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INCOME DISTRIBUTION, FERTILITY BEHAVIOR AND DEMOGRAPHIC TRANSITION IN EGYPT: A DUAL CAUSALITY?

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Abstract - Demographic-economic interrelationships have been broadly examined in the literature from a macro perspective using mostly cross-country panel regressions. A limited strand of literature has emphasized the need to examine the demographic-economic dynamics in a reversed way; inspect dual-causality relation between demographic and economic factors. In this paper, I examine the effect of changes in income distribution and fertility behavior on the speed of demographic transition. I moreover examine the reverse relation by testing effect of changed household structure on income distribution and income disparities in Egypt. Empirical results show that wealth redistribution in Egypt and moving up to higher wealth quintiles did not have a significant effect on decreasing child dependency. Moreover, results also indicate that demographic transition process and the decline in dependency levels that took place since the nineties of the past century didn't have a significant effect on income disparities in Egypt. The results affirm my previous empirical findings with Nassaret al. (2016); that the dominant effect that has led to changes in child dependency in Egypt was rather the modification in fertility behaviors within wealth groups than the changes in socioeconomic factors.

Keywords - income inequality – fertility – dependency rates – demographic transition

I. INTRODUCTION

Demographic-economic dynamics have been commonly tested from a macro perspective using cross-country panel regressions or time series analysis for a single country. As pointed out in Bloom et al.(2012) and Mason (2002), literature have always set the assumption of a "unified demographic behavior" within the economy based on the life-cycle hypothesis. Some limited literature attempts criticized this assumption and argued that when examining the relation between demographic and economic changes, one should allow more space for the non-uniformity in economic and demographic behavior of different socioeconomic, age, education, and geographical groups. Kuznets(1976, 1980),Oshima and Mason (2002), Schultz (1997) and Bloom (2012) studied the relation between demographic transition and income inequality across different wealth groups through decomposing fertility responses across differents ocioeconomic, geographical and educational categories (Nassar et al., 2016). Kuznets (1976) argued that changes in income inequality resulting from household structure changes could be measured, through comparing per-capita household income as to income per equivalent adult and the traditional per-capitaincome. This can give an estimate of the degree of inequality that results from disparities in household size.Moreover, Kuznets (1980) developed The Total Disparity Measure; an index to measure income disparity caused by variation in household size (as an indicator of dependency) (Kuznets, 1980, cited in Schultz 1997).Oshima and Mason (2002) and Schultz (1997) capitalized on Kuznets's idea and used variance decomposition techniques to examine the impact of demographic transition on income disparities.

However, despite these limited attempts to investigate the economic-demographic transition nexus on the micro level, the reverse causality between the economic-social-demographic variablesstill requires a more profound examination, especially in developing countries that are characterized by widespreadeconomic, social and geographic disparities. In my earlier work with Nassaret al (2016)[1], we examined the impact of changes in wealth levels and development indicators on the speed of demographic transition. In this paper, I examine the demographic-economic interrelationships based on the dual-causality assumption. I first examine the effect of changes in income distribution and fertility behavior on the speed of demographic transition using Bloom et al. (2012) counterfactual scenarios methodology. I then follow the previous attempts of Kuznets (1980), Schultz (1997) and Oshmia and Mason (2002) to examine the reverse causality hypothesis; that is the effect of changed household structure on income distribution and income disparities in Egypt. The paper is organized as follows: In the next section, I present the methodology and findings of testing the effect of changes in income distribution and fertility behavior on demographic transition. The following section presents the reverse causality tests of the impact of demographic transition on income disparity in Egypt. I depend on Demographic Health Survey

[1]Some of our literature findings in Nassaret al. (2016) are re-presented here as a foundation for further empirical tests in this paper.

(DHS) datasets for Egypt as well as Household Income Expenditure and Consumption Survey (HIECS) datasets for the recently available years.

Measuring the effect of changes in income distribution and fertility behavior on the speed of demographic transition (Counterfactual Scenarios) In this section, I try to test whether the decline that took place in child dependency rates in Egypt are attributed to changes in income distribution or variations in fertility behavior of some income groups. Bloom et al. (2012) investigated the distributional effects of economic and welfare benefits associated with demographic transition across socioeconomic groups over time. Using statistical analysis and quantitative regressions, the paper decomposed the possible factors affecting the changes in child dependency, across different socioeconomic groups, into (1) income-related factors and (2) fertility preferences. They thus assumed that changes that take place in the demographic transition process can be attributed to two effects: The wealth effect and the behavioral effect. The paper found wide differences in the effects of demographic transition across socioeconomic status groups in countries that are still early stages of demographic transition, in addition to substantial behavioral variations across all groups during phases of rapid fertility decline.

Building on Bloom's assumption, in this paper I test whether the change in dependency rates resulted only from moving from an income or wealth category to another or it is because people tend to change their fertility behavior with the changed income level.

First, I present a general overviewof the significant changes that took place in the number of children below 15 years per household – as a proxy for dependency rates - and in the distribution of income according to the socioeconomic status in Egypt[2].First, there is a general decline in dependency rates during the period 1988-2008 in Egypt for all socioeconomic groups. The speed of this declinevaried among socioeconomic groups. The highest speed of decline took place in the urban governorates and in the "very poor" socioeconomic group. This could be attributed to the increasing cost of living for poor people living in these areas compared to other areas; which can affect significantly the childbearing decisions. On the other side, the "very rich "socioeconomic group witnessed the fastest decline rates in other geographic regions.Likewise,figures show that the medium socioeconomic groups were also characterized by the modest rate of decline in child dependency.

Second, the highest average rates of children per household in Egypt reached 3.08 child per household in poorest quintiles in Rural Upper Egypt in 1992 and 1995 surveys. Oppositely, the lowest rate – 1.03 child per household- was found in the "richest" quintiles in urban Lower Egypt in 2005.

Third, it is clear that the poorest wealth quintiles have increased dramatically during the period 1988-2008; with an overall increase of 196%. On the other hand, households in the richest wealth quintiles have also increased by around 106% during the same period. Finally, with regards to the medium wealth quintiles, they have only increased by 10% in Urban Lower Egypt. Strikingly, this category has diminished significantly in all other geographic regions.

Based on the presented DHS survey datasets, I then construct a scenario analysis to decompose the factors behind the decline in child dependency during the examined period. Following Bloom et al. (2012), I assume that changes in child dependency can be attributed to two main factors: factors related to changes in wealth status and household distribution across wealth quintiles, and, factors related to changes in fertility behavior within each wealth group. Accordingly, I run two counterfactual scenarios to isolate/separate each effect.

In the first scenario the distribution of household is assumed to be fixed across wealth quintiles (the percentage of household in each wealth quintile is left unchanged as per the base year)[3].

The second scenario is just counter the first one; where I assume fixed fertility behavior through setting the dependency indicator at the base year values for each group. The scenarios reveal very important results. The effect of changes in household wealth distribution across the wealth quintiles on changes in child dependency is very weak. The largest impact was just a modest increase in dependency by 0.08 child per household in rural Upper Egypt in 1995. On the other side, the largest change in the opposite direction was found in the urban governorates; a decrease in dependency by 0.09 in 2000 and 2005. Overall, the wealth effect was almost negligible.

The results also indicate that direction and magnitude of fertility responses to changes in wealth distribution are different in rural versus urban regions. In urban regions generally, the responses were negative and with a large magnitude. While in rural areas it was positive but with a small magnitude. This indicates that positive changes in wealth distribution across wealth groups lead to decreasing dependency in

[2]Socioeconomic status as identified in DHS surreys and datasets.

[3] The first scenario was calculated by fixing the percentage of households in all wealth groups according to the base year 1988. Then every household group was multiplied by the base year value with the dependency rates for the same wealth group. Then the values were added up for the five levels in order to get the average dependency in the case of fixed wealth distribution across households.

urban areas while the same changes lead to an increase in dependency in rural areas. Finally, the results show that the most important and dominant factor affecting child dependency is the changes in fertility behavior within the wealth groups. Scenario results are significantly different from original values both in direction and magnitude; the highest positive difference of 1.31 child per household in was found in rural Lower Egypt.

The above scenarios imply that wealth redistribution in Egypt and moving up to higher wealth quintiles didn't have a significant effect on decreasing child dependency. In fact, the dominant effect that has led to changes in child dependency was the modification in fertility behaviors within wealth groups. Accordingly, the decrease in dependency rates in Egypt during the period 1988-2008 can be argued to result from fertility behavior changes and not from household movements up to higher wealth quintiles. In other words, fertility rates would have been significantly higher if wealth groups didn't adjust their fertility behaviors regardless of their income distribution and wealth changes.

The Relation between changes in household structure and fertility behavior in Egypt

As mentioned earlier, literature acknowledged the importance of not ignoring the reverse causality relation between demographic and economic variables. The well-studied East Asian experience has been also a pioneering example of the significant effect of declining fertility on development and shrinking income disparities; once accompanied with "the correct policy measures"[4]. As pointed out in the previous section, Egypt has already witnessed a decline in dependency rates since the end eighties. We need to test the hypothesis whether such decline has had a significant impact on income distribution or not. Accordingly, I examine in this section the impact of the demographic transition process on income disparities in Egypt on the household level using EDHS and HIECS survey datasets. However, it is important to highlight that– as Kuznets (1976) and Oshima and Mason (2002) indicated - accurate income data on an annual basis is usually unavailable which makes surveys the second best option to obtain data and information about income-related indicators. Survey-based data are subject to several problems such as the desire to disclose information about actual sources of income, levels of education of the sample, non-monetized economic sectors,,,etc. All these factors can affect the accurate estimation of income levels and indicators.

Moreover,Oshima and Mason (2002) suggested that household income would be a better indicator for micro-assessing income disparities across socioeconomic groups rather than the traditional per capita income. Since per capita income is usually concerned with wages and salaries; while rents, assets and other sources of income are more related to the family or the household.

I first examine the impact of demographic transition on income disparities using the Total Disparity Measure created by Kuznets (1980) and developed by Schutlz (1997). Literature argued that the declining dependency rates as part of the demographic transition process can result into a decline in household income disparities. Kuznets (1980) developed an index to measure the changes in income disparities that result from changes in dependency rates. Schultz (1997) has further developed the index and defined it as "the sum of differences in percentage shares of households, and shares of income, across the distribution by household size, disregarding in the summation the signs of the differences" (Schultz, 1997).

Household Income Expenditure and Consumption Surveys (HIECS) published by the Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS)[5] are used as sample datasets to examine the above assumptions. To run the tests, household sample was divided into 8 categories according to household size (Starting from 1 family member/ person up to 8 family members).The Total Disparity Measure (TDM) is calculated for each year in the last low of table (1).

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he results indicate the following: First, the household (4-5 members) ranks the highest household category. It accounted for almost 40% of the total households in the whole sample. Second, there is a clear decline in the number of large families/households over time, mirrored by their declining values throughout the four surveys. For example, households with 8 members or more decreased from 9.5% in 1999/2000 survey to 5.7% in 2010/2011 survey.

These changes in household distribution and size have implications on income distribution. As shown in the table, the average income per household increases with the number of members of the household. However, it increases with a decreasing rate as illustrated in figure (1). These results confirm Schultz (1997) results that the relative average incomes of households increase with the household size but with a decreasing rate and that average per capita income declines sharply in households with large member size.

[4] For more detailed review of the EA experience, check Bloom et al. (1998), Demographic Transitions and Economic Miracles in Emerging Asia", The World Bank Economic Review.

[5] I use HIECS survey datasets for the available years: 1999/2000, 2004/2005, 2008/2009 and 2010/2011.

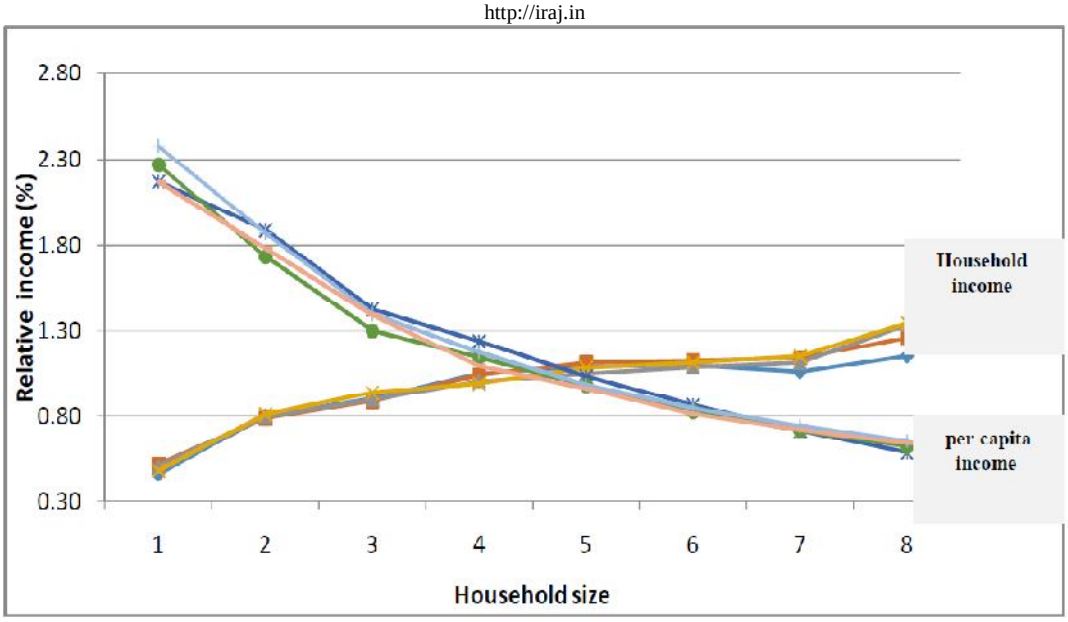

Figure (1): Relative income by household size, Egypt.
Each trend line indicates a sample year.
Source: Calculated based on table (1).

The figures show that The Total Disparity Measure (TDM) has decreased for households from 12 points in 1999/2000 survey to 11.2 points in 2010/2011 survey, with a 7% decrease during the mentioned period. On the other hand, TDM for persons (per capita) decreased from 26.9% in 1999/2000 to 22.5% in 2010/2011, with almost a 16% percentage decrease during the mentioned period. Despite the overall decrease in TDM, fluctuations in the index show that the decline in income disparity resulting from household structural changes wasn't steady or sustainable during the specified period.

To check the robustnessof the above results, I re-examine the same hypothesis using variance decomposition method applied in Oshima and Mason (2002). To measure the impact of changed household structure on income distribution in Egypt, I run a decomposition test on the variance of per capita income as –hereby defined as Var (LnY/N)- a proxy for household income disparities in Egypt. As noted in Oshima and Mason (2002) "A principal advantage of

this measure is that it can be decomposed into additive components that distinguish inequality in income per adult and income per capita. The decomposition also allows us to isolate the effect of some of the important demographic changes described above" (Oshima and Mason. 2002:8). The variance equation is stated as follows:

Var (lnY/N) = Var (Ln Y/A) + Var (Ln N/A) -2Cov (Ln Y/A, Ln N/A)

Where Y is the income, N is the number of household members and A is the number of adults in the household. I measure the impact of changed household structure and changed dependency levels through the last two components in the equation: Var (Ln N/A) -2Cov (Ln Y/A, Ln N/A). The proxy "Var (Ln N/A)" explains changes and variations the take place in dependency levels. While the covariance "2Cov (Ln Y/A, Ln N/A)" measures the heterogeneity between income and child dependency. It observes whether low-income adults support more family members than the higher income adults. As stated in Oshima and Mason (2002) "If low-income adults support more children and if the variance in the dependency ratio is greater in high fertility populations, then a decline in childbearing leads to lower inequality" (Oshima and Mason, 2002). In other ords, the component Var (Ln N/A) -2Cov (Ln Y/A, Ln N/A) measures the impact of declining heterogeneity in child dependency.

Table (2) in the annex and figure (2) show the results of variance decomposition tests for Egypt during the period 1999-2011. Using HIECS survey datasets, the displayed results show the decrease in the variance of household per capita income, per capita income and adult income per capita. The variance decreased by 22%, 21% and 24% respectively for the three variables in 2010/2011 compared to 1999/2000. Variance in dependency levels didn't show a significant change during the examined period as a result of positive and negative fluctuations. Finally, changes in household structure resulted in an increase in per capita income variance by around 7.3% during the examined period.

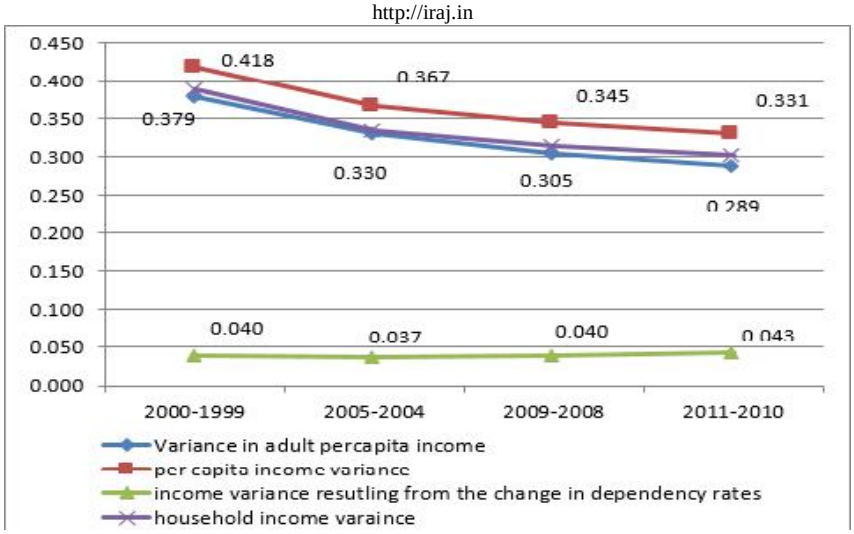

Figure (2): Income Disparities resulting from variations in dependency levels in Egypt (1999-2011)
Source: Author calculations based on HIECS survey datasets.

The above results indicate that there was a general decline in income disparities during the examined period. However, digging deeper into the reasons behind this decline, variance decomposition shows that the main component that was responsible for this decline was the decline in adult per capita income variance. Added to this, changes in household structure and child dependency variances were modest and in an opposing direction. The impact of changes in household structure on income disparities is believed to be very weak to have a significant effect on the overall changes in income disparities. This result reaffirms the pervious TDM| results, which indicated that changes in household structure resulting from the demographic transition process didn't have a significant effect on income disparities in Egypt.

CONCLUSIONS

In my earlier work with Nassaret al. (2016), we followed the mainstream literature that examined the impact of changes in income level and development indicators on the speed of demographic transition. In our micro-investigation of the demographic-economic interrelationships, we found that changes in population wealth levels didn't have a significant impact on declining dependency rates in Egypt. The main contributor to declining dependency was the changed fertility behavior in Egypt since the end eighties and until 2014. However, in this paper I examine the demographic-economic interrelationships based on a dual-causality assumption. I first examined the effect of changes in income distribution and fertility behavior on the speed of demographic transition. Results indicated that the impact of changed household income distribution on changes in child dependency is not only very weak but also non-uniform. Positive changes in wealth distribution across wealth groups lead to decreasing dependency in urban areas while the same changes lead to an increase in dependency in rural areas. Moreover, the results have shown that the most important and dominant factor affecting child dependency is the changes in fertility behavior within the wealth groups.

This affirms earlier results in Nassar et al. (2016) that empirically proved that the dominant factor affecting demographic transition is the changes in fertility behavior within the wealth groups and not the changes in the wealth status itself. To examine the reverse relation, that is, the impact of changes in demographic transition on income levels and income distribution, I tested for the impact of changed household composition –resulting from demographic transition- on income disparities in Egypt since the end nineties of the past century. Results indicate that the demographic transition process and the decline in dependency levels that took place since the nineties of the past century didn't have a significant effect on income disparities in Egypt during the mentioned period. Despite the general decrease in income disparities that took place during this period, demographic changes cannot be claimed among the determinants of these changes.

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Annex

Table (1): Total Disparity Measure, Egypt 1999-2011.

	2000-1999					2005-2004				
Household size class	-1	-2	-3	absolutedifference between percent of Household and percent of income	absolutedifference between percent of persons and percent of income	-1	-2	-3	absolutedifference between percent of Household and percent of income	absolutedifference between percent of persons and percent of income
	percentage of household *	percentage of persons**	percentage of income ***			percentage of household *	percentage of persons**	percentage of income ***		
1	4,7	1	2,2	2,6	1,2	6,5	1,5	3,4	3,2	1,9
2	10,8	4,6	8,6	2,2	4,1	11,6	5,3	9,1	2,4	3,9
3	13,5	8,5	12,2	1,3	3,6	14,8	10,1	13,2	1,7	3,0
4	19,6	16,6	20,5	0,9	3,9	20,6	18,7	21,4	0,8	2,7
5	20,1	21,2	21,9	1,8	0,7	20,4	23,2	22,7	2,3	0,5
6	13,7	17,5	15,1	1,3	2,4	13	17,8	14,7	1,6	3,1
7	8,1	12	8,6	0,5	3,4	6,7	10,7	7,7	0,9	3,0
8 or more	9,5	18,6	10,9	1,4	7,7	6,3	12,8	7,9	1,6	4,8
Total Disparity Measure				**12**	**26.9**				**14.6**	**23**

* Percent of household of…members to total households in the sample.
**percent of persons living in a household of … members to total sample.
*** Percent of household of …members to total income.
Source: Calculated based on table HIECS data.

Table (1): Total Disparity Measure, Egypt 1999-2011 -Cont'd.

	2009-2008					2011-2010				
Household size class	-1	-2	-3	absolutedifference between percent of Household and percent of income	absolutedifference between percent of persons and percent of income	-1	-2	-3	absolutedifference between percent of Household and percent of income	absolutedifference between percent of persons and percent of income
	percentage of household *	percentage of persons**	percentage of income ***			percentage of household *	percentage of persons**	percentage of income ***		
1	4,8	1	2,4	2,3	1,4	5,5	1,2	2,7	2,9	1,4
2	9,9	4,2	7,9	2,0	3,7	10,8	4,9	8,8	2,0	3,8
3	13,8	8,8	12,3	1,5	3,5	15,3	10,3	14,4	0,9	4,0
4	21,2	18,1	21,3	0,1	3,2	22,5	20,4	22,3	0,2	1,9
5	21,1	22,6	22,1	1,0	0,4	21,6	24,4	23,4	1,8	1,0
6	13,4	17,2	14,5	1,1	2,6	12,5	17,1	13,9	1,4	3,2
7	7,4	11	8,2	0,8	2,8	6,1	9,7	7,0	0,9	2,7
8 or more	8,4	17,1	11,2	2,8	5,9	5,7	12	7,7	2,0	4,3
Total Disparity Measure				**11.6**	**23.5**				**11.2**	**22.5**

* Percent of household of…members to total households in the sample.
**percent of persons living in a household of … members to total sample.
*** Percent of household of …members to total income.
Source: Calculated based on HIECS data.

Table (2): Variance Decomposition results for household and income data in Egypt (1999-2011)

	1	2	3	4	5	1-2
	household income variance	per capita income variance	Variance in adult percapita income	Variance in Dependency levels	Covariance adult percapita income, variance in dependency levels	income variance resulting from the change in dependency rates
Survey year	V ar (ln Y)	Var (lnY/N) − Var (ln Y/A) + Var (ln N/A) - 2 Cov (ln y/A, ln N/a)	Var (ln Y/A)	Var(ln N/A)	Cov (ln y/A, ln N/a)	Var (ln N/A) -2 Cov (ln y/A, ln N/a)
2000-1999	0.389	0.418	0.379	0.135	0.048	0.04
2005-2004	0.335	0.367	0.33	0.138	0.051	0.037
2009-2008	0.315	0.345	0.305	0.136	0.048	0.04
2011-2010	0.303	0.331	0.289	0.135	0.046	0.043
Percentage change	-22.108	-20.798	-23.744	-0.026	-2.962	7.313

Source: Author calculations based on HIECS survey datasets.

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