment seems to have disappeared for those who live in developed regions/metropolitan areas and for those children with more educated fathers and mothers.

The remaining of this study is organized as follows: The next section provides a literature survey on studies testing gender discrimination with the expenditure data through two different approaches. Section 3 explains the data used in the study. Section 4 is reserved for the presentation of the empirical methodology used. Section 5 presents the results. Finally, section 6 concludes.

2 Literature Review

Starting with Deaton's (1987) path breaking study, there has been an increasing interest in exploring the existence of gender bias in intrahousehold allocation of consumption or expenditure. In testing the gender bias hypothesis, the literature followed two methodologically different approaches in estimating an extended version of the the Engel curve which links the demand for a particular good and the demographic composition to total expenditure. The demographic composition is defined as the fraction of household members in various age-gender classes.

Existence of significant number of households incurring zero expenditure on a particular commodity (and hence zero budget share), mostly education, led one strand of literature to follow the hurdle model. In this approach, concentrating only on a particular commodity, education, the household first decides on whether the children in the household consume that commodity at all, a decision making process modeled by probit, and then for those who decide a positive expenditure, decision on how much to spend is modeled by Ordinary Least Squares (OLS). The Engel curve approach on the other hand, uses unconditional OLS (including in the model the zero expenditures for all goods analyzed) with the intention of testing for the total influence of demographics on expenditure including both the effects on zero consumption decision, as well as, the effects on the amount of consumption once the decision on positive consumption is made.

While the studies which used hurdle approach concentrated on only education expenditures in testing the gender bias, the studies that used Engel curve approach have embraced a larger number of commodities for the same purpose. Furthermore, while the hurdle approach fails to distinguish between two categories, adult and child goods, with Engel curve approach using Rothbarth's method (1943), adult goods can also be analyzed separately in order to provide additional and supporting information on the cost of a child within a certain age group and gender classification. In what follows, I provide a brief literature review of these studies which followed two distinct approaches.

2.1 Studies That Use Engel and Rothbarth Approaches

In their pioneering work, Deaton and Subramanian (1991) using the 38th round of the National Sample Survey (NSS) from the Maharashtra state sample conducted in 1983, estimate the Working-Leser specification to test the gender bias on household expenditure patterns. Their data set which consist of 5,500 urban and 5,630 rural households include 10 distinct food expenditure items without allowing one to distinguish between specific adult and child consumption shares as well as education and health expenditures. Their results reveal that, for food items (except for milk) gender differences are mainly between adults rather than children where adult women consume more basic food stuff. In expenditure items, which one can identify as child goods such as education and milk, they found pro male bias for 10-14 year age group for education only in rural areas and 0-4 year age group for milk in urban areas. While the results indicate no evidence of gender difference in medical expenditures in rural areas, in urban areas 5-9 year old male group seem to have been favored. Deaton and Subramanian (1991) also adopt the Rothbarth technique which requires Engel curve estimation over adult goods only, with the objective of computing Outlay Equivalent Ratios (OER) from the regression coefficients obtained, as suggested by Deaton (1989), in order to identify whether a boy is costlier than a girl. Although Indian NSS data is not the best one to identify potential adult goods, Deaton and Subramanian choose pan and tobacco, alcohol, male clothing, female clothing, leather footwear, amusement and personal care as adult goods and compute outlay equivalent ratios. Their subsequent testing procedure reveals that, of the items listed above as adult goods except for alcohol, pan and tobacco are not really adult goods which explain unexpected signs that they found for the outlay equivalent ratios. The only indication of gender discrimination among children is for the 0-4 age group where the girl child is discriminated for tobacco and pan expenditures, which finds its expression as greater consumption cuts for an additional boy at this age group.

Burgess and Zhuang (2000), tried to explore the phenomena of son preference and the consequent problem of excess female mortality in China. Using 1990 Rural Household Sample Survey for two provincial sub samples representing a poor (Sichuan) and relatively better off region (Jiangsu), this study tests whether gender biases tend to erode with modernization employing the methodology proposed by Deaton and Muellbauer (1986); Deaton and Subramanian (1991). Furthermore, by bringing together rural household data with census data for the same provinces, the paper inspects whether gender related biases in the allocation of household resources explain the observed outcomes in the census data which finds its expression as sex ratios, age specific mortality and enrollment rates. Making use of 5,380 households from Sichuan and 3,364 households from Jiangsu, Burgess and Zhuang (2000) adopt the Working-Leser Engel curve specification with seven age sex class each split by gender, concentrate on food, calorie, health (split as health goods and health services) and education (split as education goods and education services) shares as left hand side variables with the belief that differential treatment of boys and girls with regards to these items will have irreversible effects on their welfare which can be captured as an outcome from the 1990 census data. Their results signal no gender bias in children for food expenditures for age categories 0-4, 5-9, and 10-14 in either province. The same results hold for calories as well. As for the education goods, their results suggest pro-male bias in 10-14 age group in Sichuan and in 15-19 age group in Jiangsu. Pro-male bias is also observed on education services for 15-19 age group in both of the provinces but being more pronounced in Sichuan, which is a relatively poorer province, which signals the impact of modernization on alleviating gender differences in consumption patterns. The impact of modernization is even more evident on health goods expenditures where there is a pro-male bias for 0-4 age group in poorer district Sichuan but no gender difference in none of the age groups in a richer district Jiangsu. For health services on the other hand, no gender discrimination is evident in either province. In adopting the Rothbarth framework which relies on the identification of adult goods only, their data set failed to propose any good but alcohol and tobacco. This choice of adult goods which is validated for Jiangsu, was not as clear for Sichuan where test results were more mixed. Within this framework, the study reports mostly negative outlay equivalent ratios for child groups as theoretically expected. Although the magnitude of outlay equivalent ratios are suggestive pro male bias in overall spending in poorer district Sichuan, but not in Jiangsu; the F-test conducted reveal no significant difference in the same age groups. The strength of the study lies in its establishment of the link between biases in health and education spending and the corresponding biases in age specific mortality and enrollment ratios which is obtained from census data. Therefore, authors conclude that, gender biases in spending leads to gender biases in outcomes.

Following the foot steps of Burgess and Zhuang (2000), Lee (2008) re investigates the gender bias hypothesis for China, this time using a household level data set obtained from the China Standards of Living Survey (CLSS) conducted in 1995. Although this study suffers from a small sample size of 576 households, the sample selected allows the study to identify seven adult goods listed as alcoholic beverages; cigarettes; eating out; jewelery; stationary products; entertainment and lottery tickets as opposed to two adult goods identified in the previous study. Furthermore, the test on the nature of the adult goods validate that all goods considered are in fact fulfill the definition of adult goods. However, one important shortcoming of this study is its failure to consider the consumption patterns related to child goods. The results recommends that expenditure on adult goods are insensitive to the number of young children in the household, and furthermore, the test on outlay equivalent ratios refutes the existence of gender bias in rural China.

One other study that looks into the effects of gender on expenditure patterns in rural China is that of Gong, Soest and Zhang (2005). They used Rural Household Income Expenditure Survey of the State Statistic Bureau of China (SSB) and Chinese Academy of Social Science (CASS) conducted in 1995. Although the data collected contains detailed information on income, expenditures, consumption from self production as well as financial assets, labor market status of the household members, for 7,798 households in rural areas of 19 Chinese provinces, authors only focus on nuclear families with households consisting of two parents and one or more children, which reduces the sample size 5,541 households. Following the previous literature, they first estimate the traditional Working-Leser Engel curve specification for alcohol and tobacco, which they chose as the only typical adult good, food and educational goods. The strength of this study lies in its scrutiny of the functional form of parametric specification which led the authors to conduct semi-parametric partial linear estimation of Engel curves in order to check the robustness of their initial results as well as for the decision on the most appropriate specification for the functional forms of the Engel curves.While their tests conclude that the linear Engel curves are not appropriate for food expenditures, in both the parametric and semi parametric estimation of the Engel curves they find little evidence of gender discrimination in food and alcohol expenditures. For the educational expenditures, deviating from the usual convention in the literature, they include in the partial linear model number of boys and girls attending to school rather than the total number of boys and girls in a given age group. This of course makes the estimates conditional on the enrollment decisions. For this category, while they fail to find significant difference in the educational expenditures for the younger age groups, for the older age groups 16-18 and above, their results indicate lower expenditures for girls than boys. Gong, Soest and Zhang (2005) enhancing on other studies in the literature, not only investigated the decision of having more than one child where they clearly showed that the probability of having a second child significantly increases if the first child is a girl, but also test whether parents' decision to send a child to school depend on the sex of the child using both a parametric probit model and a semi parametric model. In all the specifications tried, they conclude that there exist a discrimination against girls where boys are more likely to be sent to school than girls while there is little evidence of bias in the expenditure of the rest of the goods.

2.2 Studies That Use Hurdle Approach

Kingdon (2005) uses Household Survey Data of National Council of Applied Economic Research (NCAER) conducted in 1994 which covered 33,230 households across 16 major states in India. The strength of the data set lies on its education expenditure coverage where educational expenditure is reported for each individual aged 35 or less. An important weakness of the data set on the other hand is that, it did not collect comprehensive information on total household expenditure but only food, health and education expenditure. Therefore, the study which concentrates on detecting gender bias in the intrahousehold household allocation of educational expenditures had to rely on share of educational expenditures in the sum of food, health and educational expenditures rather than total household expenditures. Kingdon (2005) limits the observations to households who have children of school going age (5-19) which yields 25,954 households. In analyzing the gender bias, the study first concentrates on individual level data by thoroughly exploring means of descriptive statistics. The second stage of this study inspects if the incorrect functional form is responsible for failure of the conventional Engel curve approach in detecting gender bias. Lastly, they investigate if the reason behind the failure of the Engel curve approach in detecting gender bias is due to aggregation of data at the household level. From the individual level data, realizing that 31% of the households did not incur education spending, the study asked the question if the households with all-girl children are actually responsible for lower rates of school participation. They found that all-girl households are nearly 19 percentage points more likely to report zero education spending than at least one-boy households and that, this difference is statistically significant. This evidence led them to conclude that there exists a correlation between the gender composition of household child population and the households' decision to incur positive educational spending. The study then concentrates on the households that have positive educational expenditure, using individual level data, they not only show that school enrollment for girls are significantly worse than for boys but also find that per child educational expenditures are lower for girls than boys. Kingdon (2005) then goes on to the estimation of traditional Engel curve method where no significant gender discrimination is detected which led him to further explore why gender biases observed at the individual level are washed out at the household level. Using hurdle model, and hence separating households' decision whether to spend money on child's education and the decision on how much spend conditional upon spending a positive amount on education, this study shows that there is more scope for detecting gender discrimination.

In a more recent study, Ziemmermann (2011) reconsiders gender bias in intrahousehold resource allocation in India with the same considerations as in Kingdon (2005). This study uses the Indian Human Development Survey (IHDS) from 2005 which includes nationally representative 41,554 households from 1503 villages and 971 urban neighborhoods. The data used both individual and household level responses on education, employment, health, and fertility. Since the studies' focus is on gender differences in educational attainment and expenditures, this limits observations to those households with children which leads to a final sample size of 32,263 household. Ziemmermann (2012) also explores the robustness on gender bias results with respect to aggregation level of data as well as the statistical methodology adopted. The study demonstrates the existence of gender discrimination against girls for children aged 5-9 which increases by age, leading to wide spread gender bias once children reach 15-19 age group and that, this result is robust to the aggregation level of data i.e, all-India versus state level data and household versus individual level data. After estimating the traditional Engel curve using unconditional OLS regression as well as probit and conditional OLS specifications at the national level as well as for 16 major Indian states separately, the overall conclusion is that Engel curve does not fail to detect gender bias in the intrahousehold household allocation of resources especially in large samples.

Himaz (2009) using data from a sample of 982 households with 2,578 children conducted by Young Lives in 2006 for Andhra Pradesh in India estimate both the Engel curve and the hurdle model to detect gender bias in educational expenditures. Since the data used includes sub categories of educational expenditures such as school fees, uniform costs, books, transport and extra tuition fees, this allowed for further detailed examination of gender bias. The results from Engel curve estimation demonstrates that there exists a pro-male bias in the age group 10-14. With the hurdle model, the study was able to show that part of this bias is due to households' decision to enroll more boys than girls as well as to spend more on boys once the decision on school enrollment is made. For older age groups, the hurdle model shows that there is a pro-male bias for the school participation decision for the age group of 15-19, however once the participation decision is made, there exists no gender bias in the level of expenditure for boys and girls. This result is is also valid for the quality of education that the boys and girls attain since girls are as likely to be sent to private schools as boys. Examination of subcategories of education expenditures revealed no gender bias except for participation and in extra tuition fees.

3 Data

The data used in this paper is drawn from the 2003, 2004 and 2005 Household Budget Survey (HBS) for Turkey conducted by TurkStat. The Household Budget Survey is a crucial source providing information on socio-economic structure; standards of living; and consumption patterns of households. In addition it is a useful tool that helps the policy makers determine the the needs of the society, and to verify the effectiveness of the socio-economic policies adopted. HBS displays households' consumption patterns, income levels according to their socio-economic groups by classifying them as the residents of urban and rural and provinces, disseminates invaluable information on consumption habits, allocation of resources on various goods and services, socio-economic characteristics of the household, employment status of household members as well as the total income of the household and the source of income.

In terms of geographical coverage HBS classifies all settlements in Turkey in two strata as urban and rural areas. HBS adopts the definition of rural and urban settlements of Ministry of Development and defines urban settlement as residences where the population is 20,001 and more, and rural settlement as residences where the population is 20,000 and less.

2003 HBS is conducted on different 1,512 urban and 648 rural households every month which sums up to 25,920 households for the entire year. 2004 and 2005 surveys interviewed 720 households from each of the urban and rural residences on a monthly basis which totaled to 8,640 households for the entire year. This study which appends 2003, 2004 and 2005 HBSs, uses data on all the reported 42,867 households where 12,619 are classified as rural households and 30,248 as urban households.

Each survey is conducted between 1st of January and 31st of December. HBS collects the data on a national sample of household that resides within Republic of Turkey borders. Households are selected randomly from a frame where the frame provides a list of all households and household members. However, the institutionalized population such as people living in elderly houses, rest homes, prisons, military barracks, hotels and hospitals with special characteristics are excluded from the listing. The sampling frame of the survey is obtained from two sources. The first source is Census of Building that has been conducted by Turkish Statistical Institute in 2000 and data from 2000 Numbering Study Building List-Form 1 which provides information for those residences that have access to municipality services. Second source is the listing of 1997 Census, which provides information on residences were municipality services are not provided (villages). The sampling method used is a stratified two-stage cluster where at first stage, the selection is from a list of clusters of households and in the second stage, households themselves are selected. Clusters, that are obtained from the frame are randomly selected with probability proportional to the population. Once the clusters are chosen, households are selected from the address update listing. In situations where selected household cannot attend the survey, substitution principle takes place. In the presence of non response[1], the survey is not conducted with that specific household.

To reduce the incidence of non-sampling errors, households are required to maintain expenditure diaries on a daily basis over the course of an entire year. These diaries are presented to the head of the household prior to the survey and explained thoroughly how to keep records. The household renews the log book every week through the month. In order to confine the international standards and country conditions, these multifunctional, comprehensive, long term surveys are organized by qualified units for collecting, checking and processing the data.

[1]In cases when the household declines to participate in attend the survey, or not present at home during the survey period, as well when they start the survey but decline to complete it, when they move to another house during the survey period, when they fail to respond due to health problems.

The survey provides three main groups of variables. First, household socio-economic status. Second is the household consumption expenditures. The concept of household expenditure used in this paper is the value of annual consumption of goods and services. Consumption variable consists of purchases of items such as; consumption from self production; consumption during the month from self produced and stocked; individuals that obtain goods and services from their work place; purchase of goods for gift/help purposes. Total household expenditure thus consists of food, alcohol and tobacco, clothing, housing expenditures, health, transportation, communication, cultural activities, education, restaurant, hotel, and services expenditures. Third, the survey also collects information on household members including their number, age, sex, and occupation.[2]

[2]For further detail on the Household Budget Survey see chapter "Definitions and Concepts and Method Applied in Household Budget Survey" from the data booklet of Turkish HBS.

4 Methodology

4.1 Parametric Approach

Demand analysis in cross-section studies is crucial in explaining behavioral differences in intrahousehold allocation of resources. Behavioral differences are driven by household characteristics which are constituted of demographic composition of the family and the total expenditure. The most common method that links the demand for a particular good q_i, to total expenditure x is called Engel curve and it takes the form;

$$q_i = g_i(x) \tag{1}$$

where equation (1) suppresses the household demographic composition and prices are absorbed in the functional form. Since cross section analysis assume that there is no price variation (i.e., prices that households face are identical), the homogeneity property of demand functions does not hold, whereas adding-up requirement still remains significant. Therefore, equation (1) can be multiplied by p_i to obtain the expenditure for the i^{th} good, $p_i q_i$, as a function of total expenditure x, which is referred as Engel curve.

Various functional forms has been tried for the Engel curve specification such as double logarithmic, semi logarithmic ($q_i = \alpha_i + \beta_i logx$), log reciprocal ($log\ q_i = \alpha_i - \beta_1 x^{-1}$) as proposed by Prais and Houthakker (1955), as well as more complex forms as the cumulative distribution function of the log normal distribution. However, these functional forms failed to satisfy the adding-up criteria which questioned the theoretical plausabilities of these models. The first functional form that is in conformity with the underlying utility function was proposed by Working (1943) and used by Leser (1963) which established a linear relationship between the share of the budget devoted to each good w_i and the logarithm of total expenditure,

$$w_i = \alpha_i + \beta_i \log x \tag{2}$$

where α_i and β_i are parameters to be estimated. Adding up requirement is satisfied when $\sum \alpha_i = 1$, and $\sum \beta_i = 0$ which leads to sum of budget shares being unity i.e., $\sum w_i = 1$. Hence, if equation (2) is estimated for each of the expenditure items by OLS, the parameter estimates will satisfy the adding up requirement automatically. This model is also nested in the Almost Ideal Demand System (AIDS) developed by Deaton and Muellbauer (1980) as well as in the Indirect Translog Model of Jorgenson (1980).

Since Turkish Household Budget Survey does not collect information on individual consumption levels within the household, one can indirectly trace systematic gender based allocations within the gender composition of the family and its aggregate consumption patterns. Therefore, the Working Leser Engel form is extended to include household demographic composition where the demographic variables are decomposed in to different age classes (n_k) which are further separated by gender (γ_{ik}) in order to detect how the children of same ages but of opposite sexes affect intrahousehold allocation of resources:

$$w_i = \alpha_i + \beta_i \ln(x/n) + \eta_i \ln\, n + \sum_{k=1}^{K-1} \gamma_{ik}(n_k/n) + \tau_i z + u_i. \tag{3}$$

In this specification, w_i is the budget share of good i, x is total expenditure, n is household size, n_j is the number of people in the age-sex class j where there are K such demographic categories in total, and u_i is the error term for the i^{th} good. The dummy variable z is added to capture the general time effects since three consecutive year cross-section data are merged for the estimation of the model.

In Working's Engel curve specification, β_i show whether the goods are luxury, for those goods which take a larger share in the budget as total expenditure increases, necessity, those that are taking a smaller share in the budget as the household gets better off, and inferior, which is designated by a decrease in demand (absolutely) as the expenditure or the income of the household increases. For those goods that are luxury, $\beta_i > 0$ which implies the total expenditure elasticity being greater than unity, and necessity when $\beta_i < 0$ implying a total expenditure elasticity less than unity.[3] The K demographic categories adopted in this study categorize the demographic variables of the households by age and sex.

In estimating (3), the selected 12 demographic categories partition six age categories 0-4, 5-9, 10-14, 15-25, 26-54, 55 and above with respect to gender as males and females. Of the K selected categories only $K-1$, i.e., 11 ratios, n_k/n, are formed to be included in the regression where the male aged 26-54 category is the omitted variable. The coefficient γ_{ik} shows the marginal effect of increasing n_k/n by replacing men aged 26-54 by a person of type k on the budget share while holding everything else constant. The sign and the magnitude of the coefficient γ_{ik} also shows commodity i^{th}'s relevance to a particular age and gender category i.e., for the adult males one should expect the γ_{ik} coefficient for alcohol and tobacco to be significantly positive. In this study, both the demographic variables and household size are treated exogenous variables. One possible explanation for this is that unobserved factors that effect fertility may be correlated with unobserved factors that determine consumption preferences. However, it is impossible to include these unobserved factors with the cross-section data.

[3] Note that, household size, n, is included in addition to the total expenditure so that household scale (η_i) has a detached effect from total expenditure on the demand of good i.

To test the gender bias, a series of F-tests are employed with the null hypothesis being the equality of coefficients by gender, $\gamma_{ij} = \gamma_{ik}$ where j and k reflects boys and girls in the same age category. When the null hypothesis is rejected i.e., that there exist a gender bias, the parameter estimates of the original model is referred to in order to detect the direction of bias. In this regard, this study employs six F-tests, where five of them compute one degree of freedom tests concerning each age category separately, while the last test is a four degree of freedom test for the hypothesis that there are no gender differences among all children (those aged under 14).

4.2 Engel Approach

One of the most straightforward and widely used method in identifying equivalence scales is defined by Engel (1857) where the identifying assumption is based on the premise that households with same budget shares devoted to food but varying demographic composition are equally well off. Hence, by comparing coefficients of demographic variables, one can compute the cost of a children for the household. This study extends this terminology by exploring how the household demand is influenced with household demographic/gender composition. Pro-male bias is evident as families devoting significantly more budget share of that particular good for the son of the family compared to the daughter i.e, $\gamma_{ij} > \gamma_{ik}$ where j and k reflect boys and girls in the same age class respectively.

The first group of goods were chosen such that differential allocation of these goods within the family may have irreversible effects for the future of the child. While selecting these goods, only the goods that are or may be consumed exclusively by children are considered and these are named as child goods. Hence, child goods include books, toys games and hobbies, child footwear, child clothing, fruit and vegetable, meat, education, and health. The data set employed is rich enough to disaggregate the adult category 15-54 into 15-25 and 26-54 in order to capture the gender bias in human investment in terms of higher education. In fact, this is an important source of information for a middle income country, a point disregarded in previous empirical applications.

4.3 Rothbarth Approach

The second approach is based on the extension of Rothbarth method (1943) for measuring the cost of a child. According to this method, expenditures on adult goods is an indicator of welfare of parents. Hence, if additional child into the family reduces the consumption of adult goods (negative income effect), this will naturally lead to a welfare loss for the parents.

This method can only be employed if one can define a set of goods that are consumed exclusively by adults, and that children have only income effects (no substitution effects). Deaton (1989) extended this methodology and formulated a test on the gender hypothesis using household expenditure. As mentioned above, since budget shares add up to unity, a reduction in the budget for a good, for example adult good, will be offset by increased budget share devoted to another good such as child good. Therefore, adults by decreasing their own consumption goods, will channel their resources for the needs of their children. Hence, gender discrimination favoring boys will be apparent if these negative income effects are significantly greater for boys (being more negative) than for girls in the same age category, which implies that parents make more room in the family budget for boys compared to girls.

The procedure starts with the extension of the Working's Engel curve specification. The estimation now is only limited to a set of adult goods which are identified as: alcohol and tobacco, restaurant and hotel, cultural activity, women footwear, men footwear, women clothing, men clothing, women personal care, jewelry and watch expenditures. Then, outlay equivalent ratio (OER) is defined as;

$$\pi_{ij} = \frac{\partial q_i/\partial n_j}{\partial q_i/\partial x} \div \frac{x}{n} \tag{4}$$

where i refers the adult good and j is the demographic category. The ratio, π_{ij}, expresses the effect of an additional person in the j^{th} demographic category on consumption on adult good i in terms of the increase in total expenditure which produces the same change in expenditure on that commodity, written as a function of per capita expenditure (Burgess et.al, 2000, 7). In other words, given the estimation results, OER calculates the equivalent reduction in the income when a child of a certain age and gender group is introduced to the family. Once the regression equation (3) is estimated by OLS, π_{ij} ratios are calculated using coefficient estimates for η_i, β_i and γ_i as:

$$\pi_{ij} = \frac{(\eta_i - \beta_i) - \gamma_{ij} - \sum_{k=1}^{K-1} \gamma_{ik}(n_k/n)}{w_i + \beta_i} \tag{5}$$

where the γ_{ik} for the male 26-54 demographic category is zero. Estimates of the confidence intervals of each π_{ij} ratios are obtained by bootstrapping the sample 99 times. Instead of calculating OER for each household, the OERs are computed at the mean values of the data i.e., means of (n_k/n) and w_i.

If adult goods are identified correctly, I would expect the OER's to be significantly negative for the children indicating that presence of a child depress the spending of the adults. For adult category on the other hand, I would expect the ratios to be large and positive. OERs also reflect the direction of bias such as discrimination against girls would be expressed as π_{ij} being significantly more negative compared to π_{ik} for adult good i, where j and k reflects the boys and the girls in the same age category.

The intuition of equation 5 is presented in Figure 1. Since the identified adult goods are normal goods, the Engel curves are upward sloping. The effect of an additional child on the share of an adult good is known from the estimated γ coefficients which corresponds to B in the figure. The slope of the Engel curves are also obtained from the estimated β coefficients, which corresponds to $\triangle$ in the figure. Therefore, making use of the slope (rise over run) the equivalent reduction in per capita income can be calculated, A.

As mentioned earlier, the method relies on two premises; first, if goods that are defined are indeed adult goods and second, if children cause no substitution effects on the consumption of these goods. If these two requirements are satisfied, the OERs will be equal for all adult goods. Deaton (1989) proposed a test of an additional implication of the same assumptions. The testing procedure starts with estimating

$$p_i q_i = b_{0i} + b_1 X_G + c_{ij} n_j + d_i Z + v_i \tag{6}$$

where expenditure on each individual adult good is regressed on total expenditure of adult goods X_G, the same set of demographic categories n_j, and on the array of control variables, Z. The method relies on the premise that children can affect spending on adult goods through only the total expenditure (an income effect). Therefore, after controlling the total expenditure on adult goods, children will have no effect on expenditure of individual adult goods (there are no substitution effects). Therefore, the test to verify the nature of the adult goods is simply a joint significance test of the children category. One issue of this method is the bias that results from regressing expenditure on individual adult goods to total expenditure of adult goods which is caused by the measurement error in these two variables. To overcome this problem, total food expenditure is used as an instrumental variable for total expenditure on adult goods.

4.4 Semiparametric Approach

The linear specification of Working (1943) and Leser (1963) has been widely used for the Engel curve due to the convenient features satisfying the requirements of utility functions, in particular, adding up. However, recent studies have argued that linear specification for Engel curve may not be convenient for some commodities, (see for relevant examples, Banks et. al, 1997, Blundell et. al,1999, Lewbel et. al, 1991). Banks et. al, (1997) for example, showed that for the U.K data, linearity of the Engel curves for the food category are not rejected, however for other goods such as alcohol and clothing expenditures, nonparametric analysis of Engel curves required the inclusion of quadratic terms of the logarithm of the total expenditure in the model.

Nonparametric approach that has been used to observe the behavior of the functional form has the advantage of preventing model misspecification since it does not force any functional form specification on the model. However, the infeasibility of this approach comes with curse of dimensionality caused by large number of control variables (including demographic categories) but limited observations. Gong et. al, (2005) explains this problem as "Fully nonparametric estimator then suffer from the curse of dimensionality: due to the slow rate of convergence of the estimator, the estimates will not be accurate in finite samples" (p. 517). Since this study aims to investigate the gender bias in intrahousehold allocation of resources, the right hand side variables include detailed information of male and female categories in various age categories. Hence, with the sample of 42,867 observations, the dimension of the explanatory variables get sufficiently large leading to infeasibility of the nonparametric estimation technique.

To avoid the curse of dimensionality, this study used a semiparametric partial linear model where the plausibility of the model comes with the flexible functional form in the relationship between logarithm of per capita expenditure, $\ln(x/n)$, and budget share of the i^{th} good, w_i. The extended partial linear model that encompasses Working's (1943) Engel curve specification takes the form:

$$w = \beta' z + f(x/n) + \varepsilon \tag{7}$$

where the family demographic composition variables γ, household size n and the time dummies τ enter through the parametric part $\beta' z$. Therefore, the F-test for gender differences in intrahousehold resource allocation concerns the β vector. The nonparametric component of the model is $f()$, which is an unknown function and since it is consisted of only one variable, the curse of dimensionality is resolved.

This partial linear regression model for the Engel curve specification is estimated using Yatchew's (2003) differencing method. According to this method, the regression effect is removed with the premise that x's that are close will have corresponding values of the regression function that are close. Therefore, before the estimation, the data is reordered so that the nonparametric variable, per capita total expenditure, is in an increasing order. Hence, first differencing equation (7) will remove the nonparametric component $f()$:

$$w_i - w_{i-1} \cong \beta'(z_i - z_{i-1}) + (\varepsilon_i - \varepsilon_{i-1}). \tag{8}$$

Since the differencing method removes the nonparametric component of the model, the inferences on β as well as the F-tests to explore gender differences is computed as if there were no nonparametric variable $f()$ in the model in the first place. The differencing technique is used both for the Engel Approach for child goods as well as for the Rothbarth approach for adult goods. The same F-tests that are used for parametric models are conducted over the first differenced demographic categories to check the robustness of the results.

After estimating the β coefficients from equation (8), the study uses semi-parametric estimation technique to make inferences on $f()$ as if β were known:

$$w_i - z_i\hat{\beta}_{diff} = z_i(\beta - \hat{\beta}_{diff}) + f(x_i/n) + \varepsilon_i \cong f(x_i/n) + \varepsilon_i. \tag{9}$$

This step of the estimation concerning the component $f()$ is crucial for the calculation of OERs since under the semiparametric identification of the model, the OER takes the form of:

$$\pi_{ij} = \frac{\partial q_i/\partial n_j}{\partial q_i/\partial x} \div \frac{x}{n} = \frac{\eta_i - f'(\frac{x}{n})\frac{x}{n} + \gamma_{ij} - \sum_{k=1}^{K-1}(\frac{n_k}{n})}{w_i + f'(\frac{x}{n})\frac{x}{n}} \tag{10}$$

Therefore, $f'(x/n)$ which is in equation (10) is estimated from (9) by locally linear least square estimation technique. Hence, the consistency and the optimal rate of convergence properties will hold because $\hat{\beta}_{diff}$ will converge sufficiently quickly to β that the approximation in the last part of equation (9) will leave the asymptotic arguments unaffected (Yatchew 2003, 8).

5 Results

5.1 Engel Approach

Tables 1 and 2 list the summary statistics for the variables that are used in the regression analysis for both rural and urban provinces of Turkey respectively. Both tables include eighteen budget shares, as well as the explanatory variables included in each of the regression analysis. In this section, the first nine goods that are considered as child goods will be tested for gender differences in the intrahousehold resource allocation while the remaining goods will be discussed in section 5.0.2.

For the rural area statistics, fruit and vegetables constitute the key elements in the budget share, accounting 11% of the total expenditures. Expenditures on meat have the second highest share comprising 5% of the budget. Books and toys games and hobbies on the other hand, are those child goods with the lowest share in households' budget, accounting for 0.09% and 0.04% of the total expenditures respectively. Expenditure patterns for the child goods are similar across the urban and rural provinces except for the book expenditures. While the book expenditures share is 0.18% of the budget in urban provinces, this expenditure item comprises the lowest portion of the budget (0.09%) in rural areas. As in rural, urban provinces also spend most of their resources on fruit and vegetable that accounts 7% of the budget, followed by expenditures on meat with a share of 4%, while toys, games and hobbies with 0.08% share in total expenditures receive the least share.

Although 64% of the rural households and 77% of the urban households record purchases on milk, meat and on fruit and vegetables, only 6%, 6%, 12% and 24% of households record purchases on education, books, child footwear and child clothing respectively in the rural provinces. The positive response rates for those expenditure items are 14%, 12%, 12% and 29% respectively for the urban provinces. Although substantial fraction of households do not consume these goods, this study still concentrates on these expenditure items since these are the key items where the discrimination against girls is strongly expected. Contradictory to the rather minimal response rates, i.e., positive expenditures, observed in other studies, health expenditures in Turkey, with 41% rural and 45% urban households recording positive expenditures, constitute the second highest positive response rate after the basic food commodities.

The results from estimates of equation (3) for nine child goods are presented in Table 3 and Table 4 for rural and urban provinces respectively. Among these nine goods, for both the rural and urban households, only milk and fruit and vegetables have been identified as necessities, with respective negative β coefficients. The respective β coefficients for the necessity good milk are -0.08 in rural and -0.04 in urban provinces and the corresponding β estimates for fruit and vegetables are -0.038 in rural and -0.030 in urban provinces. For the remaining goods, the positive β coefficients are indicative of luxuries for both the rural and urban households. The demographic coefficients γ_{ik} are also important since the sign and the magnitude of this coefficient shows commodity i^{th}'s relevance to a particular age and gender category. In this respect, one should note that for goods such as: toys, games and hobbies; child footwear; and child clothing, positive and significant γ coefficients tend to rise until the age of 14 for both sexes, indicating an increased demand (except for toys games and hobbies) until this age. The rather insignificant and/or close to zero γ coefficients for such goods after the age category 10-14 confirm that these are in fact child goods.

The gender bias in intrahousehold resource allocation for rural and urban household are tested through a series of F-tests reported at the bottom panel of

Table 3 and Table 4 respectively. The first four rows (under Table3 and Table 4) tests the equality of male and female coefficients for five age ranges; 0-4, 5-9, 10-14, 15-25 while the fifth row tests the joint significance of children demographic variables with the null hypothesis that there are no difference among children (those aged under 14). For the rural provinces, significant F-statistics together with the the direction of the γ coefficients reveal that young girls are favored in book expenditures. Coefficient estimates for 0-4 demographic category for book expenditures are 0.002 for girls and zero for boys indicate that families spend more on books when a young girl comes to the family compared to a boy of the same age. The positive and relatively larger γ coefficient for health expenditures, 0.003 for girls of age category 15-25 once compared with -0.007 for boys at the same age group, indicates that girls are favored in terms of health expenditures.[4] On the other hand the significant F-tests shows that, families devote more of their resources to boys for expenditure items toys, games and hobbies (coefficient for males 0.002 and 0.001 for females); child clothing (coefficient for males 0.0039 and 0.0029 for females) both at the age category 5-9, as well as on meat (0.010 for males and -0.005 for females) and health expenditures (0 for males and -0.014 for females) for the ages between 10-14. Although more pronounced gender biases are expected to be found for the remaining goods, in spite of larger point estimates of the demographic coefficients, the F-statistics do not indicate any significant gender difference. For instance, although coefficient for milk expenditure for 0-4 age category are relatively larger for boys 0.011 compared to girls 0.009, test statistics reveal that there is no suggestion that milk is provided more generously to boys at these age categories. The same conclusion holds for education expenditures, while one would expect strongest gender differences in the consumption of this good. Although, the coefficient

[4] This is because, the share of this expenditure type increases when a girl of this age group is introduced to the family and decreases for a boy of the same age category.

estimates show that girls of 5-9 age category have a greater positive effect on the increased share of education expenditure (0.005 for girls and 0.001 for boys), test statistics reveal that there is no significant gender difference in education expenditures. The last F-test reveal that for all child goods, except for meat expenditures, there is significant gender difference among children of different age groups. This can be interpreted as children of different ages and gender have different needs which are reflected on the demand patterns of these goods.

For the urban provinces, the results indicate existence of gender bias for goods such as: child footwear; fruit and vegetables; toys, games and hobbies; and health. However, for some commodities such as books; child clothing; and meat the gender bias detected in the rural areas, seem to have disappeared in the urban provinces. According to the significant F-statistics and γ coefficients, more is spent on fruit and vegetables, and health expenditures for females aged 15-25 as compared to males of the same age group. These are reflected in the γ coefficients as -0.004 for females and -0.009 for males in the consumption of fruit and vegetable and 0.007 for females and -0.004 for males in the health expenditures. On the other hand, results indicate that, there exists a gender bias in favor of boys in such expenditure items as: toys games and hobbies for both the age groups 0-4 and 5-9; and child footwear for the age category 10-14.

The overall results that are summarized in Table 5 indicate that for both the rural and urban provinces, there is no strong pattern in the direction of the bias. These results are striking since the pioneering works that used Engel method failed to show any significant gender difference on the whole, even in countries where outcome data such as sex ratios, mortality rates were strongly suggesting gender bias. On the other hand, the results obtained in this study reveals statistically significant gender differences in the consumption of many child goods. This may be in fact a result of a larger sample size that is used as well as the quality of the data set as mentioned earlier.[5]

5.2 Rothbarth Approach

Table 1 and Table 2 also record the summary statistics for the adult goods in urban and rural provinces respectively. Not surprisingly, in both the regions the largest share of the budget is devoted to alcohol and tobacco expenditure with a budget share of 5.3% and 4.6% for rural and urban areas. This expenditure item is also the one where 60% of households reported positive expenditure shares. Restaurants and hotel expenditures ranked second in terms of its share in households' budget comprising 2.7% of the budget in rural areas, and doubling to 4.1% in urban provinces, which can be considered as an indicator of modernity. On the other hand, men footwear and men clothing take relatively higher budget shares 0.6% and 1.3% relatively to women foot wear and women clothing 0.4% and 1.5%, an outcome which one expects to observe in patriarchal societies. Demand patterns for all the goods are again consistent in both the rural and urban provinces. Expenditure item, women personal care is ranked first among the commodities that are frequently purchased with, on the average, 82% of the households reporting positive expenditure shares. On the other hand, due to infrequent purchase of jewelry and watches, this item comprise the lowest budget share 0.03% and the lowest reported positive expenditures share of 8% on the average.

Table 6 and Table 7 report the estimation results for nine potential adult goods consumed both in rural and urban provinces respectively. Outlay equivalent ratios (OER) that are calculated from these parameter estimates, and

[5] See Deaton, (1989) for Thailand and Cote D'Ivoire, Ahmad and Morduch (1993) for Bangladesh, Subramanian and Deaton 1991 for India, Rudd (1993) for Taiwan, and Deaton (1997) for Pakistan, Gong et. al, (2005) for China.

asymptotic standard errors that are obtained through bootstrapping method, are listed in Table 8 and 9 for rural and urban provinces respectively. While the majority of the OER (π_{ij}) ratios are negative for children, for some demographic categories they are not. In particular, for the rural provinces the demographic category of 10-14 showed positive effects in consumption of women footwear, men footwear, men clothing and women clothing. However, one should note that the positive OERs occur when the demographic category is genderly related to the consumption of that particular good. For instance the OER ratio for girls in the consumption of women footwear is positive while for the same age category it is negative for boys. Therefore, these unexpected signs may be due to children of older ages consuming adult goods. Positive OERs on the restaurant and hotels and cultural activities also indicate that there seems no reason to suppose that children do not get access to these goods. Positive values of OER for 0-4 and 5-9 age categories in alcohol and tobacco consumption on the other hand, may suggest two possibilities: either some boys and girls begin to drink wine early in life, or families with young boys and girls drink more wine (Lee 2008, 91). In contrast to the negative π_{ij} ratios for children, one should expect these ratios to be positive for adult demographic categories, at least for some of the adult goods. Except for the expenditure on cultural activities, adult males do indeed show positive OER for alcohol and tobacco, restaurant and hotels, men footwear, men clothing, jewelry and watches categories. One should also note the strong relevance of alcohol and tobacco, and restaurant and hotels expenditures to adult male categories with significant and relatively large effects compared to adult females (who induce consistently negative effect on the consumption of these goods). Adult females on the other hand have the expected positive signs for the OERs except for women personal care expenditures.

The formal tests suggested by Deaton (1989) also verified that unexpected signs for some OERs due the fact that some goods that are considered as adult goods were in fact not adult goods. These tests results that check for the validity of potential adult goods are reported in Table 10. For rural provinces the test reveals that four out of nine adult goods are indeed adult goods while for urban provinces, only two category of adult good is verified. Accordingly, adult goods for rural provinces are constituted of alcohol and tobacco; restaurants and hotels; and cultural activities; jewelry and watches and for urban households the verified adult goods are alcohol and tobacco; jewelry and watch expenditures. This is perhaps an advancement compared to the previous literature since their findings were limited only to one category.[6] The signs of the OER's for rural provinces are as expected for those expenditure items that are validated as adult goods. For the urban provinces on the other hand, the wrong sign of the OERs still remains where boys and girls aged 0-4 and girls aged 5-9 have large and significant effect on the consumption of alcohol and tobacco and on jewelry and watch expenditures. Lee (2008) attribute these incorrect signs of OERs in children groups to sampling variations.

To make these income effects more interpretable, I conduct F-tests that are reported in the bottom panel of Table 6 and Table 7. The test results reveal that, in rural provinces the presence of 15-25 demographic category exert negative effects on the alcohol and tobacco, restaurants and hotels and in cultural activities consumption. In regression (3), the γ coefficients from the budget share devoted alcohol and tobacco are -0.106 for females and -0.035 for males in the 15-25 age category. For the same demographic category, the coefficients from restaurants and hotels are -0.051 for females and -0.022 for males. Hence, these results suggest that, for the 15-25 demographic category, adults reduce

[6] Deaton et. al, (1989) for Thailand could not verify the validity of adult goods. Deaton et. al, (1991) verified only tobacco as an adult good for India. Burguess (2000) validated alcohol, tobacco and tea as valid adult goods and Gong et. al, (2005) could only define one category of adult good, alcohol and tobacco.

their consumption of alcohol and tobacco as well as restaurants and hotels and divert more resources to the females compared to males i.e., females in this age category are favored. In addition, budget share devoted to restaurants and hotels, show significant F-statistics for the 5-9 demographic category. According to the parameter estimates, the female coefficient of this demographic category is -0.039 while for the male is -0.051 indicating that for this age group, families reduce more of their restaurant and hotel expenditures in order to channel their resources for the needs of the male rather than the female. The last F-statistics show significant values for restaurants and hotels, and cultural activities categories respectively, indicating for all adult goods, except for alcohol and tobacco expenditures, there is significant gender effects among children.

Significant F-statistics indicate that for urban households, there exists a strong female bias for 15-25 age category in the alcohol and tobacco expenditure. The female demographic coefficient γ of this age group is -0.058 while the male the coefficient is -0.025 indicating that urban households also cut more of their adult expenditure for girls to accommodate their needs compared to boys of the same age.

Summary results showing the direction of the gender biases are presented in Table 11. The overall picture suggests that there is a strong pattern in the 15-25 female demographic category revealing that females of this age group are favored in the family. In other words, teenage girls are costlier for their parents. These results in fact are striking since the previous evidence that used Rothbarth method to detect gender bias in China, Pakistan, India, Taiwan, Bangladesh, Cote d'Ivoire and Thailand have failed to find significant gender difference although the outcome data were highly suggestive of son preference.[7]

[7] See Burgess (2000), Lee (2008) and Gong et. al, (2005) for China, Deaton (1997) for the review of results.

5.3 Robustness Analysis with Semiparametric Methods

The robustness of the results are validated with semiparametric analysis. Table 12 and Table 13 reports the estimated coefficients and F-statistics obtained by differencing method for Engel Approach and Table 14 and Table 15 reports the results on Rothbarth Approach for both rural and urban provinces of Turkey. These results indicate the direction of the biases remain consistent with the parametric analysis.

For the Engel Approach, in addition to the same results with regards to the direction of the gender biases with parametric estimation, the semiparametric estimation showed some additional significant gender differences. Although the significant gender differences in child clothing and health category disappeared in semiparametric analysis, additional gender differences are found in areas of milk, meat expenditures in rural provinces. The F-tests and the relevant coefficient estimates indicate that for 15-25 demographic category, milk is provided more generously for females whereas in the 5-9 and 10-14 category, families spend more on meat for boys rural provinces. For urban, the results obtained from parametric and semiparametric estimations are also inline. Additional gender biases are detected in toys, games and hobbies, and child foot wear categories. The coefficient estimates of the 15-25 demographic category showed that toys, games and hobbies are provided more generously for females while families spend more for boys aged 10-14 on child foot wear.

The OERs for semiparametric estimation are presented in Table 16 and the coefficient estimates for the Rortbarth method are reported in Table 14 and 15 for rural and urban provinces respectively. For rural households, although the significant gender difference that are found in restaurant and hotel expenditures have disappeared, the rest of the results are are consistent with the parametric analysis. For urban, the results are also inline with the parametric estimation of alcohol and tobacco expenditure share. Therefore one can conclude that,the results of both the Engel and Rothbarth methods are not sensitive to the choice of the Working Leser form.

6 Conclusion

This study analyzed intrahousehold gender bias in consumption patterns for rural and urban provinces of Turkey using TurkStat's Household Budget Survey for the years 2003, 2004 and 2005. The study was based on extended version of the Working-Leser Engel curve. In estimating this curve the two different approaches that have been adopted are the Engel approach that uses child goods and, the Rothbarth approach that uses adult goods. The reason for using two different approaches is due to the premise that budget shares of all the goods add up to unity. Therefore, when the budget share of a particular good increases, economies are made elsewhere in the budget, leading to decreased budget share of another good. For instance, if families spend more on educational expenditures, then the adult consumption on alcohol and tobacco will decrease in order to divert the resources for the needs of the children. Hence, gender bias in intrahousehold resource allocation will be evident if more resource is spend or devoted more on a particular gender of a certain demographic category. The study also compared parametric and semiparametric estimates of Engel curves to test the robustness of the conclusions reached in the parametric estimation of both the Engel and the Rothbarth approaches.

The results based on Engel approach are indicative of significant gender bias. However the pattern of the gender bias indicates that there is no clear pattern. In rural settings, girl bias is evident on book and health expenditures. On the other hand, the existence of boy bias is evident in expenditure items such as toys games and hobbies; child clothing; meat; and health. In urban provinces on the other hand, girl bias is evident in health and fruit and vegetable categories. Boy bias still remains in similar goods; toys, games and hobbies and child footwear.

In the Rothbarth approach, the set of selected potential adult goods are estimated. From the estimated coefficients OERs are calculated which show equivalent reduction in the size of the income when a child of a certain demographic and gender category is introduced into the family. In theory, one should expect an additional child in the family to depress the adult consumption leading to negative OER and vice verse for an additional adult. However, unexpected signs for some of the OER's questioned the validity of the selected adult goods. The verification test on the adult goods revealed that only alcohol and tobacco; restaurants and hotels; cultural activities; jewelry and watch for rural and alcohol and tobacco; and jewelry and watch expenditures for urban are in fact adult goods. Hence, verified OERs showed expected signs. F-statistics for testing gender bias among all the demographic categories revealed strong evidence that families favor teenage girls. This result is evident in substantial savings in some adult expenditures where families reduce more of their alcohol and tobacco, restaurant and hotel, and cultural activities consumption to devote more resources for girls aged 15-25 in rural provinces. For the urban areas, the results also support girl bias in alcohol and tobacco expenditures for the 15-25 demographic category.

Semiparametric analysis are robust to the results of the parametric approach. In addition to the previous findings, semiparametric analysis revealed couple of more expenditure items where gender differentials are significantly observed. For the Engel approach, The F-tests and the relevant coefficient estimates indicate that, milk is provided more generously for females whereas, families spend more on meat for boys in rural provinces. For the urban areas, the results obtained from the parametric and semiparametric estimations are also in conformity. Additional gender biases are detected in toys, games and hobbies, and child foot wear categories. Semiparametric analysis for the Rothbarth method showed that, the results are also consistent with the parametric analysis.

Despite of the wide impression of a patriarchal culture in Turkey, the results obtained in this study are striking. While in the Engel method both boys and girls are favored significantly at some ages and for some goods, in the Rothbarth method results reveal that teenage girls are favored the most in both of the urban and rural provinces. Moreover, being the first study that examines gender discrimination in intrahousehold allocation in Turkey, this study is also important methodologically as it suggests that Engel and Rothbarth methods do have the power to detect gender bias in intrahousehold allocation given sufficient sample size. This result is striking since in the previous literature, attempts to detect gender discrimination have been unsuccessful. Although outcome data of the selected countries were strongly indicative of son preference, authors blamed Engel and Rothbarth approaches as being incapable of depicting the existent biases.

Although the outcome data that is available publicly is on aggregate levels, it would be interesting to compare the results obtained in this study with such outcome data that is available in gender categorization. Besides, the data set used in this study did not include individual level data. Therefore, it could have been interesting to replicate the same study for individual level data and compare the results. This study can be further improved by investigating how the age and gender related ordering of the children effects household resource allocation. Further studies might be conducted on the boy preference of families in Turkey. More intuitively, investigating whether families decide to stop after giving birth to a male child. If this is the case, it would worthwhile to compare the welfare of a girl, where the female population is high in the family, to welfare of boy, where the population of the household is relatively lower.

Table 1: Summary Statistics, Rural

Panel A: Child Goods

Budget Shares	Obs.	Mean	Std. Dev.	Min	Max	*p(0)*
Books	12,619	0.001	0.007	0	0.228	0.948
Toys Games and Hobbies	12,619	0.000	0.003	0	0.097	0.919
Child Footwear	12,619	0.003	0.013	0	0.433	0.877
Child Clothing	12,619	0.007	0.021	0	0.335	0.764
Fruit and Vegetable	12,613	0.107	0.061	0	0.702	0.002
Milk	12,613	0.015	0.020	0	0.445	0.172
Meat	12,613	0.051	0.084	0	0.874	0.188
Education	12,619	0.005	0.032	0	0.713	0.937
Health	12,619	0.020	0.057	0	0.804	0.590

Panel B: Adult Goods

Budget Shares	Obs.	Mean	Std. Dev.	Min	Max	*p(0)*
Alcohol and Tobacco	12,619	0.054	0.067	0	0.545	0.417
Restaurants and Hotels	12,619	0.027	0.045	0	0.699	0.415
Cultural Activities	12,619	0.011	0.035	0	0.850	0.570
Women Footwear	12,619	0.004	0.013	0	0.297	0.794
Men Footwear	12,619	0.009	0.022	0	0.269	0.783
Men Clothing	12,619	0.017	0.037	0	0.416	0.611
Women Clothing	12,619	0.012	0.029	0	0.376	0.676
Women Personal Care	12,619	0.013	0.017	0	0.272	0.238
Jewelry and Watch	12,619	0.003	0.030	0	0.876	0.943

Panel C: Explanatory Variables

Explanatory Variables	Mean	Std. Dev.
ln(x/n)	4.813	0.733
Ln n	1.393	0.535
Ratio of males		
0-4	0.036	0.085
5-9	0.043	0.093
10-14	0.047	0.097
15-25	0.077	0.133
55+	0.110	0.187
Ratio of females		
0-4	0.033	0.084
5-9	0.040	0.088
10-14	0.043	0.095
15-25	0.096	0.140
26-54	0.187	0.151
55+	0.116	0.203
Time dummies		
d04	0.203	0.402
d05	0.204	0.403

Note: p(0) is the proportion of households reporting zero consumption or purchase of the good.

Table 2: Summary Statistics, Urban

Panel A: Child Goods

Budget Shares	Obs	Mean	Std. Dev.	Min	Max	*p(0)*
Books	30,248	0.002	0.010	0	0.881	0.881
Toys Games and Hobbies	30,248	0.001	0.005	0	0.857	0.857
Child Footwear	30,248	0.003	0.011	0	0.884	0.884
Child Clothing	30,248	0.008	0.020	0	0.711	0.711
Fruit and Vegetable	30,237	0.075	0.042	0	0.002	0.002
Milk	30,237	0.010	0.012	0	0.135	0.135
Meat	30,237	0.043	0.062	0	0.090	0.090
Education	30,248	0.012	0.047	0	0.862	0.862
Health	30,248	0.017	0.050	0	0.773	0.551

Panel B: Adult Goods

Budget Shares	Obs	Mean	Std. Dev.	Min	Max	*p(0)*
Alcohol and Tobacco	30,248	0.047	0.058	0	0.616	0.390
Restaurants and Hotels	30,248	0.041	0.055	0	0.639	0.287
Cultural Activities	30,248	0.017	0.035	0	0.695	0.350
Women Footwear	30,248	0.005	0.015	0	0.276	0.790
Men Footwear	30,248	0.006	0.018	0	0.305	0.839
Men Clothing	30,248	0.014	0.033	0	0.434	0.624
Women Clothing	30,248	0.015	0.032	0	0.395	0.564
Women Personal Care	30,248	0.017	0.019	0	0.319	0.150
Jewelry and Watch	30,248	0.003	0.028	0	0.749	0.919

Panel C: Explanatory Variables

Explanatory Variables	Mean	Std. Dev.
ln(x/n)	5.272	0.752
Ln n	1.279	0.464
Ratio of males		
0-4	0.035	0.091
5-9	0.043	0.098
10-14	0.043	0.098
15-25	0.083	0.148
55+	0.074	0.162
Ratio of females		
0-4	0.034	0.091
5-9	0.039	0.095
10-14	0.041	0.096
15-25	0.100	0.154
26-54	0.217	0.163
55+	0.091	0.207
Time dummies		
d04	0.198	0.398
d05	0.198	0.398

Note: p(0) is the proportion of households reporting zero consumption or purchase of the good

Table 3: Engel Method Showing the Effects of Composition on Selected Child Goods, Rural

Panel A: Regressions

Dep. Variable:	**Books**	**Toys Games and Hobbies**	**Child Footwear**	**Child Clothing**	**Fruit and Vegetables**	**Milk**	**Meat**	**Education**	**Health**
	coef/t	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**
ln *(x/n)*	0.001***	0.000***	0.001***	0.003***	-0.038***	-0.008***	0.021***	0.007***	0.009***
	(8.181)	(6.677)	(4.159)	(10.393)	(-41.051)	(-25.488)	(16.767)	(10.667)	(9.197)
ln *n*	0.000	-0.000	0.000	0.002***	-0.010***	0.000	0.019***	0.004***	0.008***
	(0.454)	(-1.328)	(0.540)	(3.947)	(-6.120)	(0.212)	(8.486)	(4.675)	(4.840)
ratmale 0-4	0.000	0.004***	0.011***	0.023***	-0.006	0.011***	0.019*	-0.003	0.013*
	(0.035)	(7.517)	(5.889)	(8.103)	(-0.834)	(4.552)	(1.866)	(-1.008)	(1.716)
ratmale 5-9	0.003***	0.002***	0.017***	0.039***	-0.002	-0.004*	0.020**	0.001	0.004
	(3.240)	(6.123)	(9.319)	(11.728)	(-0.365)	(-1.840)	(2.102)	(0.195)	(0.560)
ratmale10-14	0.004***	0.001***	0.016***	0.029***	0.011	-0.002	0.019**	0.015***	0.000
	(4.235)	(3.098)	(8.390)	(10.320)	(1.605)	(-0.791)	(2.009)	(3.586)	(0.033)
ratmale 15-25	0.002**	0.000	-0.000	-0.002	-0.006	-0.001	0.004	0.017***	-0.007
	(2.345)	(1.034)	(-0.473)	(-1.416)	(-1.259)	(-0.586)	(0.494)	(4.847)	(-1.300)
ratmale 55+	-0.000	0.000	0.000	0.001	0.031***	0.005***	0.035***	-0.003*	0.010**
	(-0.567)	(0.273)	(0.492)	(1.117)	(7.291)	(3.894)	(5.412)	(-1.724)	(2.093)
ratfemale 0-4	0.002***	0.003***	0.009***	0.026***	-0.007	0.009***	0.009	-0.003	0.008
	(2.701)	(5.402)	(6.117)	(8.689)	(-0.956)	(3.653)	(0.847)	(-0.861)	(1.067)
ratfemale 5-9	0.003***	0.001***	0.016***	0.029***	-0.009	-0.001	0.016	0.005	-0.003
	(3.495)	(3.823)	(8.558)	(9.360)	(-1.223)	(-0.293)	(1.488)	(1.462)	(-0.515)
ratfemale 10-14	0.005***	0.001**	0.012***	0.027***	0.009	-0.001	-0.005	0.014***	-0.014**
	(4.640)	(2.194)	(7.534)	(9.472)	(1.294)	(-0.331)	(-0.575)	(3.658)	(-2.241)
ratfemale 15-25	0.002***	0.000	-0.000	0.000	0.002	0.001	0.006	0.017***	0.003
	(2.673)	(1.526)	(-0.278)	(0.006)	(0.429)	(0.826)	(0.736)	(3.981)	(0.466)
ratfemale 26-54	0.002**	0.000	-0.000	0.003**	0.027***	0.007***	0.008	0.006**	0.000
	(2.273)	(1.305)	(-0.081)	(2.201)	(4.452)	(3.998)	(0.915)	(2.006)	(0.007)
ratfemale 55+	0.001	0.000	-0.000	0.002**	0.032***	0.007***	0.028***	0.002	0.022***
	(1.037)	(0.709)	(-0.305)	(2.448)	(6.232)	(4.719)	(3.636)	(0.737)	(3.976)
d04	-0.000	0.000	0.000	0.000	0.002	0.001***	0.002	-0.000	-0.002*
	(-1.372)	(0.953)	(0.208)	(0.810)	(1.279)	(2.937)	(1.248)	(-0.011)	(-1.791)
d05	0.000	0.000	0.000	0.001**	0.003**	-0.000	-0.004**	-0.002**	-0.002
	(0.382)	(0.882)	(0.103)	(2.143)	(2.432)	(-0.698)	(-2.151)	(-2.230)	(-1.301)
constant	-0.005***	-0.001***	-0.004***	-0.018***	0.292***	0.049***	-0.087***	-0.039***	-0.038***
	(-5.610)	(-4.726)	(-3.062)	(-9.559)	(43.181)	(23.544)	(-9.545)	(-9.146)	(-5.335)

Panel B: F-tests

	Books	**Toys Games and Hobbies**	**Child Footwear**	**Child Clothing**	**Fruit and Vegetables**	**Milk**	**Meat**	**Education**	**Health**
	F/Prob>F	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**
0-4	8.64**	1.340	0.790	0.410	0.010	0.600	0.850	0.030	0.450
	0.003	0.248	0.374	0.523	0.904	0.438	0.356	0.853	0.500
5-9	0.080	5.23**	0.180	5.69**	0.680	1.520	0.170	2.010	1.210
	0.781	0.022	0.668	0.017	0.410	0.218	0.679	0.156	0.271
10-14	1.150	0.470	3.190	0.320	0.080	0.150	6.22**	0.000	5.63**
	0.284	0.493	0.074	0.572	0.771	0.701	0.013	0.953	0.018
15-25	0.040	0.470	0.040	2.090	2.800	1.560	0.090	0.000	3.97**
	0.851	0.494	0.841	0.148	0.094	0.212	0.770	0.999	0.046
All Children	8.57**	14.23**	3.77**	3.34**	2.8**	11.73**	2.130	9.94**	4.06**
	0.000	0.000	0.002	0.005	0.016	0.000	0.058	0.000	0.001

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Engel Method Showing the Effects of Composition on Selected Child Goods, Urban

Panel A: Regressions

Dep. Variable:	Books	Toys Games and Hobbies	Child Footwear	Child Clothing	Fruit and Vegetables	Milk	Meat	Education	Health
	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t
ln *(x/n)*	0.001***	0.001***	0.001***	0.003***	-0.030***	-0.004***	0.007***	0.015***	0.009***
	(14.541)	(11.938)	(8.402)	(14.890)	(-79.323)	(-30.083)	(13.279)	(23.411)	(15.300)
ln *n*	0.001***	-0.000	0.001***	0.002***	-0.005***	-0.002***	0.015***	0.013***	0.006***
	(3.282)	(-0.280)	(3.854)	(5.067)	(-6.403)	(-10.949)	(13.934)	(16.056)	(5.284)
ratmale 0-4	-0.001**	0.005***	0.007***	0.024***	-0.016***	0.021***	-0.004	-0.010***	0.025***
	(-2.186)	(12.601)	(8.836)	(14.610)	(-5.380)	(19.725)	(-0.916)	(-3.342)	(6.115)
ratmale 5-9	0.004***	0.004***	0.014***	0.033***	-0.009***	0.001	-0.000	0.009***	0.015***
	(6.467)	(8.420)	(15.533)	(19.248)	(-3.365)	(1.610)	(-0.024)	(2.784)	(3.902)
ratmale 10-14	0.006***	0.001**	0.014***	0.027***	-0.007***	-0.002**	-0.003	0.032***	0.002
	(7.019)	(2.489)	(13.190)	(16.181)	(-2.613)	(-2.141)	(-0.809)	(8.804)	(0.547)
ratmale 15-25	0.003***	-0.000	-0.000	-0.000	-0.009***	-0.002***	-0.004	0.030***	-0.004
	(4.152)	(-1.428)	(-0.443)	(-0.374)	(-4.643)	(-3.594)	(-1.349)	(10.054)	(-1.250)
ratmale 55+	-0.000	-0.001***	0.000	-0.001	0.030***	0.002***	0.029***	-0.005***	0.009***
	(-0.501)	(-4.151)	(0.556)	(-1.219)	(15.766)	(4.186)	(8.936)	(-2.729)	(3.044)
ratfemale 0-4	0.000	0.004***	0.008***	0.024***	-0.017***	0.022***	-0.008*	-0.008***	0.025***
	(0.099)	(8.364)	(10.331)	(15.939)	(-5.857)	(19.806)	(-1.903)	(-2.762)	(5.969)
ratfemale 5-9	0.005***	0.002***	0.013***	0.037***	-0.008***	0.001	-0.000	0.009***	0.012***
	(6.652)	(5.468)	(13.717)	(20.870)	(-2.648)	(0.739)	(-0.113)	(2.934)	(3.145)
ratfemale 10-14	0.007***	0.001**	0.011***	0.028***	-0.005*	-0.002**	-0.010**	0.034***	0.005
	(7.561)	(2.070)	(11.031)	(15.982)	(-1.957)	(-2.161)	(-2.265)	(8.894)	(1.238)
ratfemale 15-25	0.003***	0.000	-0.001**	-0.000	-0.004*	-0.001**	-0.008**	0.025***	0.007***
	(5.295)	(0.492)	(-1.964)	(-0.463)	(-1.880)	(-2.285)	(-2.454)	(7.938)	(2.633)
ratfemale 26-54	0.001	-0.000	0.000	0.000	0.010***	0.001*	0.003	0.009***	0.000
	(1.405)	(-0.766)	(0.227)	(0.496)	(4.589)	(1.821)	(0.996)	(3.720)	(0.146)
ratfemale 55+	-0.000	-0.000*	0.000	0.001	0.022***	0.004***	0.018***	0.002	0.016***
	(-0.365)	(-1.676)	(1.312)	(1.186)	(11.234)	(6.509)	(5.921)	(1.043)	(5.589)
d04	-0.000**	0.000	0.000**	0.001*	0.001	-0.000	0.001	-0.001	0.001
	(-2.286)	(0.829)	(1.995)	(1.940)	(1.031)	(-0.844)	(1.318)	(-1.100)	(1.643)
d05	-0.001***	-0.000*	-0.000	-0.001**	0.004***	0.000	-0.004***	-0.003***	-0.001
	(-4.313)	(-1.881)	(-1.601)	(-2.107)	(7.244)	(0.139)	(-3.839)	(-4.022)	(-1.630)
constant	-0.008***	-0.003***	-0.005***	-0.015***	0.234***	0.030***	-0.013***	-0.093***	-0.043***
	(-11.682)	(-8.258)	(-7.660)	(-12.245)	(80.610)	(34.417)	(-3.346)	(-20.849)	(-9.901)

Panel B: F-tests

	Books	Toys Games and Hobbies	Child Footwear	Child Clothing	Fruit and Vegetables	Milk	Meat	Education	Health
	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F
0-4	2.58	7.5**	0.94	0	0.16	0.68	0.81	0.52	0.01
	0.1085	0.0062	0.3329	0.9954	0.6913	0.4088	0.368	0.4718	0.9226
5-9	0.09	15.54**	0.76	1.68	0.37	0.57	0.01	0.04	0.7
	0.7701	0.0001	0.382	0.1946	0.5456	0.4487	0.9354	0.8431	0.4029
10-14	0.42	0.65	4.63**	0.28	0.29	0	1.76	0.3	0.53
	0.518	0.4215	0.0314	0.5952	0.5915	0.946	0.1842	0.5829	0.4662
15-25	0.04	3.35	3.36	0.01	7.43**	2.58	1.21	2.11	20.3**
	0.8488	0.0672	0.0666	0.9117	0.0064	0.108	0.2721	0.1459	0
All Children	36.26**	34.68**	12.91**	9.26	4.78**	180.61**	1.33	61.18**	12.28**
	0	0	0	0	0	0	0.2473	0	0

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Summary Results of the Engel Method

Panel A: Rural

	Favoring Girl				Favoring Boy			
Child Goods:	0-4	5-9	10-14	15-25	0-4	5-9	10-14	15-25
Books	X							
Toys Games and Hobbies						X		
Child Clothing						X		
Meat							X	
Health				X			X	

Panel B: Urban

	Favoring Girl				Favoring Boy			
Child Goods:	0-4	5-9	10-14	15-25	0-4	5-9	10-14	15-25
Toys Games and Hobbies					X	X		
Child Footwear							X	
Fruit and Vegetable				X				
Health				X				

Table 6: Rothbarth Method Showing the Effects of Composition on Selected Adult Goods, Rural

Panel A: Regressions

Dep. Variable:	**Alcohol and Tobacco**	**Restaurants and Hotels**	**Cultural Activities**	**Women Footwear**	**Men Footwear**	**Men Clothing**	**Women Clothing**	**Women Personal Care**	**Jewelry and Watch**
	coef/t	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**
ln *(x/n)*	-0.010***	0.007***	0.011***	0.002***	0.002***	0.009***	0.008***	0.002***	0.007***
	(-10.574)	(8.767)	(12.176)	(10.321)	(6.946)	(14.422)	(16.979)	(8.630)	(7.364)
ln *n*	0.002	-0.001	0.004***	0.001**	0.003***	0.009***	0.006***	0.000	0.006***
	(1.313)	(-0.414)	(3.612)	(2.200)	(5.256)	(9.204)	(6.853)	(0.189)	(5.434)
ratmale 0-4	-0.100***	-0.044***	0.013***	0.003**	-0.006**	-0.016***	0.012***	0.034***	-0.006
	(-11.209)	(-6.915)	(2.883)	(2.016)	(-2.246)	(-3.669)	(3.237)	(11.760)	(-1.490)
ratmale 5-9	-0.091***	-0.051***	0.015***	0.007***	-0.007**	-0.014***	0.019***	0.001	0.000
	(-11.307)	(-8.787)	(3.588)	(4.129)	(-2.497)	(-3.392)	(5.926)	(0.361)	(0.010)
ratmale10-14	-0.101***	-0.054***	0.019***	0.008***	-0.000	0.000	0.016***	0.002	-0.007**
	(-12.624)	(-9.856)	(4.411)	(4.440)	(-0.033)	(0.015)	(4.790)	(0.999)	(-1.970)
ratmale 15-25	-0.035***	-0.022***	0.011***	0.002	0.005**	0.016***	0.010***	0.002	-0.001
	(-4.998)	(-4.430)	(3.061)	(1.616)	(2.127)	(3.905)	(3.527)	(1.237)	(-0.237)
ratmale 55+	-0.062***	-0.032***	-0.001	0.002**	-0.001	-0.002	0.006***	-0.002**	-0.003
	(-10.968)	(-7.869)	(-0.459)	(2.217)	(-0.693)	(-0.586)	(3.260)	(-2.168)	(-0.896)
ratfemale 0-4	-0.090***	-0.043***	0.011**	0.007***	-0.008***	-0.005	0.017***	0.033***	-0.003
	(-10.186)	(-6.689)	(2.319)	(3.687)	(-3.005)	(-1.020)	(4.755)	(11.430)	(-0.627)
ratfemale 5-9	-0.099***	-0.039***	0.016***	0.005***	-0.010***	-0.018***	0.026***	0.001	-0.002
	(-11.765)	(-6.197)	(3.481)	(3.033)	(-3.972)	(-4.360)	(6.948)	(0.327)	(-0.491)
ratfemale 10-14	-0.112***	-0.053***	0.027***	0.012***	-0.002	-0.012***	0.032***	0.001	-0.001
	(-14.267)	(-9.807)	(5.243)	(6.938)	(-0.579)	(-2.930)	(8.623)	(0.741)	(-0.271)
ratfemale 15-25	-0.106***	-0.051***	0.002	0.015***	-0.009***	-0.015***	0.052***	0.010***	0.002
	(-15.804)	(-10.003)	(0.559)	(9.066)	(-4.614)	(-4.541)	(15.090)	(5.386)	(0.408)
ratfemale 26-54	-0.108***	-0.067***	0.006	0.011***	-0.011***	-0.023***	0.031***	0.002	-0.005
	(-14.211)	(-10.998)	(1.386)	(5.547)	(-5.095)	(-6.994)	(9.858)	(1.179)	(-1.279)
ratfemale 55+	-0.119***	-0.066***	0.000	0.008***	-0.009***	-0.020***	0.022***	-0.003**	0.002
	(-19.903)	(-13.846)	(0.132)	(6.041)	(-5.497)	(-8.107)	(8.974)	(-2.129)	(0.479)
d04	0.003**	-0.000	0.000	-0.000	-0.000	-0.002*	0.001	0.000	-0.001
	(2.086)	(-0.014)	(0.192)	(-0.194)	(-0.487)	(-1.846)	(1.333)	(1.037)	(-0.947)
d05	0.004***	0.002**	0.001	-0.000	-0.001	-0.001	0.001*	0.000	0.000
	(2.657)	(1.961)	(1.547)	(-0.876)	(-1.194)	(-1.563)	(1.873)	(1.133)	(0.099)
constant	0.177***	0.038***	-0.052***	-0.012***	-0.000	-0.026***	-0.054***	-0.001	-0.035***
	(21.388)	(5.942)	(-9.049)	(-8.669)	(-0.018)	(-6.249)	(-16.529)	(-0.554)	(-5.826)

Panel B: F-tests

	Alcohol and Tobacco	**Restaurants and Hotels**	**Cultural Activities**	**Women Footwear**	**Men Footwear**	**Men Clothing**	**Women Clothing**	**Women Personal Care**	**Jewelry and Watch**
	F/Prob>F	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**
0-4	1.05	0.02	0.21	3.89**	0.35	5**	1.77	0.13	0.77
	0.3053	0.8884	0.6462	0.0485	0.5525	0.0254	0.1839	0.7219	0.3814
5-9	0.87	3.83**	0	1.27	1.46	0.88	3.04	0	0.28
	0.3503	0.0502	0.9467	0.2605	0.2277	0.3485	0.0813	0.9834	0.5956
10-14	1.93	0.01	2.22	5.17**	0.24	6.77**	17.9**	0.06	6.01**
	0.1647	0.9197	0.1361	0.023	0.626	0.0093	0	0.8047	0.0143
15-25	112.5**	41.63**	6.04**	91.64**	38.25**	53.77**	182.35**	22.21**	0.85
	0	0	0.014	0	0	0	0	0	0.3563
All Children	1.76	2.2**	2.28**	5.51**	3.57**	4.49**	7.2**	57.88**	2.41**
	0.1179	0.0516	0.0437	0	0.0031	0	0	0	0.0341

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Rothbarth Method Showing the Effects of Composition on Selected Adult Goods, Urban

Panel A: Regressions:

Dep. Variable:	Alcohol and Tobacco	Restaurants and Hotels	Cultural Activities	Women Footwear	Men Footwear	Men Clothing	Women Clothing	Women Exenditures	Jewelry and Watch
	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t
ln *(x/n)*	-0.014***	0.008***	0.013***	0.002***	0.002***	0.008***	0.009***	0.003***	0.005***
	(-26.880)	(15.267)	(29.357)	(15.887)	(13.190)	(24.432)	(28.807)	(17.316)	(12.118)
ln *n*	-0.001	0.003**	0.004***	0.001***	0.002***	0.008***	0.008***	0.002***	0.004***
	(-0.634)	(2.495)	(6.306)	(4.655)	(6.013)	(12.241)	(12.076)	(4.597)	(7.051)
ratmale 0-4	-0.056***	-0.019***	-0.003	0.004***	-0.009***	-0.022***	0.013***	0.048***	0.002
	(-11.628)	(-4.125)	(-1.173)	(3.904)	(-5.733)	(-8.202)	(4.973)	(25.826)	(0.849)
ratmale 5-9	-0.060***	-0.025***	0.018***	0.004***	-0.009***	-0.018***	0.011***	0.001	-0.001
	(-13.341)	(-5.745)	(6.245)	(3.366)	(-6.805)	(-6.749)	(4.695)	(0.492)	(-0.439)
ratmale10-14	-0.072***	-0.042***	0.021***	0.005***	0.003*	-0.014***	0.008***	-0.003***	0.001
	(-16.869)	(-9.805)	(7.353)	(4.388)	(1.654)	(-5.608)	(3.435)	(-2.615)	(0.408)
ratmale 15-25	-0.025***	-0.008**	0.007***	0.001	0.007***	0.010***	0.002	0.001	0.001
	(-7.220)	(-2.376)	(3.314)	(1.576)	(5.119)	(4.437)	(1.226)	(0.909)	(0.355)
ratmale 55+	-0.046***	-0.049***	-0.007***	0.002**	-0.003***	-0.010***	0.003**	-0.002***	-0.000
	(-15.873)	(-19.402)	(-4.123)	(2.227)	(-3.156)	(-6.035)	(2.250)	(-2.695)	(-0.294)
ratfemale 0-4	-0.063***	-0.025***	0.002	0.004***	-0.008***	-0.019***	0.014***	0.047***	0.005**
	(-13.291)	(-5.518)	(0.675)	(3.386)	(-5.582)	(-6.906)	(5.530)	(24.731)	(1.966)
ratfemale 5-9	-0.059***	-0.029***	0.013***	0.005***	-0.008***	-0.022***	0.014***	0.000	-0.001
	(-12.719)	(-6.662)	(4.838)	(4.731)	(-5.541)	(-8.587)	(5.727)	(0.257)	(-0.422)
ratfemale 10-14	-0.072***	-0.041***	0.015***	0.011***	-0.008***	-0.023***	0.022***	0.002*	0.001
	(-16.451)	(-9.721)	(5.805)	(9.058)	(-6.083)	(-9.587)	(9.437)	(1.725)	(0.563)
ratfemale 15-25	-0.058***	-0.029***	0.002	0.017***	-0.009***	-0.023***	0.047***	0.015***	-0.001
	(-16.682)	(-8.547)	(0.723)	(13.921)	(-8.361)	(-11.130)	(20.727)	(12.004)	(-0.583)
ratfemale 26-54	-0.064***	-0.050***	-0.008***	0.014***	-0.009***	-0.025***	0.037***	0.009***	0.000
	(-17.679)	(-13.779)	(-3.576)	(11.736)	(-7.561)	(-11.250)	(14.850)	(7.312)	(0.022)
ratfemale 55+	-0.080***	-0.068***	-0.010***	0.008***	-0.009***	-0.022***	0.022***	0.000	0.001
	(-28.308)	(-24.709)	(-5.806)	(9.786)	(-9.323)	(-13.013)	(12.410)	(0.458)	(0.610)
d04	0.005***	0.001	0.001	0.000	-0.001***	-0.001	0.000	-0.000	0.000
	(5.668)	(1.089)	(1.457)	(0.570)	(-5.161)	(-1.579)	(0.600)	(-0.098)	(0.208)
d05	0.006***	-0.000	-0.000	-0.001**	-0.001***	-0.004***	-0.002***	-0.001**	0.000
	(6.891)	(-0.288)	(-0.484)	(-2.560)	(-4.536)	(-7.287)	(-3.351)	(-2.485)	(0.315)
constant	0.169***	0.025***	-0.059***	-0.016***	-0.002	-0.023***	-0.060***	-0.010***	-0.030***
	(36.818)	(5.726)	(-18.768)	(-14.251)	(-1.396)	(-8.944)	(-24.455)	(-6.641)	(-10.318)

Panel B: F-tests

	Alcohol and Tobacco	Restaurants and Hotels	Cultural Activities	Women Footwear	Men Footwear	Men Clothing	Women Clothing	Women Exenditures	Jewerly and Watch
	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F
0-4	1.64	1.41	3.1	0.26	0.02	1.45	0.14	0.54	1.28
	0.201	0.2352	0.0782	0.61	0.8804	0.2292	0.7085	0.4644	0.2586
5-9	0.11	0.82	2.19	1.89	1.14	3.03	1.51	0.06	0
	0.7457	0.3659	0.1389	0.1694	0.286	0.0817	0.2199	0.8098	0.9648
10-14	0	0.03	2.91	26.08**	46.82**	15.6**	39.31**	18.55**	0.03
	0.9943	0.8539	0.0882	0	0	0.0001	0	0	0.8542
15-25	103.24**	39.67**	6.86**	238.71**	179.73**	264.65**	579.13**	180.24**	1.06
	0	0	0.0088	0	0	0	0	0	0.3037
All Children	4.36**	8.47**	21.41**	9.07**	14.46**	4.35**	8.4**	294.14**	1.39
	0	0	0	0	0	0	0	0	0.2258

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Outlay Equivalent Ratios, Rural

Panel A: Outlay Equivalent Ratios

	Males						Females					
Adult Goods	**0-4**	**5-9**	**10-14**	**15-25**	**26-54**	**55+**	**0-4**	**5-9**	**10-14**	**15-25**	**26-54**	**55+**
Alcohol and Tobacco	-0.034	0.217	-0.042	1.696	2.634	0.997	0.230	-0.001	-0.349	-0.176	-0.248	-0.540
Restaurants and Hotels	-0.170	-0.324	-0.382	0.336	0.824	0.114	-0.149	-0.058	-0.370	-0.319	-0.676	-0.661
Cultural Activities	-0.188	-0.092	0.032	-0.264	-0.652	-0.692	-0.268	-0.080	0.346	-0.582	-0.446	-0.637
Women Footwear	-0.673	-0.143	-0.016	-0.877	-1.206	-0.838	-0.145	-0.419	0.600	1.142	0.459	-0.037
Men Footwear	0.001	-0.034	0.786	1.384	0.796	0.658	-0.237	-0.470	0.606	-0.370	-0.551	-0.335
Men Clothing	-0.251	-0.149	0.477	2.731	0.474	0.407	0.261	-0.329	-0.058	-0.202	-0.554	-0.429
Women Clothing	-0.491	-0.138	-0.315	-0.585	-1.021	-0.727	-0.266	0.150	0.413	1.356	0.407	-0.018
Women Personal Care	1.343	-0.522	-0.458	-0.448	-0.566	-0.697	1.271	-0.525	-0.486	-0.010	-0.430	-0.729
Jewelry and Watch	-0.509	0.105	-0.614	0.014	0.101	-0.147	-0.192	-0.099	-0.011	0.252	-0.386	0.280

Panel B: Confidence Intervals

		Males						Females					
Adult Goods		**0-4**	**5-9**	**10-14**	**15-25**	**26-54**	**55+**	**0-4**	**5-9**	**10-14**	**15-25**	**26-54**	**55+**
Alcohol and Tobacco	5%	-0.273	-0.011	-0.300	1.476	2.387	0.777	-0.048	-0.273	-0.604	-0.381	-0.496	-0.768
	95%	0.193	0.457	0.179	1.911	3.013	1.223	0.506	0.248	-0.115	-0.033	0.039	-0.310
Restaurants and Hotels	5%	-0.359	-0.460	-0.515	0.226	0.654	-0.005	-0.324	-0.213	-0.486	-0.420	-0.817	-0.792
	95%	-0.043	-0.179	-0.244	0.455	1.009	0.249	0.002	0.089	-0.239	-0.197	-0.499	-0.516
Cultural Activities	5%	-0.344	-0.262	-0.157	-0.407	-0.799	-0.854	-0.436	-0.275	0.089	-0.693	-0.616	-0.773
	95%	0.048	0.121	0.219	-0.109	-0.407	-0.530	-0.099	0.142	0.613	-0.420	-0.258	-0.431
Women Footwear	5%	-0.898	-0.377	-0.364	-1.115	-1.543	-1.091	-0.476	-0.685	0.273	0.907	0.218	-0.293
	95%	-0.392	0.157	0.276	-0.672	-0.894	-0.595	0.156	-0.140	0.960	1.377	0.766	0.212
Men Footwear	5%	-0.542	-0.424	0.337	0.957	0.470	0.378	-0.743	-0.894	0.097	-0.685	-0.988	-0.597
	95%	0.516	0.330	1.148	1.728	1.140	0.904	0.252	-0.056	1.118	-0.115	-0.229	-0.063
Men Clothing	5%	-0.535	-0.440	0.249	1.003	0.194	0.203	0.067	-0.546	-0.274	-0.417	-0.829	-0.643
	95%	-0.040	0.034	0.828	1.444	0.680	0.572	0.504	-0.123	0.158	-0.005	-0.382	-0.294
Women Clothing	5%	-0.658	-0.304	-0.468	-0.673	-1.223	-0.868	-0.445	-0.054	0.207	1.148	0.258	-0.191
	95%	-0.330	0.014	-0.125	-0.443	-0.812	-0.564	-0.079	0.324	0.557	1.493	0.579	0.110
Women Personal Care	5%	1.102	-0.663	-0.599	-0.549	-0.692	-0.827	1.024	-0.651	-0.597	-0.111	-0.575	-0.837
	95%	1.552	-0.374	-0.347	-0.349	-0.407	-0.591	1.476	-0.349	-0.323	0.118	-0.316	-0.635
Jewelry and Watch	5%	-0.922	-0.325	-0.879	-0.303	-0.331	-0.615	-0.640	-0.568	-0.378	-0.105	-0.807	-0.134
	95%	-0.244	0.535	-0.362	0.288	0.699	0.253	0.354	0.251	0.441	0.604	0.085	0.605

Note: Shaded areas include insignificant gender effects.

Table 9: Outlay Equivalent Ratios, Urban

Panel A: Outlay Equivalent Ratios

	Males						Females					
Adult Goods	**0-4**	**5-9**	**10-14**	**15-25**	**26-54**	**55+**	**0-4**	**5-9**	**10-14**	**15-25**	**26-54**	**55+**
Alcohol and Tobacco	0.368	0.245	-0.113	1.300	2.046	0.666	0.175	0.290	-0.112	0.310	0.142	-0.343
Restaurants and Hotels	0.132	0.008	-0.358	0.361	0.542	-0.522	0.011	-0.079	-0.340	-0.089	-0.541	-0.918
Cultural Activities	-0.562	0.129	0.233	-0.212	-0.457	-0.684	-0.391	-0.007	0.061	-0.404	-0.715	-0.799
Women Footwear	-0.397	-0.477	-0.339	-0.853	-1.039	-0.799	-0.474	-0.265	0.570	1.438	0.972	0.188
Men Footwear	-0.310	-0.405	1.082	1.551	0.746	0.372	-0.283	-0.231	-0.261	-0.423	-0.425	-0.355
Men Clothing	-0.256	-0.055	0.119	1.905	0.752	0.285	-0.108	-0.248	-0.299	-0.307	-0.378	-0.249
Women Clothing	-0.205	-0.291	-0.426	-0.669	-0.763	-0.617	-0.163	-0.175	0.206	1.274	0.820	0.210
Women Personal Care	1.840	-0.662	-0.867	-0.650	-0.698	-0.807	1.750	-0.680	-0.579	0.096	-0.223	-0.676
Jewelry and Watch	0.043	-0.291	-0.089	-0.118	-0.185	-0.234	0.381	-0.282	-0.046	-0.294	-0.181	-0.094

Panel B: Confidence Intervals

		Males						Females					
Adult Goods		**0-4**	**5-9**	**10-14**	**15-25**	**26-54**	**55+**	**0-4**	**5-9**	**10-14**	**15-25**	**26-54**	**55+**
Alcohol and Tobacco	5%	0.189	0.077	-0.257	1.160	1.885	0.559	-0.001	0.111	-0.248	0.187	0.010	-0.509
	95%	0.544	0.392	0.033	1.446	2.259	0.807	0.339	0.458	0.032	0.428	0.267	-0.191
Restaurants and Hotels	5%	0.029	-0.119	-0.449	0.274	0.451	-0.601	-0.111	-0.225	-0.451	-0.170	-0.643	-0.991
	95%	0.260	0.106	-0.261	0.458	0.647	-0.441	0.130	0.047	-0.245	-0.006	-0.445	-0.821
Cultural Activities	5%	-0.664	0.027	0.140	-0.290	-0.586	-0.780	-0.529	-0.111	-0.033	-0.479	-0.817	-0.899
	95%	-0.445	0.220	0.352	-0.123	-0.353	-0.592	-0.247	0.098	0.200	-0.337	-0.627	-0.700
Women Footwear	5%	-0.577	-0.625	-0.517	-0.965	1.301	-0.993	-0.673	-0.400	0.357	1.278	0.748	-0.019
	95%	-0.205	-0.310	-0.164	-0.671	-0.791	-0.601	-0.313	-0.091	0.797	1.629	1.225	0.407
Men Footwear	5%	-0.509	-0.615	0.854	1.344	0.523	0.186	-0.481	-0.427	-0.449	-0.600	-0.625	-0.574
	95%	-0.090	-0.211	1.344	1.798	0.940	0.557	-0.099	-0.047	-0.090	-0.285	-0.251	-0.179
Men Clothing	5%	-0.407	-0.171	0.000	1.074	0.617	0.149	-0.260	-0.369	-0.416	-0.388	-0.514	-0.388
	95%	-0.109	0.085	0.291	1.304	0.841	0.374	0.052	-0.129	-0.187	-0.226	-0.259	-0.159
Women Clothing	5%	-0.326	-0.391	-0.538	-0.741	-0.886	-0.720	-0.285	-0.280	0.065	1.145	0.683	0.064
	95%	-0.036	-0.183	-0.308	-0.568	-0.616	-0.496	-0.028	-0.073	0.327	1.335	0.919	0.293
Women Personal Care	5%	1.692	-0.748	-0.932	-0.726	-0.793	-0.890	1.622	-0.764	-0.652	0.020	-0.329	-0.772
	95%	1.961	-0.582	-0.772	-0.577	-0.592	-0.716	1.903	-0.595	-0.485	0.166	-0.129	-0.560
Jewelry and Watch	5%	-0.250	-0.611	-0.347	-0.346	-0.402	-0.469	0.023	-0.604	-0.337	-0.461	-0.454	-0.314
	95%	0.406	-0.073	0.136	0.070	0.020	-0.058	0.732	0.019	0.271	-0.096	0.030	0.065

Note: Shaded areas include insignificant gender effects.

Table 10: Testing the Validity of the Adult Goods

Panel A: Rural

	Alcohol and Tobacco	Restaurants and Hotels	Cultural Activities	Women Footwear	Men Footwear	Men Clothing	Women Clothing	Women Personal Care	Jewelry and Watch
	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F
All Children	1.140	1.480	0.330	7.12**	4.07**	3.64**	4.86**	42.37**	1.350
	0.339	0.194	0.895	0.000	0.001	0.003	0.000	0.000	0.238

Panel B: Urban

	Alcohol and Tobacco	Restaurants and Hotels	Cultural Activities	Women Footwear	Men Footwear	Men Clothing	Women Clothing	Women Personal Care	Jewelry and Watch
	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F
All Children	1.870	3.17**	15.2**	7.64**	16.39**	4.71**	6.46**	145.16**	0.740
	0.096	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.593

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 11: Summary Results of the Rothbarth Method

Panel A: Rural

Adult Goods	**Discrimination Against Girls**				**Discrimination Against Boys**			
	0-4	5-9	10-14	15-25	0-4	5-9	10-14	15-25
Alcohol and Tobacco								X
Restaurants and Hotels		X						X
Cultural Activities								X
Jewelry and Watch			X					

Panel B: Urban

Adult Goods	**Discrimination Against Girls**				**Discrimination Against Boys**			
	0-4	5-9	10-14	15-25	0-4	5-9	10-14	15-25
Alcohol and Tobacco								X

Table 12: Engel Curves Showing the Effects of Composition on Selected Child Goods with Differencing Method, Rural

Panel A: Regressions

Dep. Variable:	**dBooks**	**dToys Games and Hobbies**	**dChild Footwear**	**dChild Clothing**	**dFruit and Vegetable**	**dMilk**	**dMeat**	**dEducation**	**dHealth**
	coef/t	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**	**coef/t**
dln *n*	0.000	-0.000	0.001**	0.003***	-0.007***	-0.000	0.018***	0.004***	0.007***
	(0.645)	(-0.831)	(2.053)	(4.904)	(-4.842)	(-0.175)	(8.638)	(5.376)	(5.018)
dratmale 0-4	-0.000	0.003***	0.010***	0.023***	-0.007	0.017***	0.013	-0.001	0.011
	(-0.302)	(7.315)	(5.753)	(8.530)	(-1.072)	(6.920)	(1.419)	(-0.334)	(1.636)
dratmale 5-9	0.003***	0.003***	0.016***	0.036***	-0.015**	-0.006***	0.021**	0.004	0.005
	(3.667)	(6.611)	(9.626)	(12.707)	(-2.369)	(-2.657)	(2.309)	(0.986)	(0.797)
dratmale 10-14	0.004***	0.001***	0.015***	0.031***	-0.000	-0.005***	0.013	0.017***	-0.008
	(4.450)	(3.083)	(9.200)	(11.653)	(-0.069)	(-2.634)	(1.407)	(4.295)	(-1.368)
dratmale 15-25	0.002***	0.000	0.000	-0.001	-0.007	-0.005***	-0.006	0.024***	-0.012**
	(2.824)	(0.737)	(0.323)	(-0.604)	(-1.407)	(-2.709)	(-0.785)	(6.954)	(-2.190)
dratmale 55±	-0.000	0.000	0.002**	0.001	0.032***	0.003**	0.025***	-0.007***	0.006
	(-0.214)	(1.090)	(2.248)	(1.191)	(8.091)	(2.299)	(3.976)	(-2.703)	(1.362)
dratfemale 0-4	0.002**	0.002***	0.010***	0.026***	-0.016**	0.014***	0.006	-0.006	0.013*
	(2.126)	(4.388)	(6.997)	(9.516)	(-2.250)	(6.069)	(0.675)	(-1.464)	(1.886)
dratfemale 5-9	0.004***	0.002***	0.015***	0.033***	-0.009	-0.004*	-0.002	0.006*	-0.002
	(4.291)	(4.055)	(9.633)	(11.444)	(-1.419)	(-1.911)	(-0.246)	(1.735)	(-0.375)
dratfemale 10-14	0.006***	0.001*	0.014***	0.029***	-0.001	-0.004*	-0.007	0.016***	-0.011*
	(5.272)	(1.716)	(9.296)	(10.675)	(-0.223)	(-1.851)	(-0.863)	(4.066)	(-1.799)
dratfemale 15-25	0.002***	0.000	0.000	0.000	-0.002	-0.000	0.001	0.022***	-0.005
	(2.944)	(1.021)	(0.080)	(0.249)	(-0.393)	(-0.038)	(0.069)	(5.927)	(-0.892)
dratfemale 26-54	0.002**	-0.000	0.001	0.003	0.017***	0.005***	0.015*	0.008**	-0.002
	(2.079)	(-0.108)	(0.889)	(1.397)	(3.221)	(2.994)	(1.747)	(2.202)	(-0.360)
dratfemale 55+	0.001	0.000	0.001	0.004***	0.030***	0.007***	0.025***	0.002	0.018***
	(0.969)	(0.300)	(1.050)	(3.073)	(6.488)	(4.753)	(3.545)	(0.657)	(3.656)
dd04	-0.000	0.000	0.000	0.000	0.002**	0.001***	0.005***	-0.001	-0.000
	(-1.116)	(0.327)	(0.284)	(0.260)	(1.999)	(3.149)	(2.909)	(-1.403)	(-0.256)
dd05	-0.000	-0.000	0.000	0.000	0.003**	-0.001*	-0.002	-0.002***	-0.001
	(-1.339)	(-0.765)	(0.003)	(0.553)	(2.239)	(-1.896)	(-1.210)	(-2.641)	(-0.576)
constant	-0.000***	-0.000***	0.001***	0.000	0.010***	0.002***	0.007***	-0.001***	0.003***
	(-3.213)	(-2.858)	(3.423)	(0.674)	(15.075)	(7.142)	(7.580)	(-3.414)	(4.954)

Panel B: F-tests

	dBooks	**dToys Games and Hobbies**	**dChild Footwear**	**dChild Clothing**	**dFruit and Vegetable**	**dMilk**	**dMeat**	**dEducation**	**dHealth**
	F/Prob>F	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**	**F/Prob>F**
0-4	5.73**	2.030	0.030	0.560	1.260	0.570	0.520	1.400	0.110
	0.017	0.154	0.854	0.454	0.263	0.452	0.472	0.238	0.744
5-9	0.340	7.72**	0.170	0.880	0.630	0.220	6.65**	0.530	1.560
	0.559	0.006	0.680	0.347	0.427	0.639	0.010	0.465	0.212
10-14	1.820	2.830	0.310	0.220	0.020	0.200	4.68**	0.000	0.230
	0.178	0.093	0.580	0.637	0.885	0.652	0.031	0.958	0.632
15-25	0.010	0.320	0.070	0.720	0.910	7.63**	0.810	0.370	1.780
	0.915	0.574	0.791	0.395	0.339	0.006	0.367	0.546	0.182
All Children	8.24**	11.27**	3.72**	3.39**	1.800	34.17**	2.73**	12.64**	5.16**
	0.000	0.000	0.002	0.005	0.110	0.000	0.018	0.000	0.000

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 13: Engel Curves Showing the Effects of Composition on Selected Child Goods with Differencing Method, Urban

Panel A: Regressions

Dep. Variable:	dBooks	dToys Games and Hobbies	dChild Footwear	dChild Clothing	dFruit and Vegetable	dMilk	dMeat	dEducation	dHealth
	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t
dln *n*	0.000	-0.000	0.001***	0.001***	-0.005***	-0.002***	0.016***	0.012***	0.007***
	(1.178)	(-0.631)	(3.722)	(2.956)	(-6.770)	(-7.940)	(13.529)	(15.109)	(6.576)
dratmale 0-4	-0.001	0.005***	0.009***	0.028***	-0.016***	0.019***	0.001	-0.007**	0.022***
	(-1.396)	(11.957)	(10.597)	(17.025)	(-5.162)	(17.444)	(0.215)	(-2.195)	(5.216)
dratmale 5-9	0.004***	0.004***	0.016***	0.037***	-0.011***	0.000	0.004	0.009***	0.014***
	(5.307)	(8.925)	(18.531)	(21.750)	(-3.752)	(0.077)	(0.898)	(2.699)	(3.457)
dratmale 10-14	0.005***	0.001**	0.015***	0.029***	-0.010***	-0.002**	-0.005	0.037***	-0.002
	(6.925)	(2.469)	(16.258)	(18.132)	(-3.487)	(-1.964)	(-1.085)	(10.453)	(-0.522)
dratmale 15-25	0.003***	-0.000	-0.000	0.001	-0.011***	-0.003***	-0.004	0.031***	-0.006*
	(5.417)	(-1.002)	(-0.718)	(0.664)	(-5.030)	(-4.048)	(-1.198)	(10.956)	(-1.947)
dratmale 55±	-0.001	-0.000**	-0.000	0.001	0.034***	0.002***	0.031***	-0.004*	0.009***
	(-1.261)	(-2.325)	(-0.435)	(0.759)	(18.089)	(4.654)	(9.663)	(-1.836)	(3.219)
dratfemale 0-4	0.000	0.004***	0.009***	0.025***	-0.019***	0.020***	-0.001	-0.005	0.019***
	(0.031)	(8.250)	(10.699)	(15.783)	(-6.064)	(18.488)	(-0.187)	(-1.637)	(4.338)
dratfemale 5-9	0.005***	0.002***	0.014***	0.038***	-0.010***	-0.000	0.002	0.010***	0.010**
	(6.429)	(4.584)	(14.565)	(22.607)	(-3.066)	(-0.114)	(0.343)	(2.927)	(2.455)
dratfemale 10-14	0.007***	0.001**	0.012***	0.029***	-0.005	-0.003***	-0.013***	0.032***	-0.002
	(8.184)	(2.219)	(13.476)	(17.656)	(-1.561)	(-3.170)	(-2.654)	(8.824)	(-0.431)
dratfemale 15-25	0.002***	0.000	-0.000	0.000	-0.003	-0.001**	-0.008**	0.025***	0.005
	(4.420)	(1.184)	(-0.618)	(0.329)	(-1.488)	(-2.396)	(-2.274)	(8.382)	(1.515)
dratfemale 26-54	0.000	0.000	0.000	0.001	0.014***	0.002***	0.006	0.009***	-0.001
	(0.156)	(1.150)	(0.398)	(1.312)	(6.215)	(3.200)	(1.637)	(2.946)	(-0.415)
dratfemale 55+	-0.000	-0.000	0.001***	0.002***	0.025***	0.005***	0.024***	0.001	0.016***
	(-1.247)	(-0.638)	(2.846)	(2.665)	(12.893)	(8.482)	(7.451)	(0.620)	(5.485)
dd04	-0.000**	0.000*	0.000	0.001**	0.001*	0.000	0.002	-0.001	0.001
	(-2.060)	(1.763)	(0.184)	(2.131)	(1.941)	(0.237)	(1.465)	(-1.560)	(1.191)
dd05	-0.001***	-0.000	-0.000	0.000	0.005***	0.000	-0.003***	-0.004***	-0.002***
	(-3.973)	(-0.712)	(-1.238)	(0.174)	(9.318)	(1.261)	(-2.980)	(-5.244)	(-2.576)
constant	0.000	0.000	-0.000**	-0.000	-0.004***	-0.001***	-0.003***	0.000	-0.002***
	(1.077)	(0.846)	(-2.500)	(-0.957)	(-13.546)	(-7.844)	(-5.268)	(0.887)	(-3.708)

Panel B: F-tests

	dBooks	dToys Games and Hobbies	dChild Footwear	dChild Clothing	dFruit and Vegetable	dMilk	dMeat	dEducation	dHealth
	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F
0-4	1.120	7.99**	0.040	1.870	0.640	0.660	0.130	0.290	0.680
	0.290	0.005	0.839	0.171	0.423	0.417	0.716	0.587	0.410
5-9	0.870	21.44**	4.72**	0.650	0.320	0.030	0.260	0.050	0.960
	0.350	0.000	0.030	0.419	0.569	0.869	0.613	0.820	0.327
10-14	1.560	0.370	6.8**	0.030	2.690	1.360	2.100	1.300	0.000
	0.212	0.542	0.009	0.861	0.101	0.243	0.147	0.254	0.946
15-25	1.550	7.07**	0.000	0.090	12.86**	3.440	1.100	3.180	15.71**
	0.213	0.008	0.961	0.765	0.000	0.064	0.295	0.074	0.000
All Children	35.13**	32.43**	14.98**	11.88**	4.46**	154.34**	2.74**	58.67**	12.51**
	0.000	0.000	0.000	0.000	0.001	0.000	0.018	0.000	0.000

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 14: Test for Gender Effects in Adult Goods, Differencing Method, Rural

Panel A: Regressions

Dep. Variable:	dAlcohol and Tobacco	dRestaurants and Hotels	dCultural Activities	dWomen Footwear	dMen Footwear	dMen Clothing	dWomen Clothing	dWomen Personal Care	dJewelry and Watch
	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t
dln *n*	0.002	-0.000	0.003***	0.001*	0.003***	0.009***	0.007***	0.001**	0.005***
	(1.057)	(-0.081)	(2.990)	(1.812)	(6.492)	(9.384)	(8.614)	(2.200)	(5.415)
dratmale 0-4	-0.096***	-0.028***	0.010**	0.003*	-0.004	-0.021***	0.012***	0.037***	-0.002
	(-10.831)	(-4.372)	(2.415)	(1.807)	(-1.575)	(-4.738)	(3.195)	(14.213)	(-0.456)
dratmale 5-9	-0.076***	-0.026***	0.013***	0.006***	-0.008***	-0.015***	0.014***	-0.000	0.002
	(-9.418)	(-4.307)	(3.204)	(3.846)	(-3.127)	(-3.518)	(4.166)	(-0.158)	(0.574)
dratmale 10-14	-0.093***	-0.035***	0.023***	0.006***	-0.001	-0.006	0.013***	-0.002	-0.003
	(-11.692)	(-6.242)	(6.129)	(3.825)	(-0.525)	(-1.492)	(4.147)	(-0.870)	(-0.861)
dratmale 15-25	-0.033***	-0.011**	0.010***	0.002*	0.003*	0.011***	0.007**	0.000	0.004
	(-5.016)	(-2.180)	(2.905)	(1.814)	(1.690)	(3.067)	(2.523)	(0.146)	(1.148)
dratmale 55+	-0.059***	-0.032***	-0.003	0.003**	-0.002	-0.004	0.006***	-0.002*	-0.000
	(-10.820)	(-8.535)	(-1.283)	(2.235)	(-1.478)	(-1.279)	(2.963)	(-1.807)	(-0.023)
dratfemale 0-4	-0.085***	-0.032***	0.005	0.006***	-0.007***	-0.013***	0.017***	0.033***	0.005
	(-9.955)	(-5.030)	(1.198)	(3.512)	(-2.672)	(-2.883)	(4.752)	(12.966)	(1.176)
dratfemale 5-9	-0.090***	-0.028***	0.018***	0.005***	-0.010***	-0.021***	0.021***	0.000	0.000
	(-10.763)	(-4.502)	(4.204)	(3.040)	(-4.011)	(-5.104)	(5.768)	(0.119)	(0.092)
dratfemale 10-14	-0.102***	-0.035***	0.020***	0.011***	-0.004	-0.019***	0.028***	0.002	0.001
	(-13.021)	(-5.912)	(4.756)	(6.688)	(-1.542)	(-4.412)	(8.237)	(0.791)	(0.299)
dratfemale 15-25	-0.101***	-0.033***	0.003	0.014***	-0.008***	-0.019***	0.047***	0.010***	0.003
	(-15.447)	(-6.484)	(0.776)	(9.130)	(-4.051)	(-5.641)	(14.931)	(5.680)	(0.870)
dratfemale 26-54	-0.101***	-0.057***	0.001	0.010***	-0.009***	-0.027***	0.030***	0.002	0.001
	(-14.095)	(-10.196)	(0.315)	(5.929)	(-4.079)	(-7.124)	(9.306)	(0.974)	(0.145)
dratfemale 55+	-0.114***	-0.061***	-0.002	0.007***	-0.007***	-0.021***	0.020***	-0.004**	0.002
	(-19.893)	(-14.006)	(-0.664)	(5.185)	(-3.714)	(-7.159)	(7.591)	(-2.189)	(0.398)
dd04	0.002	-0.002**	0.001	-0.000	-0.001*	-0.001	0.000	0.000	-0.001
	(1.368)	(-2.106)	(0.878)	(-0.200)	(-1.935)	(-1.535)	(0.706)	(0.356)	(-1.407)
dd05	0.005***	0.002	0.000	-0.000	-0.001	-0.002**	0.001*	0.000	0.000
	(3.256)	(1.595)	(0.404)	(-0.176)	(-1.542)	(-1.995)	(1.919)	(0.077)	(0.060)
constant	0.002***	-0.006***	-0.000	0.000*	0.002***	0.003***	0.001	-0.001***	0.001***
	(2.862)	(-10.285)	(-0.132)	(1.817)	(8.311)	(7.813)	(1.476)	(-5.054)	(3.709)

Panel B: F-tests

	dAlcohol and Tobacco	dRestaurants and Hotels	dCultural Activities	dWomen Footwear	dMen Footwear	dMen Clothing	dWomen Clothing	dWomen Personal Care	dJewelry and Watch
	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F
0-4	1.410	0.390	1.350	2.160	1.240	3.120	1.810	1.770	4.47**
	0.234	0.534	0.246	0.142	0.265	0.077	0.178	0.184	0.035
5-9	2.490	0.060	1.590	0.480	0.710	2.010	3.7**	0.070	0.440
	0.114	0.808	0.207	0.487	0.398	0.156	0.054	0.796	0.509
10-14	1.300	0.010	0.710	8.6**	0.770	7.58**	17.93**	2.650	2.330
	0.255	0.932	0.400	0.003	0.379	0.006	0.000	0.104	0.127
15-25	117.81**	22.21**	5.34**	77.62**	34.86**	70.15**	214.21**	35.99**	0.100
	0.000	0.000	0.021	0.000	0.000	0.000	0.000	0.000	0.748
All Children	2.19**	0.800	5.83**	4.37**	2.6**	3.52**	5.95**	88.11**	2.19**
	0.052	0.552	0.000	0.001	0.023	0.004	0.000	0.000	0.053

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 15: Test for Gender Effects in Adult Goods, Differencing Method, Urban

Panel A: Regressions

Dep. Variable:	dAlcohol and Tobacco	dRestaurants and Hotels	dCultural Activities	dWomen Footwear	dMen Footwear	dMen Clothing	dWomen Clothing	dWomen Personal Care	dJewelry and Watch
	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t
dln *n*	0.000	0.001	0.004***	0.001***	0.002***	0.008***	0.007***	0.001***	0.004***
	(0.144)	(1.089)	(5.634)	(4.820)	(6.358)	(11.969)	(12.147)	(4.134)	(7.029)
dratmale 0-4	-0.062***	-0.022***	-0.001	0.004***	-0.010***	-0.023***	0.009***	0.047***	-0.004
	(-13.160)	(-4.989)	(-0.543)	(3.048)	(-6.674)	(-8.379)	(3.514)	(27.661)	(-1.449)
dratmale 5-9	-0.068***	-0.030***	0.015***	0.005***	-0.008***	-0.015***	0.012***	0.003*	-0.004*
	(-15.041)	(-7.158)	(5.205)	(4.238)	(-5.985)	(-5.670)	(5.347)	(1.934)	(-1.924)
dratmale 10-14	-0.074***	-0.046***	0.020***	0.006***	0.002	-0.015***	0.006***	-0.002	-0.002
	(-17.347)	(-11.336)	(7.171)	(5.414)	(1.478)	(-5.612)	(2.649)	(-1.353)	(-1.015)
dratmale 15-25	-0.027***	-0.016***	0.009***	0.001	0.006***	0.010***	0.001	0.002*	-0.001
	(-8.040)	(-4.624)	(3.917)	(0.985)	(4.866)	(4.727)	(0.526)	(1.897)	(-0.702)
dratmale 55+	-0.047***	-0.047***	-0.006***	0.003***	-0.002**	-0.008***	0.004**	-0.001	-0.002
	(-17.057)	(-18.769)	(-3.508)	(3.594)	(-2.363)	(-4.737)	(2.558)	(-0.892)	(-1.149)
dratfemale 0-4	-0.065***	-0.032***	0.002	0.005***	-0.009***	-0.019***	0.011***	0.048***	0.003
	(-13.946)	(-7.271)	(0.742)	(4.131)	(-6.228)	(-6.813)	(4.511)	(28.874)	(1.288)
dratfemale 5-9	-0.063***	-0.031***	0.013***	0.006***	-0.009***	-0.020***	0.015***	0.003**	-0.004*
	(-13.509)	(-7.416)	(4.790)	(4.969)	(-6.313)	(-7.615)	(6.246)	(2.182)	(-1.663)
dratfemale 10-14	-0.075***	-0.041***	0.016***	0.012***	-0.008***	-0.022***	0.024***	0.003**	-0.000
	(-17.061)	(-10.031)	(5.601)	(10.254)	(-5.844)	(-8.481)	(10.031)	(2.213)	(-0.183)
dratfemale 15-25	-0.061***	-0.036***	-0.001	0.017***	-0.009***	-0.022***	0.050***	0.016***	-0.002
	(-18.647)	(-11.182)	(-0.585)	(16.271)	(-7.988)	(-10.626)	(23.546)	(14.281)	(-0.936)
dratfemale 26-54	-0.068***	-0.058***	-0.009***	0.013***	-0.010***	-0.025***	0.035***	0.010***	-0.005**
	(-19.972)	(-16.832)	(-4.043)	(12.618)	(-8.699)	(-11.364)	(15.315)	(8.453)	(-2.115)
dratfemale 55+	-0.083***	-0.073***	-0.011***	0.008***	-0.009***	-0.021***	0.021***	0.001	-0.002
	(-30.045)	(-27.089)	(-5.939)	(10.272)	(-9.329)	(-11.778)	(11.927)	(1.194)	(-1.096)
dd04	0.005***	0.001*	0.001	-0.000	-0.001***	-0.001*	0.000	-0.000	-0.000
	(5.556)	(1.706)	(1.209)	(-0.050)	(-2.784)	(-1.794)	(0.266)	(-0.618)	(-0.441)
dd05	0.005***	0.001	0.000	-0.001***	-0.001***	-0.003***	-0.001***	-0.001***	0.000
	(6.291)	(0.925)	(0.329)	(-2.827)	(-3.456)	(-5.557)	(-2.877)	(-2.638)	(0.054)
constant	-0.001*	0.002***	-0.000	-0.000	-0.001***	-0.002***	-0.000	0.000***	-0.001**
	(-1.738)	(5.172)	(-0.088)	(-0.944)	(-5.978)	(-5.719)	(-0.973)	(3.054)	(-2.093)

Panel B: F-tests

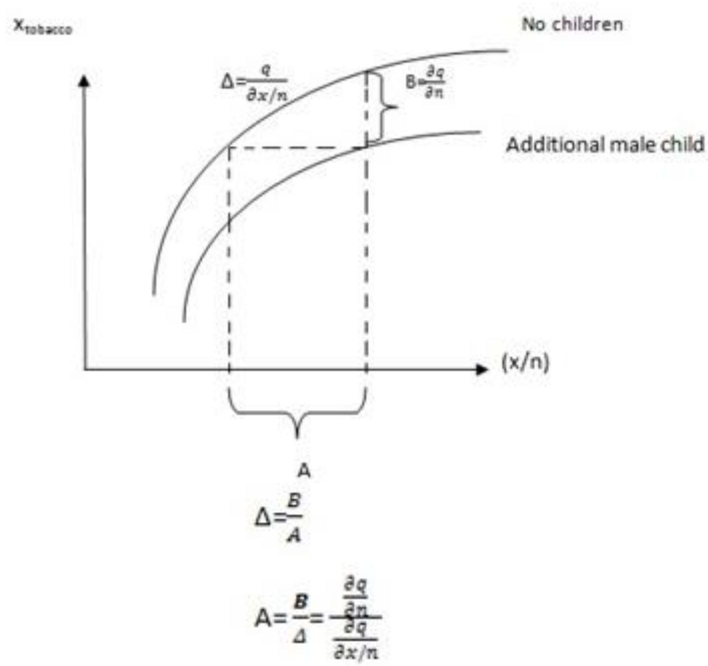
	dAlcohol and Tobacco	dRestaurants and Hotels	dCultural Activities	dWomen Footwear	dMen Footwear	dMen Clothing	dWomen Clothing	dWomen Personal Care	dJewerly and Watch
	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F	F/Prob>F
0-4	0.350	4.15**	1.530	1.330	0.300	2.490	0.950	0.310	7.73**
	0.552	0.042	0.217	0.248	0.585	0.114	0.329	0.581	0.005
5-9	0.980	0.080	0.330	0.560	0.480	3.94**	1.300	0.040	0.040
	0.321	0.781	0.568	0.456	0.490	0.047	0.253	0.849	0.840
10-14	0.040	1.330	1.630	25.81**	40.46**	6.79**	51.18**	11.4**	0.800
	0.833	0.248	0.202	0.000	0.000	0.009	0.000	0.001	0.370
15-25	113.83**	42.41**	21.22**	302.02**	154.12**	245.47**	714.52**	192.48**	0.100
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.746
All Children	2.85**	7.75**	18.52**	11.3**	15.68**	46.66**	12.01**	335.91**	2.92**
	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 16: Semiparametric Outlay-Equivalent Ratios, Turkey

	Males						Females					
Adult goods	**0-4**	**5-9**	**10-14**	**15-25**	**26-54**	**55+**	**0-4**	**5-9**	**10-14**	**15-25**	**26-54**	**55+**
Alcohol and Tobacco	-1.003	-1.004	-1.002	-1.023	-1.033	-1.011	-1.004	-1.003	-1.001	-1.003	-1.002	-1.011
Restaurants and Hotels	-0.996	-0.999	-1.003	-0.991	-0.984	-1.003	-0.999	-0.999	-1.001	-1.000	-1.005	-1.009
Cultural Activities	-0.989	-0.975	-0.969	-0.980	-0.990	-0.995	-0.987	-0.975	-0.973	-0.990	-0.996	-0.997
Women Footwear	-1.005	-1.000	-0.997	-1.012	-1.016	-1.007	-1.000	-0.999	-0.971	-0.948	-0.966	-0.989
Men Footwear	-1.000	-1.000	-0.963	-0.946	-0.967	-0.975	-1.000	-1.003	-0.998	-1.000	-1.002	-0.999
Men Clothing	-0.999	-0.990	-0.986	-0.962	-0.972	-0.979	-0.992	-0.996	-0.997	-0.997	-1.000	-0.996
Women Clothing	-0.997	-0.995	-0.999	-1.002	-1.005	-1.001	-0.994	-0.990	-0.981	-0.960	-0.973	-0.985
Women Personal Care	-0.867	-0.991	-0.997	-0.992	-0.994	-0.997	-0.867	-0.990	-0.989	-0.952	-0.974	-0.995
Jewelry and Watch	-0.995	-0.994	-0.995	-0.989	-0.988	-0.991	-0.983	-0.994	-0.989	-0.990	-0.995	-0.991

Figure 1: Intuition of Outlay Equivalent Ratio



CHAPTER 2

The Effect of Family Size on Child Development: The Use of Secondary Infertility as a Natural Experiment, Turkey

Abstract

Turkey, like some other middle income countries, is facing the problems of an aging population. As a response, the government has switched policy incentives to increase fertility rates; e.g, encouraging couples to have at least three children, enforcing severe restrictions on abortions, implementing tighter regulations on the purchase of birth control pills. If successful, these policies will reverse the decline in fertility rates. In light of these policy changes, it is critical to provide evidence of the quantity-quality tradeoff in children at the family sizes and incomes currently prevailing in Turkey. This study exploits secondary infertility, as an exogenous source of variation in family size. Using the Demographic and Health Survey of Turkey, I investigate the possible tradeoff in education outcomes that the first born child faces. I find a negative and significant relationship between the quantity (family size) and quality (education level completed) of the first born child in rural Turkey. In urban Turkey I find no evidence of a quality-quantity tradeoff. I show that urban households are significantly smaller than rural households. Particularly in single adult households, the child-care needs of younger siblings may lead first born children to be sent to school.

JEL Classifications: I31, J13, O15, N34.
Keywords: Quantity-quality tradeoff, child educational outcomes, child development, secondary infertility, Turkey.

1 Introduction

The effect of family size on child outcomes has been an issue of concern over the last four decades. The main argument is, poor child outcomes are mainly driven by high fertility rates (Becker and Lewis, 1973). A large number of siblings cause parents to lack resources for investing in the human capital of their children. Hence, an increase family size leads to situations where outcomes such as the health and education levels of the child remain low.[8] Many national and international agencies have stressed the importance of reducing family size to free up and channel resources in the form of human capital investments for children. Over the past 40 years, much development aid has been focused on family planning. For instance, the most recent report of United Nations Population Fund (UNFPA, 2012) declared family planning as a human right as well as a priority for economic development.[9]

However Turkey, like some other middle income countries, projects a rapidly aging population (See Figure 2). As a response, the government has switched policy to increase fertility rates; e.g, encouraging couples to have at least three children, enforcing severe restrictions on abortions, implementing tighter regulations on the purchase of birth control pills. If successful, these policies will reverse the decline in fertility rates. Therefore, it is critical to have evidence of the quantity-quality tradeoff at the family sizes and incomes currently prevailing in Turkey. Will the government's policies towards increasing the fertility rates lead to worse child outcomes?

This study examines the effect of an increase in the family size on first-born children's educational outcomes. I exploit secondary infertility, as an exogenous source of variation in family size developed by Agüero and Marks (2008).

[8] See Rosenzweig and Wolpin (1980); Garg and Morduch (1998); Rosenzweig and Zhang (2006); Booth and Kee (2009); Dayıoğlu, Kırdar and Tansel (2009); Filmer, Friedman and Schady (2010); Jensen (2012).

[9] For the online report visit http://www.unfpa.org/public/home/publications/pid/12511.

Secondary infertility shocks in this study are defined as the situation for those women who failed to conceive after having at least one child.

This study builds on the previous literature in a number of ways. Firstly, after having the first child, infertility can occur at any parity K>=1. Therefore, quantity-quality tradeoff can be examined starting from parity 1. The previous literature on the other hand used twinning or sex composition.[10] This limited their analysis to families that have at least two children. Secondly, this study is the first to my knowledge that uses this newly developed instrument to analyze the quantity-quality tradeoff in child educational outcomes. Thirdly, the rich data set used in this study allows an examination of educational outcomes, testing the validity of the instrument as an exogenous shock as well as to investigate the robustness.[11] Finally, Turkey is a representative of a number of upper middle income countries which may be abandoning or reversing low fertility policies in the face of aging populations. This study provides evidence of quantity-quality tradeoff in such countries.

In rural Turkey, my results indicate significant quality-quantity tradeoff in terms of additional siblings decrease grade advancement of the first-born but have no effect on school attendance. In urban Turkey I find no evidence of a quality-quantity tradeoff. I show that urban households are significantly smaller than rural households. Particularly in single adult households, the child-care needs of younger siblings may lead first-born children to be sent to school. These results are robust to controlling for birth order, family wealth index, and mother's education.

In an influential paper, Becker and Lewis (1973) generated the theoretical foundation of the quantity-quality tradeoff argument. Their model showed that

[10]See Rosenzweig and Wolpin (1980); Black, Devereux, and Salvanes (2005); Angrist, Lavy, Schlosser (2006); Cáceres-Delpiano (2006); Black, Devereux, and Salvanes (2007); Li, Zhang, and Zhu (2007).

[11]Previous studies made use of population censuses, which limited outcomes.

a decrease in the quantity of siblings will lead more resources to be allocated for each child. Hence, the average quality (quality as educational or health outcomes) of children will increase. Following this seminal model, many economists have developed alternative empirical models linking family size and child outcomes.[12] However, the challenge faced by the empirical studies is to measure the causal effect of increase in the number of children on child outcomes.[13] Omitted variables may exist that influence both family size and child outcomes. Therefore, to show the tradeoff between quantity (family size) and quality (child development) credible causal evidence is necessary for policy prescription.

Several studies have tried to find a causal impact in family size on child outcomes. Most of these studies have used twinning as an exogenous source of variation in family size. Rosenzweig and Wolpin (1980) compared the outcomes of single births and multiple births using household data from India. Black, Devereux, and Salvanes (2005), Angrist, Lavy, Schlosser (2006), Cáceres-Delpiano (2006), Black, Devereux, and Salvanes (2007) Li, Zhang, and Zhu (2007) are relatively more recent studies that exploited the same strategy in Norway, Israel, US and China respectively. Other studies have used the preference for mixed-sibling sex composition as a source of variation in family size. Angrist, Lavy, Schlosser (2005) and Black, Devereux, and Salvanes (2007) argued that families with two boys are more likely to increase their family size to obtain a girl or vice-verse. Except for Rosenzweig and Wolpin (1980) and Black et al. (2007), none of the existing studies that used twinning and mixed-sibling sex composition as an exogenous source of variation could support the quantity-quality trade-off hypothesis.

Rosenzweig and Zhang (2006), criticize the existing literature in number of

[12]See Rosenzweig and Wolpin (1980); Black, Devereux, and Salvanes (2005); Angrist, Lavy, Schlosser (2006); Cáceres-Delpiano (2006); Black, Devereux, and Salvanes (2007); Li, Zhang, and Zhu (2007).

[13]The reverse causality scenario would be family size as a choice variable in the sense that, families who see the quality of the first child might decide to have an additional child.

ways. They show that twins have lower birth weights (lower initial endowments). Therefore, if parents respond to initial endowments by reallocating resources, poorly endowed twin siblings can directly affect outcomes of the first-born child. Hence, twinning is an inappropriate instrument if one does not control for birth weights of the twins. Rosenzweig et al. (2006) and Qian (2009) point out the existence of household economies of scale for same sex and twin siblings. Therefore, households having twins will have different resources (given income and wealth) than households with two individual births. Agüero and Marks (2008) have developed a new exogenous source of variation in family size, secondary infertility, that is not subject to previous criticisms. They used this instrument to identify the causal relationship between family size and female labor supply in six Latin American countries. In this study, I adapt this instrument to analyze the quantity-quality tradeoff in child educational outcomes in Turkey.

This paper is organized as follows: the next section justifies infertility as an exogenous source of variation. Section 3 explains the data, the Turkish Demographic and Health Survey (DHS), that is used in this study. Section 4 presents the structure of the models and the applied econometric analysis. Section 5 provides the results and robustness tests. Finally, section 6 concludes.

2 Infertility

The medical definition of infertility is the inability to conceive after a year of regular intercourse without protection. This definition can be further divided into two categories: Primary infertility which describes the situation for women who have never been able to get pregnant. Secondary infertility describes the situation for those women who could successfully conceive at least once but were unable to conceive after. In this study, my focus will be on secondary infertility since the woman has to have at least one child in order to analyze the correlation with the family size and to investigate the quantity-quality tradeoff the child faces.

For secondary infertility to be a useful source of variation in the family size, it must be unrelated to unobservable determinants of investments in child quality. Fertility studies indicate that a woman's ability to conceive is highly heterogeneous. However, establishing the source of such heterogeneity remains unclear (Weinberg and Dunson, 2000). Except for the age of the mother, none of the existing studies agree on other factors that may affect infertility.[14] Buck et al. (1997), argue that lifestyle factors such as smoking, alcohol, caffeine, exercise, Body Mass Index (BMI) and drug use, contain few risk factors that may cause secondary infertility. Vilar (1993) examines the effect of stress and other environmental factors and concludes that "Until unified criteria are applied consistently, and systematically to evaluate environmental influences on human reproductive health, many cases of reproductive infertility will remain unexplained"(p.63). Joffe and Barnes (2000) show that a mother's predetermined characteristics (BMI, height, weight, and smoking habits) are not necessarily the main reasons for a woman's infertility. The next section provides additional evidence showing that predetermined characteristics of women and their first-

[14]See Buck, Sever, Batt, and Mendola (1997); Dunson, Baird, and Colombo (2004).

born children have no correlation with secondary infertility. Given this evidence, it is possible to treat secondary infertility as an exogenous shock.

3 Data

This study uses cross sectional survey data from Turkish Demographic and Health Surveys (DHS) obtained from U.S. Agency for International Development (USAID) for the years 1993, 1998 and 2003.[15] This data consists of standardized nationally representative questions for women between the ages 15 and 49. The survey questions contain information about the birth history, contraceptive use, fertility preferences, marital and health status of these women.

Two measures of secondary infertility are constructed from these self- reported surveys questions. Infertility 1 is equal to one if the woman states subfertility or infertility as a reason for not using contraceptives at the time of the survey (and zero otherwise). If the woman answers unable to get pregnant as a response to the desire for the further children infertility 2 is equal to one (and zero otherwise). Secondary infertile women are those who satisfy either condition. To keep with the medical definition of infertility, the sample includes non-sterilized women who are not using contraceptives at the time of these surveys.

Child investments are measured through information on education and health outcomes contained in DHS. Education measures are collected only for those aged between 6 and 14. Therefore, the quality indicator (education) concerns those women whose first-born child is between the ages of 6 and 14. The survey identifies two separate quality indicators. The first indicator, current school attendance, is generated as a binary variable. The second indicator is highest year of education / years of education completed.[16]

To summarize, the sample used in this analysis consists of non-twin first-born children between the ages of 6 and 14. The sample is restricted to children

[15]Further information about the DHS data can be found in the website http://www.measuredhs.com/.

[16]The highest year of education gives the years of education completed at four levels: no education, primary, secondary and higher.

whose mothers' age at first birth was between 15 and 40, who were not sterilized and were not using contraceptives at the time of the survey. Table 1 reports the summary statistics of this sample. The sample size of the children varies depending on the outcome variables. The biggest sample size is 1,909 in urban and 1,017 in rural Turkey. According to this sample, the average child has 83% probability of attending school in urban and 70% in rural Turkey. The highest year of education completed is 4 years on average for both urban and rural Turkey. The average number of children at home is 2.5 for urban and 3 for rural Turkey. On average, 5% of the women in this sample are categorized as secondary infertile and were 21 years old at the age of their first birth.

4 Methodology

4.1 Empirical Specification

The empirical specification to test the possible tradeoff in the child quantity and quality is given by

$$y_{i,j} = \alpha + \beta K_j + \gamma^{'} CHILD_{i,j} + \delta^{'} FAMILY_j + \varepsilon_{i,j}. \quad (1)$$

In this equation $y_{i,j}$ denotes measure of child development for the first-born child i of family j. In this study $y_{i,j}$ is the current school attendance and highest year of education completed. K_j is the number of children living at home, including the i'th child. β is the parameter of interest. A negative β indicates the tradeoff between quality $y_{i,j}$ and quantity K_j. Two sets of control variables are included in the model: $CHILD$ and $FAMILY$. The $CHILD$ vector contains age and gender of the child. The $FAMILY$ vector includes information about the mother: age at first birth, education, marital status, health status and survey year fixed effects. $\varepsilon_{i,j}$ is the error term related to the i'th child of family j.

Estimating equation (1) with Ordinary Least Squares (OLS) may cause biased β coefficients. As noted previously, family size may be a choice variable for the household. Therefore, the direction of the causality remains unclear. Instrumenting K_j with the infertility variable avoids this problem. Hence, in the first stage, the following equation is estimated

$$K_j = a_1 + bInfertility_j + \vartheta' CHILD_{i,j} + \theta FAMILY_j + \epsilon_{i,j}. \quad (2)$$

$Infertility_j$ is a dummy variable equal to one if the mother satisfies at least one of the Infertility measures (Infertility 1 and Infertility 2).

4.2 Validity of Infertility as an Exogenous Shock

The validity of the instrument, $Infertility$, depends on two requirements. First, exclusion restriction states that infertility and the unobserved variables $\varepsilon_{i,j}$ in equation (1) should be uncorrelated. Second is the strong correlation between $Infertility$ and K_j. The following section provides evidence of the exclusion restriction. Then, I examined the strong correlation between the instrument and the number of children at home.

Exclusion restriction requires the instrument, $Infertility$, to be uncorrelated with all possible unobservable variables that are included in the error term $\varepsilon_{i,j}$ in equation (1). Although, this requirement is untestable, I provide suggestive evidence to support this assumption.

The richness of the DHS data set allows me to test whether predetermined observable characteristics of first-born children from secondary infertile women differ significantly from fertile mothers. Predetermined characteristics refer to those characteristics that occurred before the mother realized her fertility status.[17] To test this hypothesis, the following equation is estimated

$$V_{i,j} = \theta_1 Infertile_j + \theta_2(1 - Infertile_j) + \sum_s \rho_s Age_{j,s} + \eta_{i,j}. \qquad (3)$$

This regression tests whether the predetermined characteristics of first-born children from secondary infertile mothers $V_{i,j}$ is significantly different from those born from still fertile mothers ($\theta_1 - \theta_2 = 0$), after controlling for age at first birth. Table 2 reports the estimation results and test statistics of equation (3). The results indicate that a mother's place of birth, ideal number of children, height, and miscarriage status do not vary with the infertility status. The child's sex and month of birth do not vary as well. The only variable that varies by infertility is

[17] Rosenzweig and Zhang (2006) conducted a similar analysis. They showed that mothers who gave twin births are not significantly different than those who gave two separate births after controlling for age.

current obesity status of the mother. Therefore, controlling for mother's weight, evidence indicates that infertility can be added as an explanatory variable as it satisfies the exclusion restriction.

The second requirement for instrument validity is the strong correlation with the number of children at home. Table 3 reports first stage estimation results. Point estimates indicate that infertility is strongly correlated with family size. In urban Turkey, a mother whose first-born child is between the ages of 6 and 14 will have 0.53 siblings fewer when she experiences secondary infertility. In rural Turkey, this effect is more pronounced, reducing the family size by 0.80. The Angrist-Pischke multivariate F-test of excluded instruments indicate that the instrument is powerful in both samples. In urban Turkey the F-test is 42.19 and in rural Turkey this magnitude is 33.41 with p-values of zero respectively. These results indicate that secondary infertility is a reasonable choice of instrument for family size. Therefore, infertility as a random shock can exogenously determine family size.

5 The Effect of Family Size on Children's Education

Table 4 Panel A and Panel B reports estimation results of equation (1) for both urban and rural Turkey, respectively. In Panel A column (i), OLS results show that in urban Turkey, an additional sibling decreases the probability of school attendance of the first-born child by 10%. OLS estimates in Panel A column (iii) indicate an additional sibling decreases the highest year of education attained by the first-born child to 13% in urban Turkey. OLS results for rural Turkey in panel B column (i) and (iii) indicate that increase in family size decreases school attendance of the first-born child by 12% and highest year of education attained by 8%.

Although OLS estimates are statistically significant, these results may be biased.[18] Hence, OLS estimates cannot be used as evidence of quantity-quality tradeoff. Columns (ii) and (iv) in Panel A report estimation results after number of siblings at home are instrumented using infertility. The Instrumental Variables (IV) results in column (ii) indicate that in urban Turkey, an additional child increases the probability of school attendance of the first-born child by 18%. This effect further contributes to the mean from 82% to 96% which is a very desirable level for urban Turkey. The reverse sign may be attributable to the time and family member constraints that mothers face in urban Turkey. In rural Turkey, it is usual that older family members reside in households and take care of children. However in urban Turkey, the small household composition means that fewer family members reside within the household. This may be the driving force for mothers to send older children to school in order to generate time for younger siblings. Summary statistics also supports this hypothesis. Family members other than mother and children are 1.53 in urban households

[18] Family size may be a choice variable for the household. Therefore, the direction of the causality remains unclear.

while in rural households it is 2.6. Subtracting the father from the household variable further decreases the available family members to 0.5 in urban and 1.6 in rural. Rejection of the possibility of under identification and weak instruments once again supports the strength of the instrument used. The effect of family size on school attendance of the first-born child is insignificant for rural Panel B, column (ii).

The result in Panel B column (iv) indicates that in rural Turkey, an additional sibling decreases the highest year of education attained by 40%. The average years of schooling, 4.5 years, or almost half a year loss in educational attainment, is substantial for child quality. The rejection of the possibility of under identification and weak identification once again supports the validity of the instrument used. These results are robust after controlling for birth order, wealth index of the family, and education of the mother. Black et al. (2005), Angrist et al. (2006) and Qian (2009) failed to show tradeoffs between quantity and quality when considering school related outcomes. In this study, infertility as an instrument demonstrates a highly significant negative relationship between the number of siblings and the highest year of education completed by the first-born child in rural Turkey. Hence, this result can be taken as strong evidence of a quantity-quality tradeoff in rural Turkey. In urban Turkey, on the other hand, the effect of family size on highest year of education attained is insignificant; Panel A, column (iv).

6 Conclusion

Turkey is a representative of a number of upper middle income countries which may be abandoning or reversing low fertility policies in the face of aging populations. This study provides evidence of quantity-quality tradeoff for which policies aim to increase fertility rates in family sizes and incomes currently prevailing in Turkey. Turkish Statistics Institute (TurkStat) President Birol Aydemir (2013) presented two alternative scenarios in population dynamics. In the first scenario the fertility rate starts to increase steadily from its actual level of 2.0 to 2.5, and in the second projection it would move to 3.0 by 2050. However, the extra number of people of working age by 2035 only amounts to 500,000 in the first scenario and 750,000 in the second. Obviously, the contribution of the three-child policy towards solving the aging population problem would remain modest. Instead, this study indicates that increase in family size has reverse effects on child development. This paper exploits secondary infertility as an exogenous source of variation in family size. In urban Turkey I find no evidence of a quality-quantity tradeoff. I show that urban households are significantly smaller than rural households. Particularly in single adult households, the child-care needs of younger siblings may lead first-born children to be sent to school. On the other hand, these findings show a strong causal relationship between additional siblings and school performance in rural Turkey. Increasing the family size significantly decreases the level of education attained by the first-born child by 40%. Taking into account that the average education in rural areas is 4.5 years, half a year of loss in educational attainment has serious implications for child quality.

Putting women and children at the core of the development process especially in the least developed areas is not only the right thing to do, but also a smart thing to do economically. In the uneducated, poorer areas, individual development of women and children will not only close the development gap between rural and urban families but will also become a long-term driver for a nation's development. That, in turn, will translate into competitiveness with other developing countries. Increasing fertility rates will lead nations such as Turkey to fall behind some developing countries that, over the past decade, enjoyed strong economic growth, resulting in widening inequality. Effects of family size, hence, rivalries for family resources in populated families such as rural ones, will be reduced by lifting time and credit constraints faced by parents. Instead of trying to convince families to have more children through financial incentives or taking preventive measures that will stop family planning, investments in human capital in areas that are least developed will translate into long run economic development of the nation.

Table 1: Summary Statistics

Panel A: Children's Characteristics

	Urban Turkey					Rural Turkey				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
School Attendance (=1)	1,909	0.829	0.376	0	1	1,017	0.694	0.461	0	1
Years of Schooling	1,583	4.234	1.313	0	8	706	4.550	1.072	0	6
Age (years)	1,909	9.764	2.573	6	14	1,017	9.866	2.594	6	14
Girl (=1)	1,909	0.491	0.500	0	1	1,017	0.491	0.500	0	1
No. Children at Home	1,909	2.517	1.214	1	10	1,017	3.187	1.574	1	11

Panel B: Mother's Characteristics

Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Infertility	1,909	0.057	0.231	0	1	1,017	0.045	0.208	0	1
Age at First Birth	1,909	21.632	4.092	16	39	1,017	20.736	3.442	16	36
No Education	1,909	0.171	0.376	0	1	1,017	0.306	0.461	0	1
Incomplete Primary	1,909	0.049	0.215	0	1	1,017	0.072	0.258	0	1
Complete Primary	1,909	0.517	0.500	0	1	1,017	0.556	0.497	0	1
Incomplete Secondary	1,909	0.102	0.302	0	1	1,017	0.040	0.197	0	1
Complete Secondary	1,909	0.109	0.312	0	1	1,017	0.022	0.146	0	1
Higher Education	1,909	0.053	0.224	0	1	1,017	0.005	0.070	0	1
Underweight (=1)	1,909	0.006	0.079	0	1	1,017	0.007	0.083	0	1
Normal Weight (=1)	1,909	0.163	0.369	0	1	1,017	0.233	0.423	0	1
Preobese (=1)	1,909	0.171	0.376	0	1	1,017	0.221	0.415	0	1
Obese (=1)	1,909	0.660	0.474	0	1	1,017	0.539	0.499	0	1

Note : Sample includes first-born children and those whose mothe's age at first birth was between 15 and 40 year of age and were not using contraceptive, nor sterilized at the time of the survey.

Table 2: Women's and Children's Characteristics by Fertility Status

Characteristics (V_{ij})	Mother born in city (=1)	Child's sex (Female=1)	Child's month of birth	Mother's ideal number of children	Mother's ideal number of boys	Mother's ideal number of girls	Mother is obese (=1)	Mother's height	Ever had a miscarriage
Infertile (θ_1)	0.221*	0.305**	6.010***	2.893***	1.076***	0.917***	1.166***	(dropped)	0.413***
	(1.789)	(2.139)	(5.388)	(10.314)	(3.479)	(3.269)	(31.911)	.	(2.822)
Fertile (θ_2)	0.260**	0.343**	5.997***	2.760***	0.975***	0.861***	0.945***	-1.335	0.418***
	(2.091)	(2.480)	(5.510)	(10.242)	(3.208)	(3.148)	(33.143)	(-1.395)	(2.926)
$\theta_1 - \theta_2 = 0$	2.380	0.790	0.000	1.690	0.930	0.400	53.650	1.950	0.010
Prob > F	(0.123)	(0.373)	(0.964)	(0.194)	(0.334)	(0.528)	(0.000)	(0.163)	(0.904)

Note : t-statistics in paranthesis (*** p<0.01, ** p<0.05, * p<0.1). Control Variables include women's age at first birth.

Table 3: First Stage Results for Children Between 6 and 14

Dependent Variable: Number of Children (K_j)		
Coefficient	Urban (i)	Rural (ii)
Infertility	-0.532***	-0.819***
	(-6.496)	(-5.780)
Angrist-Pischke multivariate F test of excluded instruments		
F(1, 1273)	42.19	33.41
P > F	0.00	0.00
Shea's R^2	0.017	0.022
N	1,909	1,017

Note : t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Estimates efficient for arbitrary heteroskedasticity and clustering on cluster number of the sample point. Statistics robust to heteroskedasticity and clustering on cluster number of the sample point. All regressions include controls for child's age,sex, mother's education, marital status, age at first birth, mother's health status (a set of binary variables representing underweight, overweight and obese), household wealth index and survey fixed effects.

Table 4: Effect of Family Size on Education Outcomes

Panel A: Urban

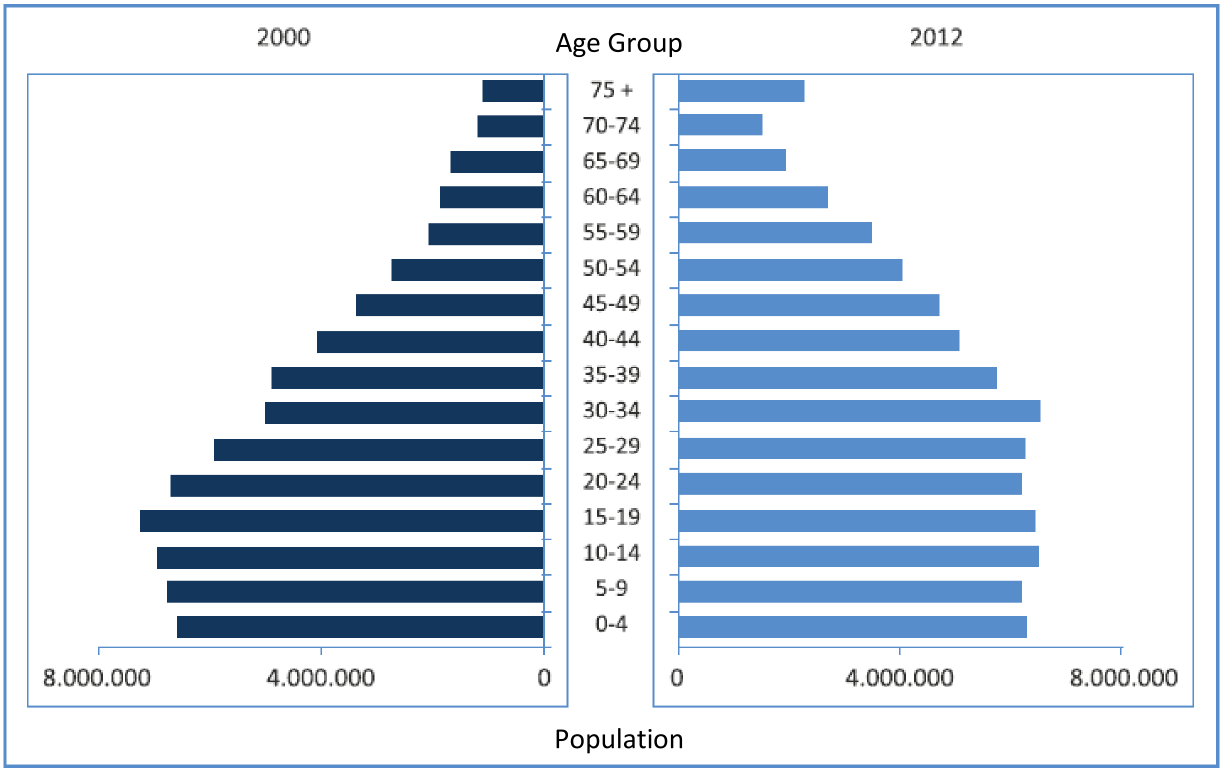
	Impact of Sibship on School Attendance (6-14 Sample)		**Impact of Sibship on Schooling (6-14 Sample)**	
Dep. Variable:	Current School Attendance		Highest Year of Education	
	OLS	**IV**	**OLS**	**IV**
	(i)	(ii)	(iii)	(iv)
Total number of children at home	-0.104***	0.181**	-0.133***	-0.323
	(-9.449)	(2.070)	(-3.782)	(-1.281)
N	1,909	1,909	1,583	1,583
Under Identification Test				
Kleibergen-Paap rk LM statistic		30.879		24.579
Chi-sq(1) P-val		<0.001		<0.001
Weak Identification Test				
Cragg-Donald Wald F statistic		32.698		27.071
Kleibergen-Paap rk Wald F statistic		42.195		35.907
Hansen J statistic		just identified		just identified

Panel B: Rural

	Impact of Sibship on School Attendance (6-14 Sample)		**Impact of Sibship on Schooling (6-14 Sample)**	
Dep. Variable:	Current School Attendance		Highest Year of Education	
	OLS	**IV**	**OLS**	**IV**
	(i)	(ii)	(iii)	(iv)
Total number of children at home	-0.127***	0.122	-0.081*	-0.376***
	(-9.848)	(1.281)	(-1.816)	(-2.624)
N	1,017	1,017	706	706
Under Identification Test				
Kleibergen-Paap rk LM statistic		18.012		10.575
Chi-sq(1) P-val		<0.001		0.0011
Weak Identification Test				
Cragg-Donald Wald F statistic		22.735		12.544
Kleibergen-Paap rk Wald F statistic		33.413		18.377
Hansen J statistic		just identified		just identified

Note : t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Estimates efficient for arbitrary heteroskedasticity and clustering on cluster number of the sample point. Statistics robust to heteroskedasticity and clustering on cluster number of the sample point. All regressions include controls for child's age, sex, mother's education, marital status, age at first birth, mother's health status (a set of binary variables representing underweight, overweight and obese), household wealth index and survey fixed effects.

Figure 2: Population Pyramid, Total, Turkey, 2000, 2012



Source: TurkStat

CHAPTER 3

The Effect of Family Size on Child Health Outcomes: Evidence from Turkey

Abstract

Due to a rapidly aging population, the Turkish government has switched policy incentives to increase (rather than to decrease) fertility rates. If successful, these policies will reverse the decline in family size. The quality-quantity tradeoff theory indicates that in economies in which budget and time constraints bind, children become rivals for family resources. Hence, an increase in family size may have negative effects on child health outcomes. In this study I examine the effects of family size on health outcomes in Turkey. I also study the consequence of having relatively more sisters than brothers. Having more sisters can result from a birth stopping rule (conceiving children until a male child is born). I find that family size has significant negative effects on child health outcomes both in urban and rural Turkey. Furthermore, I also find that in rural Turkey, having more sisters substantially reduces the health status of children. While the impacts are large, the results do not differ significantly by gender, i.e., both boys and girls are affected negatively by having more sisters. Results are more pronounced for poorer households and low educated mothers.

JEL Classifications: I14, I15, I31, N34, O12.
Keywords: Quantity-quality tradeoff, child health outcomes, child development, Turkey.

1 Introduction

The effect of increasing family size on child outcomes has been an issue of concern over the last four decades. The main argument is that poor child outcomes are mainly driven by high fertility rates (Becker and Lewis, 1973). In other words, a large number of siblings can cause parents to lack resources for investing in the human capital of their children. This leads to situations in which outcomes such as the health levels of children remain low. Turkey, like many other middle income countries, projects a rapidly aging population (See Figure 2). As a response, the government has switched policy incentives to increase fertility rates, i.e., incentives for three children, enforcing severe restrictions on abortion, implementing tighter regulation on the purchase of birth control pills. If successful, these policies will in part reverse the decline in family size. As the quantity-quality tradeoff studies also explain, increasing family size reduces the available resources that children can consume in a household (Becker and Lewis, 1973; Garg and Morduch, 1998; Jensen, 2012). Rivalries for family resources in populated families leads to malnourished children whose vulnerability to diseases increases dramatically (Dancer and Rammohan, 2009). Hence such effects on health outcomes may translate to long term extensive effects on a child's mental, physical and cognitive development. Therefore, it is critical to have evidence of the quantity-quality tradeoff at the family sizes and incomes currently prevailing in Turkey. This study examines the effect of an increase in the family size and the sex composition of the children on anthropometric outcomes at age and parities using Turkey's Demographic and Health Survey (DHS). The question is, will government policies towards increasing fertility rates lead to worse child health outcomes?

As the literature review will reveal, this study improves upon the existing literature on the following grounds. First, while most of the studies analyze the effect of family size on child's educational outcomes, only a handful of papers analyze the effects on long term outcomes, effects on child health. Second, while the quantity-quality tradeoff studies applied to lower middle income countries, upper middle income countries seem to be neglected. This study expands the range of countries for which evidence of poor health outcomes caused by high fertility rates by including Turkey, which is classified among upper middle income class. Third, this is the only current work for Turkey to my knowledge that has analyzed the effect of family size on child health outcomes since the 1980's (Cerit and Unalan, 1988). Furthermore, Turkey is a representative of a number of upper middle income countries which may be abandoning or reversing low fertility policies in the face of aging populations. I provide evidence of the quantity-quality tradeoff in such countries.

In urban and rural Turkey, my results indicate that an additional sibling decreases both age adjusted weight and age adjusted height significantly. Furthermore, I find that in rural Turkey, having more sisters substantially reduces the health status of children. While the impact of family size and sibling composition is large overall, there is little evidence in differences by gender. In rural Turkey, although interaction terms revealed no gender differences, test statistics once more indicate the negative impacts of the sisters variable on the health status of the children. One reason for this is that in a patriarchal Muslim country like Turkey, low educated and less developed rural areas practice the birth stopping rule, i.e., giving birth until a male child is conceived. Hence, in such populated families with pro male bias, both boys and girls are affected negatively by having more sisters. Further analysis in this study shows that families whose first born child and consecutive child are girls, leads them to increase the family size hence, increase the population. Results are more pronounced for poorer households and low educated mothers. Analysis on extreme health outcomes also indicate that additional children and the sex composition of these children significantly worsens the health status of children both urban and rural Turkey.

The remaining of this study is organized as follows: The next section provides a literature review exploring the quantity-quality tradeoff. Section 3 explains the data used in the study. Section 4 presents the empirical methodology used. Section 5 presents the results. Section 6 concludes.

2 Literature Review

In an influential paper, Becker and Lewis (1973) generated the theoretical foundation of the quantity-quality tradeoff argument. Their model showed that a decrease in the quantity of siblings leads to an allocation of more resources for each child. Hence, the average quality (quality as educational or health outcomes) of children will increase. Following this seminal model, many economists have developed alternative empirical models linking family size and child outcomes. While much of the literature examines the effect of family size on child educational outcomes (see Rosenzweig and Wolpin, 1980; Bauer and Gang, 2001; Black, Devereux, and Salvanes, 2005; Angrist, Lavy, and Schlosser, 2006; Cáceres-Delpiano, 2006; Rosenzweig and Zhang, 2006; Black, Devereux, and Salvanes, 2007; Li, Zhang, and Zhu, 2007; Booth and Kee, 2007; Dayıoğlu, Kırdal, and Tansel, 2009; Monstad, Propper, and Salvanes, 2008; Qian, 2009; Åslund and Gronqvist, 2010; Zaim[19], 2014), only a handful of papers have focused on child health outcomes. A study of national-level survey data from a range of developing countries presents little evidence of an anti-female bias in child nutrition using anthropometric measures (Marcoux, 2002). This is consistent with the findings of Basu for South Asia (1993), Pelletier for Africa, Asia and Latin America (1998), and Mishra et al. for India (2004) who find no evidence of gender discrimination in child nutritional outcomes. Agüero and Marks in Latin America (2008) and Jensen in India (2012) looked for a causal impact in family size on child outcomes, using secondary infertility as a valid instrument. They found a negative relation between quantity and quality of children for health indicators.

Studies that used intrahousehold resource allocations to detect gender bias in medical expenditures did not find evidence of gender difference in rural areas

[19] Unpublished manuscript

of India (see Deaton and Subramanian, 1991; Kingdon, 2005; Ziemmermann, 2012). Burgess and Zhuang (2000), Gong, Soest, and Zhang (2005) also did not find any evidence on gender differentials in intrahousehold resource allocations in child mortality rates for China. Although the excess mortality of females is well-established in India and China, there is an ambiguity in the empirical literature over whether there are any gender disparities in child nutritional outcomes. Zaim[20], 2012 on the other hand find gender bias in medical expenditures where families favor boys in rural Turkey.

A large number of studies explain such quantity quality tradeoff by linking improvements in maternal education (Behrman, 1988a; Strauss, 1990; Thomas, Strauss, and Henriques, 1991; Glewwe, 2000) to better nutritional outcomes. Few studies that examined the link between maternal autonomy and infant mortality (Kishor, 1993; Murti, Guio, and Dreze, 1995; Dancer, 2009) or access to health care (Bloom,Wypij, and Das Gupta, 2001; Maitra, 2004). However, this strand of research did not establish strong evidence in terms of mothers' status on child health outcomes.

Existing studies that have analyzed the determinants of child nutritional outcomes in Turkey have concentrated on labor markets (Berik and Bilginsoy, 2000). The current study is particularly important in showing mothers' participation in the labor force as unpaid agricultural family labor increases the relative survival chances of girls. Although there are studies which examine the differences in medicare provisions to girls and boys as in Aksit (1989), Cerit and Unalan (1988), none suggest significant gender difference. In a similar vein, Hancıoğlu's (1994) work with the Turkish Demographic and Health Survey of 1993 on infant child mortality and morbidity is also inconclusive on the existence of gender bias.

Becker (1991) generalized the pure investment model which allowed imper-

[20]Unpublished manuscript

fections in capital and labor markets. As a consequence of binding constraints, children become rivals for families' available funds and time. According to this model, where market constraints bind, children who have higher intrinsic values compared to their siblings fare better. The hypothesis was, societies that have strong pro-male biases and families with relatively more girls than boys might have better outcomes for the girls compared to families with more boys. On the other hand, it is a puzzle because a large body of evidence for developing countries suggests that, if the first-born child is a girl, parents will continue to procreate until a son arrives, while they tend to stop otherwise (Jayachandran and Kuziemko, 2009; Karbownik and Myck, 2011). This leads to situations in which children of families highly populated by girls fare worse compared to children of less populated households due to presence of a male child. Hence, Turkey, known to be a traditional patriarchal society having strong male bias, apart from the effect of family size, this study also shows the direction of the effect of sibling composition on child health outcomes. Except Garg and Morduch (1998) for Ghana, most of the studies however, have not specifically investigated the role of family size and sibling rivalry on the health status of surviving children, despite in a region where female socio-economic status is considered to be poor. This paper considers these issues using a rich demographic and health survey from Turkey, focusing not only on the family size, but also on the place of gender in terms of whether having children with relatively more brothers than sisters is healthier or vice verse.

3 Data

This study uses cross sectional survey data from Turkish Demographic and Health Surveys (DHS) obtained from U.S. Agency for International Development (USAID) for the years 1993, 1998 and 2003.[21] This data consists of standardized nationally representative questions for women between the ages 15 and 49. This data consists of standardized nationally representative questions for women between the ages 15 and 49. The survey questions also include information about birth history, contraceptive use, fertility preferences, marital and health status of these women. Since sterilization or the use of contraceptives directly constrains family size, the sample includes non-sterilized women who are not using contraceptives at the time of the survey. The data set also contains a rich set of questions on the households' demographic characteristics.

Child development information from the survey is also relevant to this paper. DHS asks a detailed set of questions to the mother about information regarding the child health status of children born five years before the survey is taken. Questions regarding child development are, in particular, prenatal care, the delivery of the baby, vaccination conditions, current and past medical illnesses and breastfeeding practices. The two anthropometric measures that will be used as key indicators for health outcomes (dependent variables) are taken for children present in the household at the time of the survey. These are information about age-adjusted height (measure of stunting) and age-adjusted weight (a measure of underweight).[22] Low age adjusted height indicates growth faltering. As stunting reflects not being able to receive enough nutrition for a long period of time, height for age represents long term indication of malnutrition of the child

[21]Further information about the DHS data can be found on the website: http://www.measuredhs.com/.

[22]The measures of age-adjusted height and age-adjusted weight are calculated using the CDC Standard Deviation-derived Growth Reference Curves derived from the NCHS/FELS/CDC Reference Population (USAID Recode book).

which does not depend on recent nutrition intake. According to World Health Organization (WHO) (1978), children whose height for age is -2 standard deviations below the reference median are characterized as stunted and chronically malnourished while -3 standard deviations below the reference median are considered as stunted.[23] Low weight for age indicates mixed long term and short term effects. Low weight for age represents a short term measure since it responds quickly to nutrition intake. Rosenzweig and Zhang (2006) explained that twins generally have lower birth weights (lower initial endowments). Hence, if parents respond to initial endowments by reallocating resources, poorly endowed twin siblings can directly affect outcomes of the first born child. Therefore the data set that I use for analysis excludes twin births. Both of the anthropometric measures are expressed in standard deviations from the reference median.

To summarize, the sample used in our analysis consists of non-twin children under the age 6. The sample is restricted to children whose mother's age at first birth was between 15 and 40, who were not sterilized and were not using contraceptives at the time of the survey. Restricting the sample to a non random subgroup of the population affects the extrapolation of the results. However, this sub-sample that I use, women who are not controlling their fertility status, are those who are targeted by policy makers and international organizations that target family planning. Therefore, the gains from the sample selection, i.e., testing the quantity-quality tradeoff in this particular sample is likely to be higher than its cost, i.e., shortage of national representability of the results. The summary statistics of this sample is presented in Table 1. Panel A lists summary statistics for children and household demographics while panel B provides summary statistics for mothers' characteristics. The sample consists of 3,230 observations in urban Turkey and 2,283 observations in rural Turkey. The

[23]See Dibley et al. (1987) for more detailed explanation for National Center for Health Statistics/Centers for Disease Control growth reference curves measures to be used as an international growth reference.

sample indicates that the gap between the anthropometric variables differ significantly for children in the urban and rural samples. While weight for age is -0.21 standard deviations below the reference median in urban, this measure is twice as low in urban Turkey, -0.48. Additionally,height 6% in the urban areas are underweight while in rural areas, 10% of children in this age group are underweight. Similarly, while height for age is -0.60 standard deviations below the reference median in urban Turkey, this measure decreases extensively in rural Turkey, -1.0. Malnourished children in urban areas are 15% while in rural areas, 22% of the sample. Similarly, stunted children in urban areas are 4% while in rural areas this number is 8% in our sample. Clearly, anthropometric variables indicate a strong difference in terms of being more severe in child health development across regions in rural areas. The portion of girl and boy child is equally split in both samples, 0.5. In the large sample including the age until 15, families whose first two births are girls captures 48% in urban areas and 53% of rural Turkey. The number of children at home is 2.5 in urban Turkey while this number is higher for rural Turkey, 3. The total number of sisters in urban and rural Turkey is 1.2 and 1.5, respectively, indicating the dominance of brothers in the household.

Panel B indicates that while mothers' anthropometric measures do not differ significantly in urban and rural areas, educational attainment differs significantly. While the probability of having limited education is 78% in urban, this number is 95% in rural Turkey. As primary education is mandatory, mothers who completed primary education in our sample is 50% in both urban and rural Turkey. However as the completion of educational phases increase, the gap between urban and rural widens significantly. While 10% of the urban sample has completed secondary education, in rural areas mothers who completed secondary education is only 2%. Similarly, while higher educated mothers are 3%

in the urban sample, this size is almost zero in the rural sample.

4 Methodology

The analysis is based on health outcomes of children controlling for a given household structure. Suppose that the health outcomes of children, in our case weight for age and height for age, h is determined as a production technology function

$$h_i = f(W_j, Z_j, X_i, \varepsilon_i) \tag{1}$$

where W_j is the variable of interest, size and composition of siblings, Z_j consists of household and parental characteristics (such as household size, mother's health status, education level), X_i is the vector of child characteristics (such as age and sex) of child i, and ε_i is the error term that effects child health outcomes. However W_j may be endogenous for number of reasons. The first reason is that a variable may be omitted or there may be a reverse causality problem. Reverse causality may occur if family size is a choice variable in the sense that, families who see the quality (quality as educational or health outcomes) of the first child might decide to have an additional child. The omitted variable bias would occur if variables may exist that influence both family size and child outcomes; for example, when parents who care more about the health of their children prefer to have fewer children. The second reason for endogeneity may also be due to the presence of temporary offspring and mobility of these children. Empirical studies faced the challenge of solving the first problem in order to measure the causal effect of increase in the number of children on child outcomes. The sample of anthropometric variables collected in the DHS surveys prohibited finding a valid instrument for the exogenous source of variation in family size. The DHS contains information on anthropometric measures for children that are at most 5 years old prior to the survey. Therefore, the tight birth spacing and hence low variation in family size enabled me and existing studies to find convenient instruments for this model. Therefore, it is hard to solve the first problem of endogeneity due to the structure of the existing data. However, this study solves the second endogeneity problem. Due to the mobility of the offspring I instrument siblings residing at home with the total number of siblings ever born. An alternative approach would be to estimate a reduced form equation that excludes these potentially endogenous variables. However, my interest is in how parents act given their current constraints. Therefore, I follow standard approaches in empirical studies of consumer behavior and hence, condition on the present structure of the household. I follow a similar model that Garg and Morduch (1998) used to estimate the main equation:

$$H_{ij} = \alpha_0+\alpha_1 N_j+\alpha_2 Z_j+\alpha_3 X_{ij}+\alpha_4 S_{ij}+\alpha_5 S_{ij}^2+\sum_{sex}\sum_{age}\alpha_{as} Sex_{ij} Age_{ij}+\eta_j+\varepsilon_{ij} \tag{2}$$

where H_{ij} quality indicator, i.e., health status of child i in household j. N_j is total number of children at home in household j. In this equation, α_1 is the parameter of interest. A negative α_1 indicates the tradeoff between quality $H_{i,j}$ and quantity N_{ij}. The rest of the control variables are: X_{ij}, a vector of child specific characteristics such as age and sex, Z_j is a vector containing household characteristics such as education level of the mother, Body Mass Index of the mother (BMI), height of the mother. I also included wealth index of the household to control for the effect of sibling composition of the household on total available household resources. S_{ij} is the number of sisters living at home. η_j contains the survey year fixed effects and finally ε_{ij}, is individual specific errors. Equation (2) is a linear approximation to a fundamentally nonlinear relationship. Therefore, I estimate the above equation with a quadratic term in the number of siblings, S_{ij}^2, and without the “one brother” dummy variable. The main conclusions are robust to these permutations.

I estimate the latter equation for both quality indicators, weight for age and height for age, using two alternate techniques: Ordinary Least Squares (OLS) and Instrumental Variable (IV). The advantage of the OLS estimation is that it allows me to take advantage of the entire range of information on both anthropometric measures. However in the estimation process, this equation does not include children who are not present temporarily or permanently in the household. Hence, results that are based on number of children residing in the household would indicate short term concerns of the household. The richness of the DHS data set allows me to examine those children in particular who are no longer present in the household. Total children ever born (alive), number of sisters ever born, and quadratics of sisters' variable are used as instruments for number of children, number of sisters at home and quadratics of sisters at home, respectively. By instrumenting these variables, I also control for endogeneity caused by the choice of who leaves the house and who enters the household. To test gender bias in health outcomes, sex dummy (female=1) is interacted with total number of children at home, total number of sisters at home and total number of sisters squared. In the last section, I use the first specification, pooled OLS, to estimate equation (2) for three extreme health outcomes extracted from the previous independent variables, weight for age and height for age: underweight, malnourishment and stunted, respectively.

To provide suggestive evidence that parents practice birth stopping rule, I estimate the following equation:

$$N_j = (first\ two\ children\ are\ girls)_i^{'}\gamma_1 + \gamma_2 Z_j + \eta_{ij} \qquad (3)$$

where N_j ,Z_j and η_{ij} are the same parameters as previously. γ_1 is the parameter of interest. Positive values of γ_1 coefficient indicates that families who conceive two girls at the first two births consecutively tend reproduce and which leads to more crowded families. As the sample gets smaller for the analysis of the first two born female children, I estimate this equation for all children that are at most 15 years old not to lose observation and precision of the results.

5 Results

5.1 Results on Anthropometric Variables

Table 2 and Table 3 give the estimation results for weight for age and height for age for urban and rural Turkey, respectively. Column I and column II of Table 2 report base estimation results for weight for age and height for age in urban Turkey. Column III and column IV in Table 2 report the same equations with the interaction variable, sex dummy (female=1) for weight for age and health for age respectively. Similar representations are replicated in Table 3 for rural Turkey. Column I and column II in Table 2 and column II in Table 3 indicate that number of children at home affects child health significantly in urban and rural Turkey. The negative and significant coefficients in this specification indicate that *Ceteris Paribus*, in urban Turkey, increasing the family size decreases the age adjusted weight by 4% and age adjusted height 7% and significantly decreases age adjusted height 5% from the reference median in rural areas given the present structure of the household. While in urban Turkey the coefficient on sisters at home and the quadratic terms are insignificant, these coefficients are significantly negative for weight for age and height for age variables in rural Turkey. While an additional sister significantly decreases the age adjusted weight by 12%, height for age is affected by 14% from the reference median, which are big in magnitude. This may indicate the problem of big family size caused by the birth stopping rule that prevails in rural Turkey. Hence, children belonging to populated households face constrained household resources that translate to malnutrition of the family members.

In both urban and rural areas, mother's weight and height significantly contribute to child's weight and height. While underweight mothers affect the weight of their children negatively by 30% in urban areas, preobesity and obesity affect the child's weight and height significantly in both urban and rural

Turkey. Educational status of the mother is also a significant parameter affecting health outcomes. Increasing the percentage of the low education of the mother negatively affects the age adjusted weight and height of the child in both urban 30 % and even higher in rural Turkey, 25 % weight for age and 45% height for age, respectively. Wealth index is also a significant parameter that affects the health status of the child. Given the present structure of the household, increased poverty negatively and significantly affects the health outcomes of the child in both urban and rural areas. As the family gets richer, children's health outcomes remains unaffected.

Estimation results with the interaction term shows none of the interacted terms with the number of children at home, sisters at home and sisters at home squared are significant in either urban or rural Turkey. Linear combination test statistics on the other hand, reveal that adding one and more sisters to the family decreases the age adjusted weight in rural Turkey significantly (-2.30 and -2.09 t-statistics respectively). While the impacts are large, both boys and girls are affected negatively by having more sisters. I cannot reject the null hypothesis: the effect on boys and girls are the same in both urban and rural Turkey. The coefficient of interest, number of children at home, loses its significance once the interaction terms are added to the model. Column III of Table 2 and Table 3 shows the negative coefficient of the sisters variable for weight for age -15% for urban and -25% deteriorates the health status of children in rural households respectively. The base variables regarding the mothers' characteristics and the household structure still remains in the same directions once the interaction terms are added.

Table 4 column (I) and column (II) demonstrates the estimation results of Equation 3 for the effect of the first two children being female on the family size for urban and rural Turkey, respectively. Families who conceive two girls at the first two births tend to reproduce significantly in both urban (coeff: 2.04, t stat: 14.61) and rural (coeff: 1.62, tstat 14.62) Turkey. These estimation results support the explanation of why both boys and girls are affected negatively in the presence of sisters. Due to male child preference, families who use the birth stopping rule until conceiving a male child are crowded families. This leads to reduced resources and hence, negative affects on child health outcomes.

5.2 Results of Instrumental Variables

Table 5 gives the IV estimation results when total number of children, total number of sisters and total number of sisters squared are used as instruments for number of children at home, sisters at home, and sisters squared at home, respectively. To further demonstrate the robustness of the results, additional explanatory variables are added to the model. Quadratics of the number of children at home is added and instrumented along with the birth order index of the children. While the main qualitative result, large and significantly negative coefficient estimate of number of children, is carried through this model for urban Turkey, -24% for weight for age and -45% for height for age, the effect in rural Turkey has decreased. The additional quadratic term of sibling size is positive and significant in urban Turkey, 2% for weight for age and 4% for height for age. None of the sisters' variables are significant once the model is estimated with instruments. The coefficient estimate of mother's educational status still remains significantly negative on both weight and height of the health status of the child. Similarly, the coefficient estimates of the height and weight status of the mother still remains as an important variable that affects the health status of the child.

5.3 Disaggregation by Mother's Education

Table 6 and Table 7 represent OLS and IV estimation results for disaggregation of the sample by children according to their mothers' education for urban and rural Turkey, respectively. The regression analysis also contains the quadratic of number of children at home and birth order of the children to keep with the previous robustness results. Also, we estimate the same model with OLS and IV methods to show the consistency of the estimation results. The IV estimation is conducted when total number of children, total number of sisters and total number of sisters squared are used as instruments for number of children at home, sisters at home and sisters squared at home respectively, as before. Results strongly indicate that families whose mother is low educated, increasing the family size reduces the age adjusted weight significantly of the children in urban Turkey. This result holds for both OLS (-20%) and IV (-35%) estimation. Furthermore, the quadratic term on the number of children at home is positive and significant. In line with the previous results, sisters at home has no effect on the weight outcome of the children. Similarly, OLS and IV estimation results also indicate families with low educated mothers, increasing family size has significant negative impacts on the age adjusted height of the children in urban Turkey. The results are in line with both OLS (-35%) and IV (-55%) estimations. Again, the quadratic term of number of children at home squared is significantly positive for both child outcomes for OLS and IV estimations. Quadratic term of sisters at home has a significantly negative effect on the height for age variable when the model is estimated with OLS. As one can expect, once the sample is disaggregated for highly educated mothers in urban Turkey, the effect of family size on child outcomes vanish. None of the interested parameter estimates are significant anymore.

OLS results strongly indicate that families whose mother is low educated, increasing the family size reduces the age adjusted height significantly by 4% in rural Turkey, which is inline with the previous result. Additional evidence is found for IV estimation in this sample indicating that an increase in family size decreases age adjusted weight significantly by 24% and age adjusted height by 20%. However, the negative significant effect of sisters variable that is found in the previous pooled sample vanishes when the sample is restricted to low educated mothers that are located in rural Turkey. The highly educated rural sample shows significant parameter estimates. However, results will not be discussed as the small sample size (127 observations) leads to unreliable conclusions.

5.4 Results on Extreme Health Outcomes

Table 8 represents the effect of additional children and the sex composition of those children on extreme health outcomes. I analyze three different extreme health outcomes: underweight, malnourishment and stunted. These extreme health outcomes are generated according to the definition of WHO (1978). -2 standard deviations below the reference median are characterized as stunted and chronically malnourished for the age adjusted height variable and underweight for the age adjusted weight variable. -3 standard deviations below the reference median are considered as stunted for the height for age variable. Although additional children have no significant effect on increased probability of underweight of the children, column IV indicates that household composition in terms of having more sisters significantly increases the probability of being underweight by 1% in rural Turkey. Column II and column V indicate that an increase in number of children at home will significantly increase the probability of malnourishment of the children by 2% in both urban and rural areas. Column V further demonstrates that the effect of additional sisters in the household increases the probability of being malnourished significantly by 2.5% in rural Turkey. Finally, column VI shows that increasing the family size will increase the probability of being stunted significantly, 1.5% in rural Turkey. Linear combination test statistics also reveal that in urban Turkey, the addition of two or more children increases the probability of the children becoming stunted by 1.5%. Mother's height is a significant factor that decreases the probability of the children being underweight, malnourished and stunted in both urban and rural Turkey. Mother's educational status is also an important determinant that affects the extreme health outcomes of the children. Note that an increased probability of poorly educated mothers increases the probability of the child being underweight by 3% whereas the educational status increases the probability of being malnourished by 6-7%, and the probability of being stunted by 2% both urban and rural areas. The mother's BMI is an important predictor of these variables. Obviously, the mother's obesity structure decreases the probability extreme in health outcomes. Children from the lowest first and second quartile of the wealth index face an increased probability of extreme health outcomes. *Ceteris paribus*, an increased probability of poverty (w==1) increases the probability of being underweight by 11% for urban and by 9% for rural Turkey. Increased probability of poorness also increases the probability of being malnourished by 13% in both areas and increases the probability of being stunted 7% and 5% in urban and rural areas, respectively. However, as the income of the household increases, the effect on extreme health outcomes vanishes. Although the magnitude of these estimation coefficients seem small, having significant positive effects of increasing family size and sibling composition on extreme health outcomes indicate upcoming serious child development problems in the long term.

6 Conclusion

Since the 1980's, Turkey has been experiencing a decreasing trend in fertility rates. This translates to a rapidly aging population. The government has been taking preventive actions to increase fertility rates. However, Turkish Statistical Institute (TurkStat) projections indicate that even if the reverse occurs, it will not be very helpful in avoiding the adverse effects of an aging population. Therefore, the TurkStat President, Birol Aydemir, presented two alternative scenarios in population dynamics (2013). In the first scenario, the fertility rate starts to increase steadily from its actual level of 2.0 to 2.5, and in the second projection it would move to 3.0 by 2050. However, the extra number of people of working age by 2035 only amounts to 500,000 in the first scenario and 750,000 in the second. Obviously, the contribution of the three-child policy towards solving the aging population problem would remain very modest. Instead, this study shows that an increase in family size has reverse effects on child development. Many national and international agencies have also stressed the importance of reducing family size to free up and channel resources in the form of human capital investments for children. A recent Organization for Economic Co-operation and Development (OECD) report (2011) declared that in Turkey, 24.6% of children fall into the hunger threshold; ranked 3rd after Israel and Mexico. Furthermore, this report also states that Turkey is ranked 1st in the child mortality rate. According to the OECD report, the driving forces behind such results are poverty and household size. In this context, four out of eight United Nations Development Program (UNDP) Millennium Development Goals (MDGs) specifically emphasize reduction of child mortality and improvement of child outcomes in developing countries.[24]

This paper provides evidence that if such a reversal occurs in fertility rates,

[24] UNDP MDG reports can be found by visiting: http://www.undp.org/content/undp/en/home/librarypage/mdg/mdg-reports/ecis/.

increased family size will have large negative effects on the health outcomes of children in current household structures. The base estimation results reveal that increasing family size decreases both age adjusted weight and age adjusted height significantly in urban and rural Turkey. Since sibling composition is an important parameter affecting these outcomes, I also gave importance on how sibling composition affects these outcomes by adding a sisters variable to this model. I find that in rural Turkey, having more sisters (controlling for family size), substantially reduces the health status of children in rural Turkey. While the impact of family size and sibling composition is large overall, there is little evidence in differences by gender. The gender bias in health outcomes are hidden by the health status of the gender. The results show how such inequalities are manifested within gender groups. In both urban and rural Turkey, I failed to reject the following hypotheses: the effect on boys and girls are the same in rural Turkey. Although interaction terms revealed no gender differences, in rural Turkey, test statistics once more revealed the negative impacts of the sisters variable on health status of children. This can be interpreted as follows: in a patriarchal Muslim country like Turkey, in families whose parents favor boys over girls, both boys and girls are affected negatively by having more sisters in rural Turkey. Son preference is more evident in low educated poor families in rural Turkey. One explanation is in such areas, families practice the birth stopping rule until conceiving a male child. My results support the explanation that children in families with girls belong to more populated families. Having more girls leads children to face reduced family resources and hence deteriorating health outcomes of the children. These results are stronger to the wealth status of the family and educational status of the mother. The strong negative effects of family size on the health outcomes are stronger for poor families and as well as for low educated mothers. However, once the wealth index increases, as well as the educational status of the mother, the effects of family size and sibling composition have no impact on health outcomes of the children. The main results are robust to IV estimation and additional parameters to the model such as quadratics of family size and birth order of children. The analysis on extreme health outcomes also supports the baseline results. While the probability of underweight and malnourished children significantly increases with additional girls in rural Turkey, the probability of being malnourished in urban and rural areas as well as stunted in rural areas increases significantly with additional siblings in the household. Linear combination test statistics also reveal that in urban Turkey, the addition of two or more children increases the probability of the children becoming stunted. However, the data that has been used in my analysis do not explain which sorts of constraints would improve such inequalities. Additional data is also needed to better understand why having more girls has detrimental effects on health outcomes in rural Turkey. It would be interesting to pin down the reasons behind these problems with additional data. Further studies should be conducted to mitigate the biases caused by potential endogenous household structures.

Putting women and children at the core of the development process is not only the right thing to do, but also a smart thing to do economically. The reason is that, gender equality in individual development is a long-term driver for a nation's development that will translate into competitiveness with other developing countries. Increasing fertility rates will lead nations such as Turkey to fall behind some developing countries that, over the past decade, enjoyed strong economic growth, resulting in widening inequality. I predict that effects of family size on child health outcomes, hence rivalries for family resources, will be reduced by lifting time and credit constraints faced by parents. Instead of trying to convince families to have more children through financial incentives or taking preventive measures that will stop family planning, it could be wiser to spend the money on improving market performance that could have substantial effects on health levels even if everything else about households were to remain unchanged. Hence, families with higher wealth and educational status will have more flexibility on investing in child quality.

Table 1: Summary Statistics for Children Under 5

Panel A: Children's Characteristics

	Urban Turkey					Rural Turkey				
Variable	Obs	Mean	Std. Dev	Min	Max	Obs	Mean	Std. Dev	Min	Max
Age-adjusted Weight	3,230	-0.214	1.229	-5.34	5.33	2,283	-0.471	1.244	-5.27	4.25
Age adjusted Height	3,230	-0.601	1.364	-5.82	5.23	2,283	-0.956	1.478	-5.95	5.34
Underweight	3,230	0.0665	0.249	0	1	2,283	0.102	0.302	0	1
Malnourished	3,230	0.151	0.358	0	1	2,283	0.226	0.418	0	1
Stunted	3,230	0.047	0.212	0	1	2,283	0.077	0.267	0	1
Girl (=1)	3,230	0.490	0.499	0	1	2,283	0.487	0.499	0	1
First Two Children are Girls (=1)	3,230	0.484	0.499	0	1	2,283	0.538	0.498	0	1
No. of Children at Home	3,230	2.498	1.707	0	11	2,283	3.144	2.147	1	13
No. of Sisters at Home	3,230	1.209	1.130	0	9	2,283	1.537	1.351	0	9
No. of Sisters at Home^2	3,230	2.740	5.129	0	81	2,283	4.188	7.443	0	81
Girl (=1)*No. of Children at Home	3,230	1.233	1.726	0	11	2,283	1.551	2.183	0	13
Girl (=1)*No. of Sisters at Home	3,230	0.348	0.815	0	9	2,283	0.505	1.015	0	9
Girl (=1)*No. of Sisters at Home^2	3,230	0.787	3.177	0	81	2,283	1.286	4.335	0	81
Total No. of Children	3,230	2.720	2.043	1	16	2,283	3.608	2.721	1	16
Total No. of Sisters	3,230	1.320	1.267	0	8	2,283	1.676	1.552	0	9
Total No. of Sisters at Home^2	3,230	3.349	6.143	0	64	2,283	5.219	9.331	0	81

Panel B: Mother's Characteristics

	Urban Turkey					Rural Turkey				
Variable	Obs	Mean	Std. Dev	Min	Max	Obs	Mean	Std. Dev	Min	Max
Height (cm)	3,230	156.14	5.575	115.6	185.2	2,283	155.37	5.436	139.1	171.2
Low Education (=1)	3,230	0.777	0.415	0	1	2,283	0.944	0.229	0	1
No Education	3,230	0.246	0.430	0	1	2,283	0.384	0.486	0	1
Incomplete Primary	3,230	0.046	0.208	0	1	2,283	0.08	0.271	0	1
Complete Primary	3,230	0.486	0.499	0	1	2,283	0.480	0.499	0	1
Incomplete Secondary	3,230	0.091	0.288	0	1	2,283	0.028	0.167	0	1
Complete Secondary	3,230	0.099	0.299	0	1	2,283	0.022	0.149	0	1
Higher Education	3,230	0.030	0.173	0	1	2,283	0.003	0.062	0	1
Underweight (=1)	3,230	0.021	0.143	0	1	2,283	0.0153	0.122	0	1
Normal Weight (=1)	3,230	0.415	0.492	0	1	2,283	0.495	0.5	0	1
Preobese (=1)	3,230	0.358	0.479	0	1	2,283	0.315	0.464	0	1
Obese (=1)	3,230	0.205	0.404	0	1	2,283	0.173	0.378	0	1
w1 (Poorest==1)	3,230	0.0702	0.255	0	1	2,283	0.295	0.456	0	1
w2 (Poorer==1)	3,230	0.121	0.326	0	1	2,283	0.192	0.394	0	1
w3 (Middle==1)	3,230	0.165	0.371	0	1	2,283	0.087	0.282	0	1
w4 (Richer==1)	3,230	0.142	0.349	0	1	2,283	0.041	0.199	0	1

Note : Sample includes non-twin children and those whose mother's age at first birth was between 15 and 40 year of age who were not using contraceptive and not sterilized at the time of the survey.

Table 2: OLS-Base Health Outcomes, Urban Turkey

	Specifications			
	Pooled		Interacted	
Coefficient	**Weight-for-age (I)**	**Height-for-age (II)**	**Weight-for-age (III)**	**Height-for-age (IV)**
No. of Children at Home	-0.046**	-0.076***	-0.039	-0.036
	(-2.284)	(-3.385)	(-1.529)	(-1.246)
No. of Sisters at Home	-0.038	0.001	-0.149*	-0.153
	(-0.839)	(0.024)	(-1.713)	(-1.249)
No. of Sisters at Home^2	0.002	-0.008	0.023	0.016
	(0.236)	(-0.805)	(1.629)	(0.730)
Girl (=1)*No. of Children at Home			0.017	-0.053
			(0.385)	(-1.121)
Girl (=1)*No. of Sisters at Home			0.085	0.181
			(0.717)	(1.103)
Girl (=1)*No. of Sisters at Home^2			-0.031	-0.041
			(-1.466)	(-1.125)
Mother's Height	0.036***	0.055***	0.036***	0.055***
	(9.987)	(11.883)	(9.975)	(11.922)
Mother is Low Educated (=1)	-0.281***	-0.282***	-0.282***	-0.281***
	(-5.378)	(-4.951)	(-5.407)	(-4.947)
Mother is Underweight (=1)	-0.297**	-0.184	-0.299**	-0.179
	(-2.096)	(-1.111)	(-2.103)	(-1.075)
Mother is Preobese (=1)	0.277***	0.190***	0.277***	0.187***
	(6.134)	(3.709)	(6.131)	(3.644)
Mother is Obese (=1)	0.394***	0.221***	0.394***	0.219***
	(7.153)	(3.663)	(7.172)	(3.640)
Year-1993	-0.201**	0.140*	-0.201**	0.136
	(-2.511)	(1.668)	(-2.511)	(1.634)
Year-1998	-0.183**	0.167*	-0.185**	0.158*
	(-2.265)	(1.955)	(-2.294)	(1.860)
w1 (Poorest==1)	-0.658***	-0.771***	-0.665***	-0.776***
	(-4.352)	(-4.864)	(-4.409)	(-4.882)
w2 (Poorer==1)	-0.467***	-0.708***	-0.474***	-0.714***
	(-5.110)	(-7.320)	(-5.192)	(-7.433)
w3 (Middle==1)	-0.225***	-0.293***	-0.224***	-0.288***
	(-2.599)	(-3.446)	(-2.589)	(-3.408)
w4 (Richer==1)	-0.121	-0.099	-0.126	-0.100
	(-1.566)	(-1.248)	(-1.615)	(-1.245)
Constant	-4.790***	-8.097***	-4.603***	-7.924***
	(-8.267)	(-10.873)	(-7.929)	(-10.784)
Number of observations	3,230	3,230	3,230	3,230
F	40.195	45.416	34.482	39.238

Note : t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Estimates efficient for arbitrary heteroskedasticity and clustering on cluster number of the sample point. Statistics robust to heteroskedasticity and clustering on cluster number of the sample point. Additional variables include all sex and age interactions.

Table 3: OLS-Base Health Outcomes, Rural Turkey

	Specifications			
	Pooled		Interacted	
Coefficient	Weight-for-age (I)	Height-for-age (II)	Weight-for-age (III)	Height-for-age (IV)
No. of Children at Home	-0.022	-0.051**	-0.004	-0.055
	(-1.112)	(-1.983)	(-0.152)	(-1.452)
No. of Sisters at Home	-0.125**	-0.148*	-0.251**	-0.250
	(-2.051)	(-1.875)	(-2.247)	(-1.589)
No. of Sisters at Home^2	0.023*	0.032*	0.034*	0.047
	(1.832)	(1.766)	(1.816)	(1.585)
Girl (=1)*No. of Children at Home			-0.035	0.004
			(-1.008)	(0.088)
Girl (=1)*No. of Sisters at Home			0.181	0.169
			(1.411)	(0.961)
Girl (=1)*No. of Sisters at Home^2			-0.010	-0.027
			(-0.493)	(-0.842)
Mother's Height	0.037***	0.056***	0.037***	0.057***
	(7.237)	(9.516)	(7.317)	(9.565)
Mother is Low Educated (=1)	-0.248**	-0.457***	-0.243**	-0.456***
	(-2.444)	(-4.139)	(-2.379)	(-4.121)
Mother is Underweight (=1)	-0.279	-0.106	-0.260	-0.089
	(-1.025)	(-0.348)	(-0.972)	(-0.296)
Mother is Preobese (=1)	0.226***	0.127**	0.223***	0.128**
	(3.910)	(2.016)	(3.898)	(2.027)
Mother is Obese (=1)	0.456***	0.332***	0.454***	0.333***
	(6.041)	(3.721)	(6.041)	(3.747)
Year-1993	0.213	0.503**	0.205	0.494**
	(0.959)	(2.261)	(0.911)	(2.188)
Year-1998	0.094	0.475**	0.085	0.464**
	(0.430)	(2.124)	(0.383)	(2.048)
w1 (Poorest==1)	-0.702***	-0.758***	-0.696***	-0.749***
	(-3.150)	(-3.333)	(-3.082)	(-3.248)
w2 (Poorer==1)	-0.374*	-0.517**	-0.368*	-0.509**
	(-1.708)	(-2.318)	(-1.654)	(-2.245)
w3 (Middle==1)	-0.301	-0.335	-0.293	-0.324
	(-1.409)	(-1.554)	(-1.348)	(-1.475)
w4 (Richer==1)	-0.380	-0.319	-0.369	-0.306
	(-1.526)	(-1.318)	(-1.455)	(-1.248)
Constant	-5.112***	-8.241***	-5.050***	-8.176***
	(-6.364)	(-8.741)	(-6.346)	(-8.657)
Number of observations	2,283	2,283	2,283	2,283
F	18.014	25.866	15.197	22.006

Note : t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Estimates efficient for arbitrary heteroskedasticity and clustering on cluster number of the sample point. Statistics robust to heteroskedasticity and clustering on cluster number of the sample point. Additional variables include all sex and age interactions.

Table 4. Effects of First Two Child's Gender on Fertility

	Specifications	
	Urban	**Rural**
Coefficient	**No. of Children**	**No. of Children**
	(I)	**(II)**
First Two Children is Girl (=1)	2.043***	1.625***
	(14.611)	(14.623)
Age of Mother at First Birth	-0.211***	-0.155***
	(-7.731)	(-6.500)
Mother's Height	-0.028	-0.026*
	(-1.297)	(-1.945)
Mother is Low Educated (=1)	2.091***	1.259***
	(10.035)	(9.927)
Mother is Underweight (=1)	-0.118	-0.306
	(-0.104)	(-1.095)
Mother is Preobese (=1)	0.414*	0.171
	(1.863)	(0.971)
Mother is Obese (=1)	0.967***	0.646***
	(3.174)	(3.574)
Year 1993	-0.537*	-0.176
	(-1.789)	(-0.765)
Year 1998	-0.520*	0.045
	(-1.710)	(0.198)
Constant	10.823***	9.412***
	(3.224)	(4.095)
Number of observations	2,090	2,481
F	45.659	36.437

Note : (*** p<0.01, ** p<0.05, * p<0.1). Estimates efficient for arbitrary heteroskedasticity and clustering on cluster number of the sample point. Statistics robust to heteroskedasticity and clustering on cluster number of the sample point.

Table 5: Instrumental Variables Estimates

	Specifications			
	Urban		Rural	
Coefficient	**Weight-for-age (I)**	**Height-for-age (II)**	**Weight-for-age (III)**	**Height-for-age (IV)**
No. of Children at Home	-0.246**	-0.458***	-0.036	-0.210
	(-2.533)	(-4.032)	(-0.347)	(-1.463)
No. of Children at Home^2	0.026**	0.041***	0.003	0.018
	(2.183)	(3.201)	(0.321)	(1.281)
No. of Sisters at Home	0.099	0.123	-0.141	-0.036
	(0.778)	(0.951)	(-1.287)	(-0.238)
No. of Sisters at Home^2	-0.038	-0.050	0.021	-0.002
	(-1.048)	(-1.411)	(0.948)	(-0.074)
Mother's Height	0.036***	0.055***	0.037***	0.056***
	(9.981)	(11.928)	(7.280)	(9.359)
Mother is Low Educated (=1)	-0.274***	-0.255***	-0.238**	-0.434***
	(-5.254)	(-4.617)	(-2.332)	(-3.929)
Mother is Underweight (=1)	-0.293**	-0.186	-0.287	-0.101
	(-2.097)	(-1.121)	(-1.068)	(-0.338)
Mother is Preobese (=1)	0.281***	0.200***	0.230***	0.125*
	(6.189)	(3.916)	(3.998)	(1.948)
Mother is Obese (=1)	0.399***	0.226***	0.460***	0.327***
	(7.180)	(3.805)	(6.175)	(3.623)
Year-1993	-0.203**	0.125	0.185	0.452**
	(-2.563)	(1.542)	(0.827)	(2.004)
Year-1998	-0.181**	0.152*	0.064	0.426*
	(-2.215)	(1.811)	(0.292)	(1.889)
Birth Order (=1)	-0.111	-0.400**	0.017	-0.143
	(-0.753)	(-2.354)	(0.096)	(-0.662)
Birth Order (=2)	0.070	-0.145	0.086	0.000
	(0.632)	(-1.176)	(0.656)	(0.000)
Birth Order (=3)	0.034	-0.090	-0.020	-0.085
	(0.373)	(-0.871)	(-0.195)	(-0.730)
w1 (Poorest==1)	-0.647***	-0.743***	-0.671***	-0.715***
	(-4.340)	(-4.778)	(-2.980)	(-3.090)
w2 (Poorer==1)	-0.461***	-0.675***	-0.351	-0.489**
	(-5.006)	(-6.893)	(-1.587)	(-2.174)
w3 (Middle==1)	-0.226***	-0.282***	-0.278	-0.294
	(-2.602)	(-3.334)	(-1.287)	(-1.356)
w4 (Richer==1)	-0.130*	-0.104	-0.359	-0.280
	(-1.666)	(-1.310)	(-1.433)	(-1.143)
Constant	-4.523***	-7.359***	-5.102***	-7.907***
	(-7.572)	(-9.885)	(-5.995)	(-7.659)
Number of observations	3,230	3,230	2,283	2,283
F	35.613	37.879	15.674	23.004
Under Identification Test				
Kleibergen-Paap rk LM statistic	29,111	29,111	16,058	16,058
Chi-sq(1) P-val	0	0	0	0
Weak Identification Test				
Cragg-Donald Wald F statistic	207,951	207,951	245,295	245,295
Kleibergen-Paap rk Wald F statistic	7,743	7,743	10,104	10,104
Hansen J statistic	just identified	just identified	just identified	just identified

Note : t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Estimates efficient for arbitrary heteroskedasticity and clustering on cluster number of the sample point. Statistics robust to heteroskedasticity and clustering on cluster number of the sample point. Additional variables include all sex and age interactions.

Table 6: Disaggregating by Mother's Education, Urban

	Specifications							
	Urban-Low Educated				Urban-High Educated			
	OLS	OLS	IV	IV	OLS	OLS	IV	IV
Coefficient	**Weight-for-age**	**Height-for-age**	**Weight-for-age**	**Height-for-age**	**Weight-for-age**	**Height-for-age**	**Weight-for-age**	**Height-for-age**
	(I)	**(II)**	**(III)**	**(IV)**	**(V)**	**(VI)**	**(VII)**	**(VIII)**
No. of Children at Home	-0.195**	-0.347***	-0.321***	-0.547***	-0.034	-0.245	-0.524	-0.213
	(-2.457)	(-3.838)	(-3.034)	(-4.329)	(-0.138)	(-0.712)	(-0.746)	(-0.671)
No. of Children at Home^2	0.014*	0.028***	0.030**	0.048***	-0.004	0.020	0.138	0.025
	(1.897)	(3.398)	(2.497)	(3.491)	(-0.064)	(0.227)	(0.640)	(0.322)
No. of Sisters at Home	-0.027	0.040	0.077	0.065	0.065	0.214	2.848	0.213
	(-0.489)	(0.643)	(0.560)	(0.455)	(0.451)	(1.492)	(1.420)	(1.534)
No. of Sisters at Home^2	-0.004	-0.026**	-0.035	-0.041	-0.042	-0.066	-1.340	-0.073
	(-0.330)	(-2.028)	(-0.948)	(-1.157)	(-0.770)	(-1.212)	(-1.445)	(-1.393)
Year-1993	-0.459***	-0.221**	-0.461***	-0.224**	-0.374***	0.010	-0.359***	0.030
	(-5.834)	(-2.355)	(-5.856)	(-2.420)	(-3.816)	(0.103)	(-2.732)	(0.324)
Year-1998	-0.462***	-0.206**	-0.461***	-0.209***	-0.461***	-0.199**	-0.466***	-0.179*
	(-6.873)	(-2.526)	(-6.802)	(-2.577)	(-4.917)	(-2.000)	(-3.309)	(-1.845)
Birth Order (=1)	-0.137	-0.213	-0.209	-0.515***	0.090	-0.209	-0.362	-0.116
	(-1.006)	(-1.358)	(-1.279)	(-2.692)	(0.234)	(-0.458)	(-0.269)	(-0.303)
Birth Order (=2)	0.033	-0.001	0.005	-0.186	0.238	-0.114	-0.286	-0.065
	(0.299)	(-0.009)	(0.040)	(-1.323)	(0.693)	(-0.260)	(-0.222)	(-0.174)
Birth Order (=3)	0.020	-0.022	0.026	-0.115	0.052	-0.059	-0.171	-0.045
	(0.215)	(-0.209)	(0.257)	(-1.014)	(0.190)	(-0.162)	(-0.171)	(-0.145)
Constant	-4.761***	-8.012***	-4.595***	-7.497***	-6.166***	-8.858***	-4.767**	-8.899***
	(-6.546)	(-8.520)	(-6.491)	(-8.319)	(-5.761)	(-7.252)	(-2.369)	(-7.674)
Number of observations	2,512	2,512	2,512	2,512	718	718	718	718
F	26.528	29.313	26.513	28.066	8.626	7.024	5.058	6.986

Note : t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Estimates efficient for arbitrary heteroskedasticity and clustering on cluster number of the sample point. Statistics robust to heteroskedasticity and clustering on cluster number of the sample point. Additional variables include all sex and age interactions, mother's characteristics.

Table 7: Disaggregating by Mother's Education, Rural

	Specifications							
	Rural-Low Educated				Rural-High Educated			
	OLS	OLS	IV	IV	OLS	OLS	IV	IV
Coefficient	**Weight-for-age**	**Height-for-age**	**Weight-for-age**	**Height-for-age**	**Weight-for-age**	**Height-for-age**	**Weight-for-age**	**Height-for-age**
	(I)	**(II)**	**(III)**	**(IV)**	**(V)**	**(VI)**	**(VII)**	**(VIII)**
No. of Children at Home	0.028**	-0.038***	-0.245***	-0.196***	-1.907	-3.063	-1.841	-3.431
	(0.399)	(-0.428)	(-0.712)	(-1.370)	(-2.542)	(-3.965)	(-1.364)	(-3.166)
No. of Children at Home^2	-0.003*	0.001***	0.020**	0.016***	0.378	0.665	0.190	0.616
	(-0.498)	(0.062)	(0.227)	(1.205)	(2.358)	(3.565)	(0.656)	(2.608)
No. of Sisters at Home	-0.129	-0.162	0.214	-0.070	-0.044	0.062	4.471	2.734
	(-1.914)	(-1.745)	(1.492)	(-0.450)	(-0.123)	(0.169)	(1.208)	(1.028)
No. of Sisters at Home^2	0.024	0.032**	-0.066	0.003	0.045	0.207	-2.332	-1.214
	(1.681)	(1.508)	(-1.212)	(0.078)	(0.283)	(1.239)	(-1.247)	(-0.930)
Year-1993	-0.312***	-0.097**	0.010***	-0.114**	0.055***	0.350	-0.008***	0.286
	(-4.086)	(-1.170)	(0.103)	(-1.362)	(0.239)	(1.597)	(-0.019)	(0.959)
Year-1998	-0.441***	-0.130**	-0.199***	-0.142***	-0.324***	0.107**	-0.545***	-0.041*
	(-5.231)	(-1.397)	(-2.000)	(-1.519)	(-1.669)	(0.489)	(-1.347)	(-0.128)
Birth Order (=1)	0.191	0.130	-0.209	-0.077***	-0.466	0.232	-4.608	-2.495
	(1.410)	(0.848)	(-0.458)	(-0.355)	(-0.681)	(0.275)	(-2.200)	(-1.568)
Birth Order (=2)	0.246	0.219	-0.114	0.085	-0.287	0.531	-3.716	-1.602
	(2.227)	(1.801)	(-0.260)	(0.561)	(-0.464)	(0.676)	(-2.131)	(-1.187)
Birth Order (=3)	0.070	0.050	-0.059	-0.022	-0.403	-0.240	-3.453	-2.055
	(0.720)	(0.443)	(-0.162)	(-0.182)	(-0.791)	(-0.373)	(-1.949)	(-1.582)
Constant	-5.718***	-9.053***	-8.858***	-8.637***	-2.282***	-5.497***	-7.269**	-7.508***
	(-6.643)	(-8.990)	(-7.252)	(-8.118)	(-0.724)	(-1.659)	(-1.130)	(-1.479)
Number of observations	2,156	2,156	718	2,156	127	127	127	127
F	16.981	22.577	7.024	23.363			1.343	2.155

Note: t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Estimates efficient for arbitrary heteroskedasticity and clustering on cluster number of the sample point. Statistics robust to heteroskedasticity and clustering on cluster number of the sample point. Additional variables include all sex and age interactions, mother's characteristics.

Table 8: Probability of Extreme Health Outcomes

	Specifications					
	Urban			Rural		
Coefficient	**Underweight (I)**	**Malnourished (II)**	**Stunted (III)**	**Underweight (IV)**	**Malnourished (V)**	**Stunted (VI)**
No. of Children at Home	0.005	0.018***	0.001	0.006	0.015***	0.015***
	(1.439)	(3.237)	(0.395)	(1.496)	(2.940)	(3.660)
No. of Sisters at Home	-0.014	-0.005	0.003	0.017*	0.024*	0.009
	(-1.595)	(-0.459)	(0.340)	(1.833)	(1.696)	(0.949)
No. of Sisters at Home^2	0.004**	0.001	0.002	-0.003	-0.004*	-0.003*
	(1.990)	(0.559)	(0.995)	(-1.554)	(-1.795)	(-1.809)
Mother's Height	-0.002***	-0.007***	-0.002***	-0.005***	-0.009***	-0.004***
	(-3.244)	(-6.205)	(-3.910)	(-5.075)	(-6.832)	(-4.451)
Mother is Low Educated (=1)	0.023***	0.056***	0.022***	0.030**	0.071***	0.023***
	(3.448)	(5.342)	(4.052)	(2.055)	(3.437)	(3.185)
Mother is Underweight (=1)	0.064*	0.047	0.026	0.103	0.051	0.049
	(1.958)	(1.164)	(1.006)	(1.559)	(0.817)	(0.990)
Mother is Preobese (=1)	-0.020**	-0.010	-0.013*	-0.033***	-0.037**	-0.021**
	(-2.407)	(-0.861)	(-1.888)	(-2.885)	(-2.362)	(-2.038)
Mother is Obese (=1)	-0.036***	-0.047***	-0.018**	-0.044***	-0.068***	-0.033**
	(-3.862)	(-3.456)	(-2.119)	(-2.857)	(-3.337)	(-2.387)
w1 (Poorest==1)	0.113***	0.135***	0.076***	0.091***	0.139***	0.045**
	(2.895)	(3.837)	(3.504)	(5.203)	(4.529)	(2.508)
w2 (Poorer==1)	0.056***	0.140***	0.043***	0.022	0.102***	0.018
	(3.329)	(5.411)	(3.329)	(1.386)	(3.467)	(1.096)
w3 (Middle==1)	0.027*	0.031	0.014	-0.009	0.059*	-0.013
	(1.919)	(1.625)	(1.621)	(-0.578)	(1.949)	(-0.879)
w4 (Richer==1)	-0.004	-0.008	0.005	0.043	0.017	-0.021
	(-0.381)	(-0.459)	(0.778)	(1.429)	(0.446)	(-1.589)
Year-1993	0.012	-0.010	-0.030***	-0.022	-0.093***	-0.005
	(1.046)	(-0.564)	(-3.795)	(-1.325)	(-3.028)	(-0.290)
Year-1998	-0.005	-0.044**	-0.019**	-0.015	-0.106***	-0.016
	(-0.426)	(-2.429)	(-2.248)	(-0.983)	(-3.483)	(-0.983)
Constant	0.313***	0.987***	0.361***	0.671***	1.378***	0.624***
	(3.107)	(5.745)	(3.694)	(4.772)	(6.364)	(4.038)
Number of observations	3,909	3,909	3,909	2,803	2,803	2,803
F	5.468	14.452	5.387	6.113	16.445	6.535

Note : t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1). Estimates efficient for arbitrary heteroskedasticity and clustering on cluster number of the sample point. Statistics robust to heteroskedasticity and clustering on cluster number of the sample point. Additional variables include all sex and age interactions.

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Appendix A.

What follows derives equation (5) from equations (3) and (4);

$\pi_{ij} = \frac{\partial q_i/\partial n_j}{\partial q_i/\partial x} \div \frac{x}{n}$

$\frac{\partial q_i}{\partial n_j}$:

$\frac{p_i}{x_i} dq_i = -\beta_i \frac{dn_j}{n} + \eta_i \frac{dn_j}{n} - \sum_{k=1}^{K-1} \gamma_{ik} \frac{n_k}{n} \frac{dn_j}{n} + \gamma_{ij} \frac{dn_j}{n}$

$\frac{p_i}{x_i} dq_i = (\eta_i - \beta_i + \gamma_{ij} - \sum_{k=1}^{K-1} \gamma_{ik} \frac{n_k}{n}) \frac{dn_j}{n}$

$\frac{dq_i}{dn_j} = (\eta_i - \beta_i + \gamma_{ij} - \sum_{K=1}^{K-1} \gamma_{ik} \frac{n_k}{n}) \frac{x_i}{p_i n}$

$\frac{\partial q_i}{\partial x}$:

$-\frac{p_i q_i}{x_i^2} dx + \frac{p_i}{x_i} dq_i = \beta_i \frac{dx}{x_i}$ multiplying both sides with x_i

$-w_i dx + p_i dq_i = \beta_i dx$

$dx(w_i + \beta_i) = p_i dq_i$

$\frac{dq_i}{dx} = \frac{(w_i + \beta_i)}{p_i}$

$\frac{dq_i/dn_j}{dq_i/dx} \div \frac{x}{n} = \frac{(\eta_i - \beta_i + \gamma_{ij} - \sum_{k=1}^{K-1} \gamma_{ik}(n_k/n)) \frac{x_i}{p_i n}}{\frac{w_i + \beta_i}{p_i}} \div \frac{x}{n}$

$\frac{(\eta_i - \beta_i) - \gamma_{ij} - \sum_{k=1}^{K-1} \gamma_{ik}(n_k/n)}{w_i + \beta_i}$.

Appendix B.

The final form of equation (10) comes from the following derivation:

$$\frac{p_i q_i}{x_i} = w_i = f(\frac{x}{n}) + \eta_i \ln\, n + \sum_{k=1}^{K-1} \gamma_{ik}(n_k/n) + u_i$$

$$\frac{\partial q_i}{\partial n_j} :$$

$$\frac{p_i}{x_i} dq_i = -f'(\frac{x}{n})\frac{x}{n^2} dn_j + \eta_i \frac{dn_j}{n} + \sum_{k=1}^{K-1} \gamma_{ik}\frac{n_k}{n}\frac{dn_j}{n} + \gamma_{ij}\frac{dn_j}{n}$$

$$\frac{p_i}{x_i} dq_i = \eta_i - f'(\frac{x}{n})\frac{x}{n}\frac{dn_j}{n} + \eta_i \frac{dn_j}{n} + \sum_{k=1}^{K-1} \gamma_{ik}\frac{n_k}{n}\frac{dn_j}{n} + \gamma_{ij}\frac{dn_j}{n}$$

$$\frac{dq_i}{dn_j} = \frac{x_i}{p_i n}(\eta_i - f'(\frac{x}{n})\frac{x}{n} + \gamma_{ij} - \sum_{k=1}^{K-1} \gamma_{ik}\frac{n_k}{n})$$

$$\frac{\partial q_i}{\partial x} :$$

$$\frac{p_i}{x_i} dq_i = \frac{p_i q_i}{x_i^2} dx - f'(\frac{x}{n})\frac{dx}{n}$$

$\frac{dq_i}{dx} = \frac{x_i}{p_i}[\frac{w_i}{x_i} + f'(\frac{x}{n}) \cdot \frac{1}{n}]$ multiplying right side with$x$ and $\frac{1}{x}$;

$$\frac{dq_i}{dx} = \frac{1}{p}[w_i + f'(\frac{x}{n})\frac{x}{n}]$$

$$\pi_{ij} = \frac{\partial q_i/\partial n_j}{\partial q_i/\partial x} \div \frac{x}{n} = \frac{\eta_i - f'(\frac{x}{n})\frac{x}{n} + \gamma_{ij} - \sum_{k=1}^{K-1}(\frac{n_k}{n})}{w_i + f'(\frac{x}{n})\frac{x}{n}}.$$