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Quality-Quantity Tradeoff of Children in Egypt

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Abstract: In Egypt, children are still seen as a source of income. We would, therefore, expect that quantity–quality tradeoff decisions are central in shaping fertility and education choices so that a negative causal effect of family size on child's schooling exists. In this paper we argue that families display degrees of trading off quantity for quality and that this range of reactions is affected by socioeconomic, cultural and demographic covariates. The dataset used is that of the Egypt Labor Market Panel Survey (ELMPS) 2012. The sample includes 6,808 individuals in the age group (18-30). By applying cluster analysis, the sample was divided into six distinct homogenous clusters of families according to the outcome of their tradeoff choices and ranked. A tradeoff was adopted by (48.5%) of the families who choose a completed family size of 3 children or less and provided high or medium education. The remainder of the families (51.5%) had a larger number of children ranging between 5 and 9 and provided medium or low education. An ordinal logistic model was developed to explain the relationship between the order of the quality-quantity tradeoff choices and socio-economic background variables. The results indicate that a male child of low birth order, a child living in an urban area or belonging to the richest wealth index group or has an educated mother or a white collar father/mother has a relatively lower risk of belonging to a family that chooses quantity over quality than the reference child. Examples are given to illustrate how the results can be used to make predictive probabilities by changing the categories of the dependent variables. The most powerful impact was that of parity, wealth and mother's education. By expanding and improving female education and employment it is expected that choosing to have a smaller family size and offering education to the children, will become more popular.

Keywords: Quality Quantity Tradeoff, , Fertility, Education, child quality, Egypt

1 Introduction

Egypt has a young population structure with 61.9% of its population in the workforce and a dependency ratio[1] of 61.5% (CAPMAS, 2019). However, it lags behind in terms of productivity keeping the GDP per capita (adjusted by the PPP) at $11,014 in 2018, which is far less than the world average figure estimated to be $15,941[1]. This situation implies that the quality of the large Egyptian working population is not sufficient to promote economic growth. This is reflected in the low Human Capital Index[2] (HCI) of 0. 49 (with uncertainty limits of 0.47-0.50) calculated by the World Bank for 2017 [1]. This value indicates that a child born in Egypt today is expected to achieve a productivity - as a future worker- which is 51% below what could have been achieved if he/she received complete education and full health. These benchmarks are among the targets of Egypt's development plans.

Researchers presented evidence and argued that a quality-quantity trade-off of children affects the quality of the human resources produced inside nations ([2]; [3]; [4]; [5]; [6]). The impact of economics on fertility was explained by Becker, Murphy, and Tamura (1990). The authors show that "the economy exhibits two steady states, one in which income per capita stagnates and fertility is high, and one in which there is sustained growth in income per capita and fertility is low" [7]. Some research studies such as Heer, D. (1985)**Error! Reference source not found.**, Downey (1995) concluded that there is a negative relationship between the number of siblings and quality of children while others have concluded the converse of this theory such as Black et. al. (2005)[9]. However, it is now clear that recent studies have made a distinction between the rich and poor countries. When child labor restrictions are strong and the cost of an additional child does not pose restrictions

[1]The dependency ratio is calculated as the number of people below age 15 and above age 65 decided by the number of people in the age group 15-54

[2]The Human Capital Index is measured in terms of the productivity of the next generation of workers relative to the benchmark of complete education and full health. An economy in which a child born today can expect to achieve complete education and full health will score a value of 1 on the index. Lower and upper bounds indicate the range of uncertainty around the value of the HCI for each economy.

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on the family budget, fertility decisions are based on factors other than the quality- quantity tradeoff. The opposite is true in many poor countries today where children are still seen as a source of income so that families use their children to generate income within a relaxed application of child labor restrictions. These features imply a high opportunity cost of education, and we would expect the quantity–quality tradeoff to be central in shaping fertility and education choices [7].

However, there is a need for a closer look into the population dynamics of Egypt. Since 1990, the total fertility rate (TFR) in Egypt has been slowly declining from 4.1 in 1991 to 3.5 in 2000. An additional decline in TFR to 3.0 births per woman was shown by the Egypt Demographic Health Survey (EDHS) of 2008[10] but unexpectedly increased to 3.5 as indicated in EDHS 2014. The mean ideal number of children is still high at 3.4 children among men and 3.1 children among women (Ministry of Health and Population, 2014). As reported by Ambrosetti[11], no major differences were observed in the ideal number of children by background characteristics of women and that " comparison between the cohorts of women aged 15–24 in 2008 and 2015, outlined an overall increase in the preference for larger family, regardless education and place of residence. An explanation of the preference for larger families reveals that "having a large number of children is desirable to many Egyptian women as they perceive children to be their only current and future security" [12]. Recent research also finds that "since social norms in Egypt favor a higher number of births and labor market participation among women is low, women with agency could be fulfilling social expectations of having children and choosing to have more children" [13]. This result implies that some Egyptian women with specific background characteristics continue to want large families in spite of economic constrains. Contrary to expectations, these segments of women have not exchanged the quantity of children for their quality.

Studies concerned with the quantity – quality tradeoff have focused on the objective of proving or disproving the existence of the tradeoff in specific settings. A recent comprehensive review of this literature was presented by Alidou and Verpoorten (2019)[14]. They conclude that the causal effect varied from negative to positive within different socio economic and demographic settings.

This paper tends to go beyond studying the tradeoff. It rather investigates the degree of the tradeoff. Families do not just "accept or reject" the choice of trading off quantity for quality but their acceptance ranges from complete to none and that this range of reactions is not only affected by affordability but also by the socioeconomic, cultural and demographic covariates as well. This paper contributes to the existing literature by offering the possibility of ranking/ordering families according to their degree of choosing the quality-quantity tradeoff of children. It also attempts to identify the determinants of such choice in Egypt. To fulfill this objective we look at the outcome of the continuous process of decision making that the family has gone through during its reproductive span. Therefore, we use (for each individual in the sample) the complete number of his/her family (number of siblings+1) as the fertility measure and the completed educational level reached by him/her as a proxy measure of child quality.

2 Methodology

A Sample

The dataset to be used in this study is that of the Egypt Labor Market Panel Survey (ELMPS) 2012[15]. However, due to data limitations our focus is on education where the child's highest level of educational attainment will be used as a proxy for that child's quality.

Only youth in the age group 18-30 years who have completed their education will be selected (i.e. individuals who were still at school at the time of the survey were excluded) because their mothers would have most probably reached their completed reproductive life. Also, the outcome of the family's decision regarding the child's education would have been taken and complete. The youngest of these children was chosen since his/her birth represents the most recent fertility/education decision taken in the family and will therefore stand for the cumulative decision making and economic/financial history of the family. It is worth mentioning that the selected individual may not be the youngest in the family since there might be younger siblings who do not meet the study sample selection criteria. This process of selection has resulted in selecting 6,808 individuals belonging to the same number of families.

B Methods

A new index/variable will be generated. Families will be classified into a number of distinct homogenous groups according to their choice regarding both family size and education. By applying cluster analysis to the data, each group will consist of families that have made almost similar choices. Cluster analysis maximizes the differences between clusters and diminishes the similarities between observations in the same cluster.

This study uses the two-step technique, developed by Chiu et al. (2001)[16] which deals with large datasets. The distance measure used here is a combination of the likelihoods calculated for the continuous variable and for the categorical variable. The first step in the cluster analysis is called "pre-clustering" which scans the cases one by one and decides if the current case should be merged with the previously formed clusters or starts a new cluster based on the cluster feature (CF) constructed. In the second step, 'the cluster step", the sub-clusters resulting from the pre-cluster step are taken as input and are grouped into the desired number of clusters which can be determined automatically using recent software packages StataCorp v.15 and SPSS v.25.

The resulting clusters are ordered/ranked in a variable representing the degree of accepting the choice of a quantity-quality tradeoff so that the first ordered choice is that taken by families with the highest degree of acceptance who had the lowest completed fertility and provided the highest level of education to their indexed child. The last ordered choice is that taken by families with the lowest degree of acceptance who had the highest completed fertility and provided the lowest level of education to their indexed child. In between the highest and lowest, four degrees of partial acceptance exists. Following this classification, the socio-economic characteristics of the families are tested to find out their relationship with the different tradeoff ranks/orders. A model will be developed using ordinal logistic regression. This type of regression is used to explain the relationship between the level of family tradeoff choice, as an ordinal dependent variable determined by the cluster analysis, and the socio-economic factors that may affect the dependent variable such as parents' education, place of residence and parents' occupation and birth order.

In addition, the ordinal logistic regression allows for predicting trends and variations in the level of family acceptance of the tradeoff decision, when a change in their socio-economic characteristics is made. Considering the data: $(Y_i, X_{1i}, \dots, X_{ki})$ for observations $= 1, \dots, n$, where Y is a response variable for household choices with C ordered categories $j = 1, \dots, C$ (assuming $Y_i$are statistically independent of each other) and probabilities $\pi^{(j)} = P(Y = j)$, and $X_1, \dots, X_k$ are $k$explanatory variables which represent socio-economic factors. The following equation holds for $\gamma_i^{(j)} = P(Y_i \leq j)$ for each unit i and each category $j = 1, \dots, (C-1)$;

$$\log\left(\frac{\gamma_i^{(j)}}{1-\gamma_i^{(j)}}\right) = \log\left(\frac{P(Y_i \leq j)}{1-P(Y_i \leq j)}\right) = \alpha^{(j)} - (\beta_1 X_{1i} + \cdots + \beta_k X_{ki}) \quad (1)$$

Thus, the model for the cumulative probabilities is

$$\gamma^{(j)} = P(Y \leq j) = \frac{e^{\alpha^{(j)} - (\beta_1 X_1 + \cdots + \beta_k X_k)}}{1 + e^{\alpha^{(j)} - (\beta_1 X_1 + \cdots + \beta_k X_k)}} \quad (2)$$

3 Results

A Degrees of Trade off Choices

Applying the Two-Step Cluster Analysis six clusters were identified which means that the sample can be divided into six distinct homogenous clusters based on the two variables under consideration: completed family size and educational level of the last child who completed education. The cohesion and separation efficiency of the classified clusters/groups is indicating by the Silhouette scale shown in (Fig 1) to be 0.6. This technique provides a succinct graphical representation of how well each object lies within its cluster. The figure shows that the classification is good for the current observations. This scale ranges between positive and negative 1 with the classification of the observations being good and poorly matched to neighboring clusters if it is positive 1 and poor classification of the observations when it is equal to -1 and the value of zero means an unclear classification of cases.

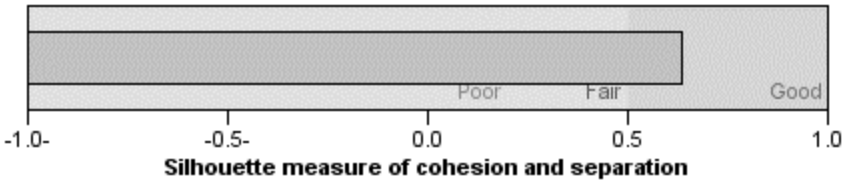

Fig. 1: Silhouette measure of cohesion and separation for the resulting clusters of the two-step cluster analysis.

Table 1 presents the six identified clusters. It shows that families belong to one of the following six mutually exclusive orders that represent degrees of tradeoff acceptance:

Order 1: The choice to fully accept the quantity-quality tradeoff (lowest completed fertility and highest child education)

Order 2: Low completed fertility and medium child education

Order 3: Medium completed fertility and medium child education

Order 4: High completed fertility and medium child education

Order 5: Medium completed fertility and Low child education

Order 6: The choice to fully reject the quantity-quality tradeoff (highest completed fertility and lowest child education)

Table 1: Family ordered tradeoff choices according to child's educational level and average number of children in the family.

		Family Ordered Tradeoff Choices						
		1	**2**	**3**	**4**	**5**	**6**	**Total**
Educational Level	**None**	—	—	—	—	100% (884)	100% (298)	17.4% (1182)
	Less than Intermediate*	—	22.9% (447)	43.4% (607)	—	—	—	15.5% (1054)
	Intermediate	—	77.1% (1502)	56.6% (792)	70.6% (652)	—	—	43.3% (2946)
	Above Intermediate	100% (1355)	—	—	29.4% (271)	—	—	23.9% (1626)
Total		19.9% (1355)	28.6% (1949)	20.5% (1399)	13.6% (923)	13.0% (884)	4.4% (298)	100.0% (6808)
Average number of children/family		3.0	2.9	6.1	8.0	4.9	9.0	4.8

* complete or incomplete primary

It is clear that the highest percentage of families (28.6%) belong to the second rank of acceptance, while the lowest share (4.4%) belong to the sixth . Together the first and second ranks of choices were adopted by (48.5%) of the families who had a low average completed family size of 3 children and managed to provide their children with some education. The remainder of the families (51.5%) had a larger average number of children ranging between 5 and 9 and have not provided their children with enough education. An exception however is in group 4 where (70.6%) provided their child with intermediate education and (29.4%) with above intermediate education.

A Degree of tradeoff choices by socio-economic characteristics of the family

In this section we examine the effect of some socio-economic characteristics of the family on the six trade-off categories as shown in Table 2. The results show significant associations for all explanatory variables with the outcome variable (orders of tradeoff choice), except for the urban governorates. The distribution of family choices tends to favor high fertility over children's education with the proportion of households making the first and second choices being about 48.5% of the total sample. It reaches 63.5% in urban areas and only 38% in rural areas.

Table 2: Percent distribution of family ordered tradeoff choices according to selected family characteristics.

	Family Ordered Tradeoff Choices						N
	First	**Second**	**Third**	**Forth**	**Fifth**	**Sixth**	
Place of Residence							
Urban	31.6%	31.9%	15.4%	11.4%	7.6%	2.0%	**2799**
Rural	11.7%	26.3%	24.1%	15.0%	16.8%	6.0%	**4009**
Region							

Greater Cairo	41.5%	30.8%	11.8%	5.7%	8.5%	1.8%	**761**
Urban Governorates	34.1%	38.0%	13.1%	7.5%	6.1%	1.2%	**642**
Urban Lower Egypt	32.2%	37.7%	13.9%	7.6%	7.4%	1.2%	**995**
Urban Upper Egypt	23.2%	24.6%	20.2%	20.3%	8.3%	3.4%	**1196**
Rural Lower Egypt	17.6%	33.7%	20.9%	13.5%	11.6%	2.7%	**2720**
Rural Upper Egypt	5.6%	18.9%	27.5%	16.7%	21.9%	9.3%	**2774**
Wealth Index							
Poorest	2.6%	20.8%	24.1%	13.2%	28.3%	11.0%	**1405**
Poorer	7.1%	29.8%	25.3%	14.0%	18.0%	5.9%	**1531**
Middle	13.1%	34.1%	23.9%	16.3%	10.1%	2.6%	**1492**
Richer	29.6%	34.9%	17.9%	12.7%	3.8%	1.1%	**1331**
Richest	59.2%	21.6%	7.5%	10.6%	1.0%	0.0%	**1049**
Father's Education							
Illiterate	5.7%	26.8%	24.8%	14.0%	21.8%	6.9%	**3349**
Reads & Writes	14.0%	31.4%	23.4%	18.5%	8.5%	4.1%	**1069**
Less than Intermediate	22.0%	39.7%	17.2%	14.2%	5.0%	1.8%	**878**
Intermediate	43.2%	30.6%	14.8%	9.0%	1.7%	0.7%	**888**
Above Intermediate	70.1%	15.2%	5.6%	8.3%	0.6%	0.0%	**623**
Mother's Education							
Illiterate	9.0%	27.9%	24.5%	15.7%	17.2%	5.8%	**4891**
Reads & Writes	23.9%	34.5%	20.0%	13.8%	4.8%	3.0%	**435**
Less than Intermediate	30.8%	40.5%	16.0%	8.7%	3.6%	0.4%	**526**
Intermediate	60.2%	29.2%	4.3%	5.7%	0.6%	0.0%	**671**
Above Intermediate	86.0%	8.4%	0.7%	4.6%	0.4%	0.0%	**285**
Father's Occupation							
No Job	25.4%	26.2%	18.7%	14.3%	10.7%	4.8%	**252**
Blue Collars	9.5%	30.0%	23.2%	14.3%	17.3%	5.7%	**4300**
White Collars	39.1%	26.4%	15.8%	12.0%	4.9%	1.9%	**2256**
Mother's Occupation							
No Job	15.8%	29.6%	21.7%	14.7%	13.5%	4.6%	**5583**
Blue Collars	7.9%	26.4%	27.5%	12.0%	19.0%	7.2%	**542**
White Collars	63.0%	22.1%	5.7%	5.1%	3.7%	0.4%	**683**
Birth Order							
First	30.6%	42.2%	11.1%	4.8%	10.5%	0.9%	**1768**
Second	25.3%	37.6%	16.0%	6.2%	12.9%	2.1%	**1361**
Third	19.5%	32.6%	20.9%	8.7%	15.6%	2.7%	**1238**
Fourth	14.5%	24.1%	24.9%	14.6%	16.2%	5.7%	**863**
Fifth or more	6.6%	5.0%	32.4%	33.0%	12.0%	11.0%	**1578**
Total	**1355 (19.9%)**	**1949 (28.6%)**	**1399 (20.5%)**	**923 (13.6%)**	**884 (13.0%)**	**298 (4.4%)**	**6808**

The higher the educational level of the parents, the more prone is the family to choose the quantity-quality tradeoff. White collar fathers tend to make the first order choice while those who are blue collars make the second and third choices. The same happens with mother occupation. At the same time, non-working mothers are more likely to have a higher degree of tradeoff choice than those who are blue collars who are in need of money and would prefer for their children to contribute to the family income rather than attend school. Household wealth is highly associated with degrees of tradeoff choice. The higher the wealth index, the higher the tendency toward making the first and second order of choices.

A Determinants of Tradeoff Choices

An ordinal logistic model is developed to determine the relationship between the orders that represents degrees of quantity-quality trade-off choices and socio-economic background variables allowing for the impact of each background variable to be measured while all other variables are held constant.

The following independent variables were used in the model:

1. Gender
2. Place of residence (urban/ rural)
3. Household wealth index
4. Father's highest educational level

5. Mother's highest educational level
6. Father's occupation
7. Mother's occupation
8. Birth order

The model chi-square is 3681.26 (21 d.f.). This is highly significant and indicates that the used explanatory variables have a significant effect on the tradeoff choices. The significant chi-square statistic ($p<.0005$) indicates that the final model makes a significant improvement over the baseline intercept-only model. In order to compare the fit of different models for the same dependent variables more detail is provided in appendix A-2.

Table 3 shows that having a male child makes the family less likely (by 40%) to reject the tradeoff choice than if the child was a female. A family living in an urban area is at a decreased likelihood of rejecting the tradeoff choice (by about 25%) than another who lives in a rural area. Also, a child belonging to the richest wealth index group has a lower chance (by 86%) of being in a family that rejects the tradeoff choice than a child in the poorest wealth quintile. In families where mothers are educated, it is less likely that the rejection choice is made compared to those with illiterate mothers. When the mother's educational level is "reads & writes", "less than intermediate", "intermediate" and "above intermediate", families are less likely by 23%, 35%, 55%, and 80%, respectively to reject the tradeoff choice than when the mother is illiterate. The same applies for father's education. A family whose father's educational level is "intermediate and above intermediate", is less likely to reject the tradeoff choice by 53% and 69% respectively. Father's occupation has no significant effect on tradeoff choices. However, the blue-collar occupation of the mother is associated with a higher likelihood to reject the tradeoff choice (at significance level 10%) than that with a non-employed mother and both have higher risks than those with white-collar mothers.

Table 3: Ordinal Logistic Parameter Estimates

	Coef.	Odds Ratio	Std. Err.	z	P>z	95% Conf.	
Gender							
Female (Reference)							
Male	-0.51	0.60	0.03	-9.90	0.00	0.54	0.66
Place of Residence							
Rural (Reference)							
Urban	-0.29	0.75	0.04	-5.79	0.00	0.68	0.83
Wealth Index							
Poorest (Reference)							
Poorer	-0.62	0.54	0.04	-9.11	0.00	0.47	0.62
Middle	-1.01	0.37	0.03	-14.43	0.00	0.32	0.42
Richer	-1.52	0.22	0.02	-19.64	0.00	0.19	0.25
Richest	-1.96	0.14	0.01	-20.27	0.00	0.12	0.17
Father's Education							
Illiterate (Reference)							
Reads & Writes	-0.36	0.70	0.05	-5.47	0.00	0.62	0.80
Less than Intermediate	-0.54	0.58	0.04	-7.40	0.00	0.50	0.67
Intermediate	-0.76	0.47	0.04	-8.14	0.00	0.39	0.56
Above Intermediate	-1.17	0.31	0.04	-9.12	0.00	0.24	0.40
Mother's Education							
Illiterate (Reference)							
Reads & Writes	-0.26	0.77	0.07	-2.72	0.01	0.64	0.93
Less than Intermediate	-0.43	0.65	0.06	-4.75	0.00	0.54	0.77
Intermediate	-0.81	0.45	0.05	-6.89	0.00	0.35	0.56
Above Intermediate	-1.63	0.20	0.04	-7.58	0.00	0.13	0.30
Father's Occupation							
No Job Or Blue Collars (Reference)							
White Collars	-0.08	0.92	0.06	-1.39	0.17	0.82	1.04
Mother's Occupation							
No Job (Reference)							
Blue Collars	0.16	1.18	0.10	2.00	0.05	1.00	1.38
White Collars	-0.42	0.66	0.07	-3.78	0.00	0.53	0.82
Birth Order							

First (reference)							
Second	0.26	1.30	0.09	3.73	0.00	1.13	1.49
Third	0.59	1.81	0.13	8.24	0.00	1.57	2.08
Fourth	0.96	2.60	0.21	11.93	0.00	2.23	3.05
Fifth or more	1.58	4.86	0.33	22.97	0.00	4.25	5.57
Cut 1		-3.13	0.08			-3.29	-2.97
Cut 2		-1.08	0.07			-1.23	-0.93
Cut 3		0.11	0.07			-0.03	0.26
Cut 4		1.03	0.07			0.89	1.18
Cut 5		2.74	0.09			2.57	2.91

Also, the child's birth order has a significant effect on the family choices. Table 3 shows that as the birth order gets higher it is more likely for the family to reject the tradeoff choice. Reference to the first order child, the family of a second birth order child is significantly more likely (by 30%) to reject the tradeoff choice. Also, a fifth order child or more is 4 times more likely to belong to a family that rejects the tradeoff choice than a first order child.

A Prediction of Q-Q tradeoff Choices

Based on the equations presented in appendix A-3, the model allows for the calculation of the probabilities for each category of the dependent variable, these predictions are usually easier to understand than the coefficients or the odds ratios. Predictive probabilities are extracted to correspond to each individual according to the characteristics of the family.

We first calculate the probabilities corresponding to individuals who have the following base characteristics for each explanatory variable (Reference group values):

- Gender: Female
- Place of Residence: Rural
- Wealth Index: Poorest
- Father's Education: Illiterate
- Mother's Education: Illiterate
- Father's Occupation: No Job Or Blue Collars
- Mother's Occupation: No Job
- Birth Order: First

As shown in table 4, the probabilities associated with the "reference group" individuals who are first birth order females living in a rural area who belong to the poorest wealth index group and who have illiterate parents, mothers who have no job and fathers who have blue collar jobs or do not work are shown on the reference category row. The probability of this "reference" individual to be in a family that fully chooses the tradeoff is 0.042 while the probability of this individual to be in a family that fully rejects the tradeoff is 0.061. Out of 1000 families in this study, it is expected that 212, 275, 209 and 202 families will belong to the second, third, fourth and fifth ordered degrees of tradeoff choices. It is expected that this individual will be in a family that belongs to third ordered degree of choice (the choice with the highest probability). The table presents all predictive probabilities associated with all of the explanatory variables separately keeping other variables constant.

Table 4: Predictive Probabilities.

	Ordered Tradeoff Choices					
Individual Characteristics	**First**	**Second**	**Third**	**Forth**	**Fifth**	**Sixth**
Gender						
Female (Reference)^R	0.042	0.212	0.275	0.209	0.202	0.061
Male	0.068***	0.293***	0.29*	0.173***	0.139***	0.037***
Place of Residence						
Rural (Reference)^R	0.042	0.212	0.275	0.209	0.202	0.061
Urban	0.055***	0.257***	0.287	0.19***	0.164***	0.046***
Wealth Index						
Poorest (Reference)^R	0.042	0.212	0.275	0.209	0.202	0.061
Poorer	0.075***	0.311***	0.289*	0.164***	0.127***	0.034***
Middle	0.107***	0.375***	0.272	0.131***	0.092***	0.023***
Richer	0.167***	0.442***	0.228***	0.091***	0.058***	0.014***
Richest	0.238***	0.47***	0.181***	0.064***	0.039***	0.009***

Father's Education						
Illiterate (Reference)[R]	0.042	0.212	0.275	0.209	0.202	0.061
Reads & Writes	0.059***	0.268***	0.289*	0.185***	0.156***	0.043***
Less than Intermediate	0.07***	0.299***	0.29*	0.17***	0.135***	0.036***
Intermediate	0.086***	0.335***	0.285	0.152***	0.113***	0.029***
Above Intermediate	0.124***	0.399***	0.261*	0.117***	0.08***	0.02***
Mother's Education						
Illiterate (Reference) [R]	0.042	0.212	0.275	0.209	0.202	0.061
Reads & Writes	0.054***	0.252***	0.287	0.192**	0.168***	0.047***
Less than Intermediate	0.063***	0.281***	0.29*	0.179***	0.147***	0.04***
Intermediate	0.089***	0.343***	0.283	0.148***	0.109***	0.028***
Above Intermediate	0.183***	0.452***	0.217***	0.083***	0.052***	0.012***
Father's Occupation						
No Job Or Blue Collars (Reference)[R]	0.042	0.212	0.275	0.209	0.202	0.061
White Collars	0.045	0.224*	0.280	0.204	0.190*	0.056
Mother's Occupation						
No Job (Reference)[R]	0.042	0.212	0.275	0.209	0.202	0.061
Blue Collars	0.036*	0.188***	0.264	0.217	0.224***	0.071**
White Collars	0.062***	0.278***	0.29*	0.18***	0.149***	0.041***
Birth Order						
First (Reference)[R]	0.042	0.212	0.275	0.209	0.202	0.061
Second	0.033***	0.175***	0.256**	0.221*	0.238***	0.077***
Third	0.024***	0.135***	0.225***	0.226**	0.287***	0.104***
Fourth	0.017***	0.099***	0.186***	0.218	0.337***	0.144***
Fifth or more	0.009***	0.056***	0.122***	0.179***	0.395***	0.239***

***P-value <0.01, **P-value<0.05 & * P-value <0.1 (Significance level for predictive probability difference from the reference group)
[R] Reference groups have the same characteristics: Gender: Female, Place of Residence: Rural, Wealth Index: Poorest, Father's Education: Illiterate, Mother's Education: Illiterate, Father's Occupation: No Job Or Blue Collars, Mother's Occupation: No Job, and Birth Order: First.

The results of table 4 can be used to make predictive probabilities by changing the categories of the dependent variables. These can be calculated using the formula outlined in appendix A-4 as shown in the following examples:

Example 1: A first birth order female child living in an urban area, who belongs to the poorest wealth index group, has an illiterate mother who has no job and a father who has a blue collar job or does not work (i.e. a reference individual) will most probably (0.275) belong to a family that is in the third order of accepting the tradeoff choice (i.e. medium child education and medium completed fertility).This degree of choice would be changed to the second if only the mother's educational level changes. The calculated predicted probability to be in the second degree increased significantly from 0.212 to 0.281 if the mother has less than intermediate education, and to 0.343 if the mother has intermediate education and to 0.452 if the mother reached a level above intermediate education.

Example 2: In a rural area, the family of a female first child who belongs to the poorest wealth index group and who has an illiterate mother who has no job and a father who has a blue collar job or does not work, is more likely (0.275) to belong to the third degree of choice as shown in table 4 (i.e. medium child education and low completed fertility). However, living in an urban area while all other characteristics remain the same implies that the family is likely to take the third (0.287) or second order of decisions (0.257) (i.e. medium child education and medium/low completed fertility). On the other hand, by allowing the wealth index to change, the degree of choice for this rural family may change to the second (i.e. medium child education and low completed fertility) if the rural family was wealthier. The probability of belonging to the second degree of choice increases to (0.311) as the wealth index increases to the "poorer" category and to (0.375) as the wealth index increases to the "middle" group and to (0.442) as the wealth index increases to the "richer" group and to (0.47) as the wealth index increases to the "richest" group while all other variables remain constant.

Example 3: Birth order has a remarkable impact on the probabilities of all choices, Moving from the first birth order to the second increases the probability of being in a family that makes the fourth and fifth choices from 0.209 and 0.202 to 0.221 and 0.238 respectively. While being a " third birth order or more" child increase the likelihood of belonging to the fifth ordered degree of choice (i.e. low child education and medium completed fertility) with probability 0.287 rather than the third ordered choice (i.e. medium child education and medium completed fertility) for the reference group family.

4 Discussion

This study reveals a new perspective of child quantity-quality tradeoff choices made by Egyptian families. Six groups of families were identified and ranked according to the degree of choosing the quantity-quality tradeoff. A little less than half of the sample (48.5%) fully accepted the tradeoff choice and had a small family size (3 children or less) and provided high or medium education. The rest of the sample (51.5%) did not fully accept the quantity-quality tradeoff choice. They had four or more children and provided medium or no education. Families who accepted the tradeoff live in urban areas, fathers and mothers are highly educated (intermediate or above), fathers and mothers have white collar jobs and they belong to the rich and richest wealth categories. The ordinal logistic regression model showed that gender of the child, place of residence, and mother's occupation had a relatively moderate impact on the tradeoff choice, while father's occupation had no significant effect . It also seems that blue collar mothers are more aware and demanding of their children to work and earn income that will help support the family. These empirical results confirm the expected existence of a quality-quantity tradeoff of children that matches the economic situation especially that related to the high incidence of child labor.

5 Policy Implications

The shift from making a choice of having a large family and providing children with less education to a choice of having a small number of educated children is essential and is at the core of improving the economic situation in Egypt. The quantity-quality trade-off choices taken at the level of the Egyptian family will contribute to the realization of two important Egyptian strategic plans. Reducing the total fertility rate is a major goal of the National Strategic Population Plan 2015-2030 (National Population Council, 2015). Also providing primary education for all Egyptian children is a major goal of the Sustainable Development Strategy, Egypt vision 2030 (Ministry of Planning, Monitoring and Administrative Reform, 2016)[17].

Efforts to affect tradeoff choices require, as a first step, determining the socioeconomic and demographic factors associated with these choices. This paper highlights the factors and assists policy makers to target identified groups at specific locations. While all socioeconomic factors included in this analysis were significantly related to the probabilities of making a quantity-quality tradeoff choice, we find that the mother's education and occupation are the most powerful predictors. By expanding and improving female education and employment it is expected that preferring a smaller family size and offering education to the children, will become more popular.

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Appendix

Appendix A-1: Correlation matrix of the Independent Variables

	Gender	Place of residence	Wealth index	Father education	Mother education	Father occupation	Mother occupation	Birth Order
Gender	1.000							
Place of Residence	0.019	1.000						
Wealth Index	0.048	-0.358	1.000					
Father's Education	-0.070	-0.265	0.470	1.000				
Mother's Education	-0.080	-0.301	0.461	0.611	1.000			
Father's Occupation	0.010	-0.194	0.332	0.502	0.388	1.000		
Mother's Occupation	-0.070	-0.085	0.157	0.240	0.373	0.173	1.000	
Birth Order	-0.092	-0.099	-0.131	-0.235	-0.289	-0.132	-0.150	1.000

Appendix A-2: Model Diagnostics

The pseudo-R^2 explained in the table below provides a quick way to describe or compare the fit of different models for the same dependent variable, although it lacks the straightforward explained-variance interpretation of true R^2 in OLS regression. But it indicates that there is relatively small proportion of the variation in family decisions. This is just as we would expect because there are numerous factors that affect family choices. However, there is no strong guidance in the literature on how these should be used or interpreted (Lomax & Hahs-Vaugn, 2012; Osborne, 2015; Pituch & Stevens, 2016; Smith & McKenna, 2013). As such, one should interpret these with caution.

Pseudo R-Square

Cox and Snell	.418
Nagelkerke	.433
McFadden	.161

Link function: Logit.

At the same time, multicollinearity was assessed between the independent variables in the model, the results showed that mean VIF is 1.58 which is less than 10 (Heir et al., 1995) OR 5 (Ringle et al., 2015) which is the maximum VIF that reports multicollinearity problem. Also, the condition number was 8.6 which is not large (greater than 10) to report global instability of the regression coefficients.

Appendix A-3: Threshold/Cut Points Parameters

The threshold parameters of (Cut points explained in the bottom of the table) indicate where the latent variable Y_i^* is cut to make the six groups that we observe in our data. Note that this latent variable is continuous. In general, these are not used in the interpretation of the results.

The threshold coefficients are representing the intercepts, specifically the point (in terms of a logit) where family decision might be predicted into the 6 categories. Since there are six possible values for family ordered degrees of choices (Y), the values for Y are:

$Y_i = 1 \; if \; Y_i^* \; is \; \leq -3.13$

$Y_i = 2 \; if \; -3.13 \leq Y_i^* \leq -1.08$

$Y_i = 3 \; if \; -1.08 \leq Y_i^* \leq 0.11$

$Y_i = 4 \; if \; 0.11 \leq Y_i^* \leq 1.03$

$Y_i = 5 \; if \; 1.03 \leq Y_i^* \leq 2.74$

$Y_i = 6 \; if \; Y_i^* \; is \; \geq 2.74$

Appendix A-4: Predicted Probabilities Formulas

$$P(Y_i = 1) = 1 - \frac{\exp(X_i\beta - \kappa_1)}{1 + [\exp(X_i\beta - \kappa_1)]}$$

$$P(Y_i = j) = \frac{\exp(X_i\beta - \kappa_{j-1})}{1 + [\exp(X_i\beta - \kappa_{j-1})]} - \frac{\exp(X_i\beta - \kappa_j)}{1 + [\exp(X_i\beta - \kappa_j)]} \quad j = 2, \ldots, M-1$$

$$P(Y_i = M) = \frac{\exp(X_i\beta - \kappa_{M-1})}{1 + [\exp(X_i\beta - \kappa_{M-1})]}$$

Where:

$X_i$represents the explanatory variables in the model

β Parameter Coefficient Estimates for each explanatory variable

K_jCutpoints/Thresholds/Intercept