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Rethinking the time allocation of Egyptian females: A matching analysis

Rana Hardy

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WORKING PAPER SERIES

Poverty, Job Quality and Labor Market Dynamics

Rethinking the Time Allocation of Egyptian Females: A Matching Analysis

Rana Hendy

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Abstract

This study explores the extremely biased division of labor within Egyptian households. The effects of marriage on women's market and domestic labor supplies are important aspects of this study. New explanations for married women's low participation rates are proposed. A matching model is estimated to determine how selection into marriage alters the time allocation of women. The empirical results show that marriage significantly affects both types of work. Married women spend weekly about eight hours less on market work relative to their single counterparts. Interestingly, marriage as a treatment increases domestic labor supply by thirty hours weekly.

JEL classification: D13, J16, J22.

Keywords: Time Allocation, Marriage, Matching, Egypt.

1. Introduction

The classical dichotomy of "work in the market" versus "leisure" may serve as a good approximation of the role played by men in the productive activity of the household but does gross injustice to women, since it overlooks the whole time she spends outside the market on domestic activities. For this reason, studying females' invisible unpaid work is crucial.

The need to adopt the household as a unit of analysis is particularly significant if the focus of attention is women's economic behavior, as women tend to invest more time in activities that remain outside the cash economy. Economists have made a great effort to explain the market behavior of married women (i.e., patterns of participation, number of working hours, and determinants of wives earnings etc.), although very little has been done, in developing countries, to analyze the allocation of time within the home sector.

Let us start by defining "domestic production." It represents all the unpaid work done to maintain family members and/or a home. This topic has been widely recognized in developed countries as an important area of research study since the 1990's. Over the last decade, increasing attention

has been paid to the analysis of the labor division between members of the same household.

As Becker (1964) and Gronau (1976) argued, calling the whole time spent by women outside the market sector “leisure” is to underestimate her contribution to the economy and to overlook the production activities she engages in through work at home. These activities are better termed “domestic production.”

According to the UN convention “*all persons of either sex who furnish the supply of labor for the production of economic goods and services*” should have been included in labor force statistics during the last two decades (ILO, 1976), quoted in Beneria (1981). In addition to this, economic activities, theoretically, should satisfy human needs through the production of goods and services, regardless of whether they are channeled through the cash market or other forms of exchange. There is no good reason why cooking and food processing should be considered less productive than growing food, especially that cooking for one’s employer is an economic activity but cooking for one’s own household is not (Waring, 1988). Adoption of such a definition would give visibility to women and children in national figures, since they make important economic contributions to both the domestic unit and to the national economy through these activities. Moreover, correct information on women’s work is “crucial for diagnosing the causes of poverty and inequality and for guiding policymakers in their attempts to improve living standards” (Schaffner, 2000a).

Neoclassical theory (Becker, 1965) has convincingly argued that the division between women’s participation in non-market activities and males’ participation in market activities is based on efficiency and the maximization of utility. However, the latter point does not seem to be justified, since females’ contribution to their household often exceeds that of males and their share of benefits is less (Folbre, 1984). Moreover, while many women contribute more hours of work to support their households than their spouses do, they often declare “*I do not work*” or “*I am only a housewife*,” because their labor is not remunerated. This has significant implications on their status and their position not only in their own households, but also in the society (Hoodfar, 1997).

As Gronau (1976) mentioned, the wife’s time is an *iceberg* since we have plenty of information about the visible tip, the time spent in the market, but almost none about the submerged part spent at home. In other words, “*the problem of females’ activities is that they are often not ‘counted’ in statistics, not ‘accounted for’ in representations of the economy and not ‘taken into account’ when policies are created*” (Elson, 2000). Suitable statistical means are

greatly needed to recognize and make visible the full extent of women's work and all their contributions to the national economy, including their contribution to unremunerated sectors (United Nations, Fourth World Conference on Women, 1995-68.b).

An extensive literature exists on the "dilemmas" of modern family life (Gerson, 1985; Frinking and Willemsem, 1997). It has to be recognized that the division of paid and unpaid work concerns the family unit as well as the whole society since it has many socioeconomic implications.

Yet, time allocation in Egypt and in the Arab world has not been empirically studied. The present work aims at studying the allocation of time between market and domestic work to allow for better measurement and consideration of women's work. Unfortunately, data on domestic production are only available for women. Nevertheless, assuming that men do not participate in non market work does not seem to be a strong assumption in the Egyptian and Arab contexts.

As in most developing economies, female labor force participation rates in Egypt remain relatively low. At different points of time- 1988, 1998 and 2006- over 65 percent of ever married women were not actively engaged in market production and not more than 30 percent participated in the labor market (Assaad, 2007; Assaad and El-Hamidi, 2009). In other words, the women's main occupation in Egypt remains housewives. The present research gives new evidence on the perfectly biased intrahousehold allocation of time that represents a considerable constraint for married females to reconcile between family and professional lives. Hence, the implementation of more serious family-friendly policies calling for a more equitable division of labor within the family are strongly needed. For instance, increasing part-time jobs that take into full consideration the burden of women's household responsibilities are also crucial to enable women to continue working after marriage.

Bearing in mind these facts, several questions arise: how has domestic production changed over time especially with the decrease in fertility and increase in time-saving devices. And, how does marriage affect the time-use of Egyptian women. The present study provides a deep descriptive analysis that aims at having a glance at how Egyptian women use their time, the evolution of women's time allocation over time and, the difference between single and married women's time allocation.

Time-use profiles are constructed using the Egyptian Labor Market Panel Surveys (ELMPS) of 1998 and 2006. Unfortunately, the time-use questionnaire is available only for women and children. As the data collectors argued, men refused to answer the questions on domestic

activities because they think it is humiliating. For this reason, comparisons between time allocation of men and women cannot be made in this study.

In the analysis, we distinguish between single and married women. Note that, as defined in the present study, single women are those who have never been married, and married ones are those currently married and living with their spouse in the same household. All divorced and widowed women are excluded from the analysis.

This paper first provides a cross-sectional analysis that aims at exploring Egyptian women's time-use among different work categories in 2006. Then, using both surveys from 1998 and 2006, I make use of the panel aspect of the data in order to observe differences in women's time-use that result from changes in their marital status. Finally, a matching model is estimated to identify how selection into marriage alters the time allocation of women.

In the analysis, I distinguish between three main work categories. (1) 'market work' encompasses all activities that produce goods and services that contribute to national wealth and economic growth (Donahoe, 1999). The latter includes all market and subsistence activities whether paid monetarily, in kind, or unpaid work for family. This type of work is common in most developing countries. (2) 'domestic work' involves all unpaid work done to maintain family members and/or a home. It includes housework and child care activities (see Appendix A for more details). Finally, (3) 'total work' regroups these two working activities to account for the total time spent per week in all types of work. Typically, subtracting the latter from the total weekly time available for individuals (24 hours multiplied by seven days, or 168 hours per week) would allow the calculation of the amount of hours per week available for leisure activities.

The paper is organized as follows: section 2 is devoted to the presentation of the data. Section 3 displays the descriptive analysis using a cross sectional as well as a panel approach. Section 4 presents the matching model specifications. Section 5 shows the empirical results and, section 6 concludes.

2. Data

Data used in this study are obtained from the nationally-representative Egyptian Labor Market Panel Surveys (ELMPS) of 1998 and 2006. Of the 8,371 households interviewed in 2006, 3,701 were households that were interviewed in ELMS 1998, 2,167 were splits from the original

households, and 2,498 were part of an entirely new refresher sample. In total, 17,364 individuals were successfully tracked from 1998 to 2006. These households were selected from a CAPMAS (Central Agency for Public Mobilizations and Statistics) master sample prepared in 1995. The questionnaire is composed of three major sections: (1) a household questionnaire administered to the head of household or the head's spouse that contains information on basic demographic characteristics of household members, movement of household members in and out of the household since 1998, ownership of durable goods and assets, and housing conditions, (2) an individual questionnaire administered to the individual him or herself containing information on parental background, detailed education histories, activity status, job search and unemployment, detailed employment characteristics, a module on women's work, migration histories, job histories, time-use, earnings and fertility. (3) a household enterprise and income module that elicits information on all agricultural and non-agricultural enterprises operated by the household as well as all income sources, including remittances and transfers (Barsoum, 2007).

The ELMPS is the first panel data available in the Arab region and is known for its richness, which allows economists to closely study various issues related to the Egyptian labor market. In the present study, all women aged between 16 and 64 are considered. The analysis of domestic production activities is based on a specific question: how did you spend the preceding week. In the data, domestic activities were classified into 14 groups (see Appendix A for more details). However, for the 1998 survey, only three aggregated questions are available. For this reason, in the following section, I conduct the cross sectional analysis using only the 2006 survey since this is able to reflect the real time that women spend in domestic activities. In addition, a panel analysis is conducted using all women who were single in 1998 and changed (or not) their marital status between 1998 and 2006. In the panel analysis, the sample consists of 1,850 women.

3. Stylized Facts

3.1 Cross-sectional Analysis

Table 1 shows the time-use of women and men by marital status in 2006. All numbers showed in this table are weekly mean hours. Egyptian married women spend weekly, on average, 46.72 hours on domestic chores. Turning our attention to market labor supply, men spend longer hours on market

activities than women, and this does not seem to differ among married and unmarried men. Contrary to men, single women spend longer hours in the market than married women do, at 43.86 and 37.34 hours, respectively. Also, single and married women spend 19.09 and 46.72 hours respectively on ‘work at home’ activities. Note that the ‘work at home’ category is composed of housework activities as well as child care activities. Total work is calculated as the sum of hours spent on both market and domestic activities. Interestingly, the latter is higher for women than for men whether they are married or single. As shown in Table 1, for the married population, 84.04 and 50.92 hours among women and men, respectively, are spent on total work. Again, men are assumed to not participate at all in domestic activities, which is not a strong assumption for the Egyptian context. Finally, leisure is calculated as the difference between the total time available per week and the time spent on total work.

Table 1: Time-use by gender and marital status in 2006

Time-use (Mean hours)	Women		Men	
	Married	Not married	Married	Not married
Work at home	46.72	19.09	-	-
Housework	37.15	18.58	-	-
Child care	9.57	0.51	-	-
Work in the market	37.34	43.86	50.92	50.01
Total work	84.04	62.95	50,92	50,01
Leisure	27.96	49.05	61,08	61,99

Notes: i. - means that this information is not available in the ELMPS 2006.
 ii. Total work represents the sum of all time spent on work in the market and work at home.
 iii. Leisure is calculated as the difference between total time available per week (24-8 “time for sleeping” multiplied by 7) and the time spent on total work.
 Source: Author’s calculations using the ELMPS of 2006.

Table 2 displays the time allocation of both single and married taking into account the presence or not of children in the household. It shows that married women having children spend the greatest amount of hours on domestic work, at 51.72 hours per week. They spend about 20 hours more on domestic activities compared to women without children and 30 hours more compared to single women. Marriage increases dramatically

the time spent on housework activities; the number of hours is 19.97 and 31.74 respectively for singles and married women without children. Married women with children remain the most productive, with a weekly time spent on total work of 60.98 hours.

Table 2: Time-use of all women: Sample means by marital status and the presence of children in the household*

Time-use *	Single	Married	Married	All
		without children	with children	
Market work	8.87	7.56	9.26	8.83
Domestic work	20.84	32.58	51.72	37.53
Housework	19.97	31.74	38.86	30.97
Child care	0.87	0.84	12.86	6.56
Total work	29.71	40.14	60.98	46.36
N	4103	2000	5526	11629

Note: * This table shows women’s time-use using weekly hours of work.

Source: Author’s calculations using the ELMPs of 2006.

Table 3 displays women’s time allocation by marital status and age group. Interestingly, regardless of the age group, single and married women spend a similar number of hours on market activities. However, married women in general tend to spend longer hours on domestic activities than their single counterparts do. For instance, for the 16-35 age group, married and single women spend on average 32.05 and 18.91 hours respectively on domestic activities. Consequently, for all age groups, the ‘total work’ category is significantly greater for married than for single women. Turning our attention to the 46-64 age group, married and single women spend 40.91 and 31.75 hours respectively on total work. Similarly, married and single women aged between 16 and 35 spend 37.54 and 26.80 respectively. However, there is no difference in total work for the 36-45 age group. To put it in a nutshell, married women do not work less in the market but do work much more at home than single women do.

Table 3: Time-use of all women: sample means by marital status and age group

Time-use	Single			Married		
	16-35	36-45	46-64	16-35	36-45	46-64

continued ►

Market work	7.89	19.26	8.81	5.49	18.31	8.05
Domestic work	18.91	34.49	22.94	32.05	32.28	32.86
Housework	18.28	31.35	21.99	31.92	32.03	31.64
Child care	0.63	3.14	0.95	0.12	0.25	1.22
Total work	26.80	53.75	31.75	37.54	50.59	40.91
N	2954	284	865	640	65	1295

Source: Author's calculations using the ELMPs of 2006.

Table 4 presents married women's time allocation by the presence of children in the household and by age group. For the 36-45 age group, we observe that the presence of children decreases time spent on market work by five hours. This is the result of child care activities that increase significantly with the presence of children. Thus, children largely influence women's total work; 60.85 hours for those with children and 50.59 hours for women without children. In Table 4, women with and without children aged between 16 and 35 spend 62.30 and 37.54 hours on total work respectively. This is also valid for the other age groups. To conclude, both marriage and fertility are important factors affecting both market and domestic labor supply.

Table 4: Time-use of married women: Sample means by presence of children and age group

Married without children		Age 16-35	Age 36-45	Age 46-64
	Market work	5.49	18.31	8.05
	Domestic work	32.05	32.28	32.86
	Housework	31.92	32.03	31.64
	Child care	0.12	0.25	1.22
	Total work	37.54	50.59	40.91
	N	640	65	1295
Married with children				
	Market work	6.46	13.83	13.11
	Domestic work	55.84	47.02	39.42
	Housework	38.98	39.24	36.80

continued ►

	Child care	16.86	7.77	2.62
	Total work	62.30	60.85	52.53
	N	3379	1645	502

Source: Author's calculations using the ELMPS of 2006.

Table 5 presents the time allocation of married women by number of children. It mainly distinguishes between three types of married women: those who don't have children, those who have only one child and those who have two children or more. It is worth noting that the first child is the one who affects the mothers' time-use patterns the most. As shown in Table 5, the arrival of the first child increases the time spent on domestic activities by more than 20 hours (from 32.74 to 53.91) and decreases by only one hour, on average, the time spent in the labor market. This is mainly due to a significant increase in the time spent on child care activities. Similarly, the time spent on total work for married women without children and married women with one child is 40.35 and 60.34 respectively.

Table 5: Time-use of married women: Sample means by the number of children

	Number of children			
Time-use	Zero	One	Two or more	Total
Market work	7.61	6.43	10.08	8.83
Domestic work	32.74	53.91	51.15	46.72
Housework	31.9	36.23	39.65	37.04
Child care	0.84	17.68	11.49	9.68
Total work	40.35	60.34	61.23	55.5
N	1989	1229	4293	7511

Source: Author's calculations using the ELMPS of 2006.

Table 6 shows working women's time allocation by economic sector. It reveals that, in general, women working in the private sector work for longer hours than both women who work in the public sector and independent workers. Turning our attention to single females, these women spend 41.11, 54.27 and 36.99 hours in the public, private and the independent sectors respectively. Furthermore, 70.34 percent of all women working in the private sector are single. Compared to married women, single women spend longer hours in the private sector. However, public sector labor supply is similar for all women. In addition, the presence of children in the household decreases, as expected, both public and

private employment. Table 6 also shows that 59.68 percent of all women working in the public sector are married and have children. This is thanks to the flexibility of working hours and the family-friendly policies in the public sector. Concerning the independent sector, single, married women without children and married women with children spend 36.99, 31.43 and 32.89 hours respectively. Although the independent sector is dominated by married women, as will be shown later, having a family project increases female market labor supply. Generally, the owners of the family project are members of the same household. Finally, only 31.83, 15.68 and 52.49 percent of single women, women married without children and women married with children, respectively, are working in the labor market.

Table 6: Time-use of all women: Sample means by marital status, presence of children and working sector (working women only)

	Single	Married	Married	All
		without children	with children	
Public	41.11 (23.3%)	41.41 (17.03%)	40.55 (59.68%)	37.72 (100%)
Government	40.93	41.16	40.42	
Public enterprises	42.84	44.92	43.25	
Private	54.27 (70.34%)	47.12 (6.3%)	43.2 (23.36%)	51.70 (100%)
Formal	51.09	45.15	44.7	
Informal	55.93	49.45	45.84	
Independent	36.99 (27.23%)	31.43 (17.58%)	32.89 (55.18%)	33.75 (100%)
N	830 (31.83%)	409 (15.68%)	1369 (52.49%)	2608 (100%)

Source: Author's calculations using the ELMPS of 2006.

Table 7 displays married women's time allocation by level of education. Interestingly, we observe that the higher the level of education the greater is women's total work. More precisely, women who are illiterate, less than intermediately educated, intermediately educated and have an above intermediate education spend, respectively, 49.65, 51.37, 60.85 and 65.67 hours on total work. Note that the time spent on child care activities increases with the level of education. Moreover, women with an intermediate education or above have higher market labor supply than those with a less than intermediate education. Consequently, as shown in Table 7, increasing married women's level of education implies an increase

in the time spent on both total work and child care activities, and decreases the time spent on housework activities.

Table 7: Time-use of married momen: Sample means by level of education

	Level of education				
	Illiterate	Less than intermediate	Intermediate	Above intermediate	Total
Age	40.17	34.78	31.36	33.99	36
Time-use					
Market work	6.68	3.14	9.79	17.66	8.83
Domestic work	42.97	48.23	51.06	48.01	46.72
Housework	36.42	38.51	37.87	36.08	37.04
Child care	6.55	9.72	13.18	11.94	9.68
Total work	49.65	51.37	60.85	65.67	55.5
N	3241	955	2146	1167	7511

Source: Author’s calculations using the ELMPS of 2006.

Table 8 shows, for single women, the same information available in Table 7. Single women with high levels of education spend between five and ten hours less on domestic activities than illiterate single women. Women with an above intermediate education also have higher market labor supply than less educated ones. Interestingly, illiterate single women spend longer hours in total work than women with a less than intermediate or an intermediate education. This result was expected since working, for illiterate women, is an absolute necessity. Nevertheless, those having an above than intermediate education are those who work the most since they spend 41.01 hours on all activities compared to 34.79, 20.04 and 29.07 among those who are illiterate, have less than intermediate education and have an intermediate education, respectively

Table 8: Time-use of single women: Sample means by level of education

	Level of education				
	Illiterate	Less than intermediate	Intermediate	Above	Total
Age	42.73	22.45	23.05	28.02	29.41

continued ►

Time-use					
Market work	8.73	3.77	9.02	19.66	8.97
Domestic work	26.06	16.27	20.05	21.35	21.05
Housework	24.76	15.70	19.20	20.73	20.17
Child care	1.29	0.56	0.85	0.62	0.88
Total work	34.79	20.04	29.07	41.01	30.02
N	1211	1026	1296	522	4056

Source: Author's calculations using the ELMPs of 2006.

More detailed results on women's time allocation by marital status are presented in Figures 1, 2, 3, 4, 5, and 6. Clearly, as shown in Figure 1, the hours spent on domestic activities are significantly higher for married women than for single ones. However, married and single women spend similar amounts of time on market employment.

Figure 1: Time allocation by marital status

Source: Constructed by the author using the ELMPs 2006.

Figure 2 displays the results for all illiterate women. They spend longer hours on both domestic and market activities. As mentioned above, this result is in line with expectations.

Figure 2: Time allocation by marital status: Illiterate wom

Source: Constructed by the author using the ELMPS 2006.

Figures 3 and 4 present the difference between women with general and technical intermediate education. Interestingly, married women's time allocation changes dramatically across the two figures. Among women with a general education, married women's market labor supply is higher than single women's. In contrast, Figure 4 shows that for the population with a technical education, single women are those who spend longer hours in the labor market.

Figure 3: Time allocation by marital status: Women with eneral intermediate education

Source: Constructed by the author using the ELMPS 2006.

Figure 4: Time allocation by marital status: Women with technical intermediate education

Source: Constructed by the author using the ELMPS 2006.

Finally, for women with an above intermediate or university education, Figures 5 and 6 show similar results. Generally, single women work more in the labor market and less in domestic activities than married ones.

Figure 5: Time allocation by marital status: Women with above intermediate education

Source: Constructed by the author using the ELMPS 2006.

Figure 6: Time allocation by marital status: University educated women

Source: Constructed by the author using the ELMPS 2006.

3.2 Panel Analysis

This section aims to understand how women's time allocation changes over time as they transition into marriage. To address this issue, I rely on the panel component of the ELMPS of 1998 and 2006. The sample I use consists of all women that were single in 1998 and did or did not change their marital status before 2006. The working sample is then restricted to single women aged 13 to 35 years in 1998, noting that the legal age of marriage in Egypt is 16. The final sample contains 1,144 women. In the panel analysis, I compare the time allocation of women who remained single during the entire eight-year period to those who got married between 1998 and 2006.

Figures 7 and 8 display the evolution of women's time allocation, by age group, from 1998 to 2006 respectively for women who did and did not change their marital status within this eight-year period. Figure 7 presents the time allocation of women who got married between 1998 and 2006. In other words, all women represented in Figure 7 were single in 1998 and married in 2006. Time allocation seems to change dramatically with marriage. Clearly, the time spent on domestic activities became significantly higher after marriage. For the 26-39 age group, domestic labor supply grew from 21 hours to 52 hours weekly in 1998 and 2006, respectively. Turning our attention to market labor supply, women work

less when they are married than when single. This observation is in line with our expectations, since marriage creates the double burden issue that prevents women from spending long hours in the labor market.

Figure 7: Time allocation evolution of newly married women by age group

Note: Women presented in this figure are those who changed their marital status to become married between 1998 and 2006.

Source: Constructed by the author using the ELMPS of 1998 and 2006.

Similarly, in Figure 8, we observe women that remained single between 1998 and 2006. For all age groups, both domestic and market labor supply are similar in 1998 and 2006. Thus, keeping the same marital status avoids big changes in employment patterns. All single women spend between 15 and 30 hours per week on domestic activities. The number of hours tend to increase with age, as the 40-45 year old women spend the longer hours compared to the younger groups. Also, market labor supply is higher for women aged 30 years old and above in 2006 than in 1998. Notably, the reason for this is that, with age, single women become more and more discouraged about finding a partner in the marriage market.

Figure 8: Time allocation evolution of women who remained single by age group

Note: Women presented in this figure are those who did not change their marital status between 1998 and 2006.
Source: Constructed by the author using the ELMPs of 1998 and 2006.

Table 9 displays women's transitions into and out of market activity by marital status. Interestingly, for single and married women, respectively, 75.64 and only 40.4 percent of those who were working in 1998 continue to participate in market activities in 2006. Furthermore, 59.60 percent of women who got married between 1998 and 2006 dropped out of the labor force by 2006, relative to only 24.36 percent among their single counterparts. Thus, Table 9 shows important transitions from market activity to inactivity as a result of marriage. Again, marriage seems to significantly increase the probability of exiting the labor market.

Table 9: Employment transitions between 1998 and 2006 by marital status

	Market work in 2006					
	Single			Married		
Market work in 1998	No	Yes	Total	No	Yes	Total
No	285	106	391	500	76	576
	72,89	27,11	100	86,81	13,19	100
Yes	19	59	78	59	40	99
	24,36	75,64	100	59,6	40,4	100

continued ►

Total	304	165	469	559	116	675
	64,82	35,18	100	82,81	17,19	100

Note: All females were single in 1998.

Source: Author's calculations using the panel sample 1998-2006.

Turning our attention to the evolution of domestic labor supply between 1998 and 2006, we see that, not surprisingly, 100 percent of married women were engaged in domestic activities in 2006.

Table 10: Transitions from/into domestic activities by marital status in 2006

	Domestic work in 2006					
	Single			Married		
Domestic work in 1998	No	Yes	Total	No	Yes	Total
No	21 (13,64%)	133 (86,36%)	154 (100%)	0 (0%)	142 (100%)	142 (100%)
Yes	27 (8,57%)	288 (91,43%)	315 (100%)	0 (0%)	533 (100%)	533 (100%)
Total	48 (10,23%)	421 (89,77%)	469 (100%)	0 (0%)	675 (100%)	675 (100%)

Note: All females were single in 1998.

Source: Author's calculations using the panel sample 1998-2006.

Both the cross-sectional and panel analyses presented above illustrated that women who transitioned into marriage were less likely to pursue market work and, were also more likely to be involved in domestic activities than their unmarried peers.

4. Propensity Score Matching Model

The main objective of this section is to measure the Average Treatment Effect on the Treated (ATT) where the treatment is getting married between 1998 and 2006. For this, a propensity score matching model is estimated to identify how selection into marriage alters the time allocation of women.

4.1 The Propensity Score Basic Setting

Rosenbaum and Rubin (1983) proposed propensity score matching as a method to reduce bias in the estimation of treatment effects with observational data sets. This method has become increasingly popular, particularly in the evaluation of economic policy interventions.

The propensity score method is a popular inexact matching method. Rather than matching on the regressors, it matches on the propensity score. Propensity score matching does not require a unique match, which is a major advantage compared to exact matching, since households with no exact match do not have to be excluded. In this way, we prevent regression to the mean by matching based on a distance measure (the distance is then the difference in propensity).

When treatment is not by random assignment but depends stochastically on a vector of observable variables X_i , as in observational data, or when the treatment is targeted to some population defined by some observable characteristics (such as age, sex, or socioeconomic status), then the concept of propensity scores is useful. This is a conditional probability measure of treatment participation given X_i and is denoted $p(X_i)$ (Cameron and Trivedi; 2005).

By definition, the assignment of subjects to the treatment and control groups in observational studies is not random. Therefore, there is no direct counterpart of the ATT. Hence, the estimation of the effect of the treatment may be biased by the existence of confounding factors. In other words, the counterfactual is not identified. As a substitute, following Rosenbaum and Rubin (1983), we may obtain data from a set of potential comparison units that are not necessarily drawn from the same population as the treated units, but for whom the observable characteristics, X_i , match those of the treated units up to some selected degree of closeness. More precisely, the propensity score allows us to correct the estimation of the treatment effect, controlling for the existence of these confounding factors, based on the idea that bias is reduced when the comparison of outcomes is performed using treated and control subjects that are as similar as possible to one another.

The propensity score is defined by Rosenbaum and Rubin (1983) as the conditional probability of receiving a treatment given pre-treatment characteristics:

$$p(X) \equiv P \{D = 1 | X\} = E\{D | X\} \quad (1)$$

where $D = \{0, 1\}$ indicates whether the agent is treated or not, and X is a vector of pre-treatment characteristics. Now, let us consider a population of individuals denoted by i . If the propensity score $p(X_i)$ is known, then the Average Treatment Effect on the Treated (ATT) can be estimated as follows,

$$\begin{aligned} \tau &= E\{Y_{1i} - Y_{0i} | D_i = 1\} \\ &= E\{E\{Y_{1i} - Y_{0i} | D_i = 1, p(X_i)\}\} \\ &= E\{E\{Y_{1i} | D_i = 1, p(X_i)\} - E\{Y_{0i} | D_i = 0, p(X_i)\} | D_i = 1\} \end{aligned} \quad (2)$$

where Y_{1i} and Y_{0i} are the potential outcomes in the two counterfactual situations of treatment and no treatment.

Some hypothesis need to be made in order to derive Equation 2 given Equation 1. First is the balancing of pre-treatment variables given the propensity score,

$$D \perp X | p(X) \quad (3)$$

We also need to assume that assignment to the treatment is unconfounded,

$$Y_1, Y_0 \perp D | X \quad (4)$$

Thus, the assignment to the treatment is unconfounded given the propensity score,

$$Y_1, Y_0 \perp D | p(X) \quad (5)$$

It is important to note that the second hypothesis about unconfoundness cannot be tested. However, the first hypothesis about balancing can be verified. If Equation 3 is satisfied, then, for a given propensity score, exposure to the treatment is random and therefore treated and control groups should be on average observationally identical. Hence, any standard probability model can be adopted to estimate the propensity score.

4.2 Identification of the Model

As Becker and Ichino (2002) argued, the propensity score is estimated according to the following process:

1. Estimate a probit model of the likelihood of marriage,

$$P \{D_i = 1 | X_i\} = \Phi(h(X_i)) \quad (6)$$

where Φ is the normal (logistic) c.d.f. and $h(X_i)$ represents the vector of covariates that determine the treatment (the decision to marry between 1998 and 2006).

More precisely, I run the following logistic regression,

$$y_i = \beta X_i + \delta Z_{i(t-1)} + \varepsilon_i \quad (7)$$

where y_i is a dummy variable that equals one if the woman married between 1998 and 2006 and zero otherwise. X_i is a vector of explanatory variables at date t (2006) that determine the probability of marriage, such as age, level of education, and region of residence. $Z_{i(t-1)}$ is vector of lagged variables at date $t-1$ (1998), such as the woman's work status and the wealth of her parental household. The latter is used because all women in my sample were single in 1998 and were then living in their parental household. ε_i represents the error term that follows a normal distribution $N(0, \sigma)$.

2. I split the sample into k equally spaced intervals of the propensity score ($k = 5$).
3. Within each interval, I test for the similarity between the average propensity scores of the treated and the control groups. The test is repeated until, under all alternatives, the average propensity score of treated and control units do not differ.
4. Within each interval, the means of each characteristic should not differ between treated and control units. This is a necessary condition for the balancing hypothesis.

4.3 The Average Treatment Effect on the Treated

The estimation of the propensity score is not enough to estimate the ATT using Equation 2. The reason is that the probability of observing two units with exactly the same propensity score is almost zero since $p(X)$ is a continuous variable. To solve this problem, different methods have

been proposed in the literature such as nearest neighbor matching, radius matching, and kernel matching. These methods reach different points on the frontier of the tradeoff between quality and quantity of the matches. However, none of them is a priori better than the others.

In the present research, I opt for the nearest neighbor method to match treated and control groups. The nearest neighbor method is an easy method that allows the comparison of the matched variables of the simulated control group with those of the intervention group. This method consists of looking for the closest propensity score in the control group to the propensity score of each woman in the treated group, and matching these cases to one another. Note that a woman in the control group can be the best match for more than one woman in the treated group. After matching, the difference between the outcome of the treated women and those of the matched control women is computed. Then, the ATT can be obtained by averaging these differences, although, some of these matches can be poor since the nearest neighbor may have a very different propensity score.

Let us denote the treated group (e.g. the women who got married between 1998 and 2006) by T and the control group (e.g. the women who remained single during the entire period) by C . Y_i^T and Y_j^C represent the observed outcomes of the treated and control groups respectively. The nearest neighbor matching can then be represented as,

$$C(i) = \min_j P_{p_i} - p_j P \quad (8)$$

where $C(i)$ is the set of the control women matched to the treated women i with an estimated value of the propensity score of p_i .

Equation 8 could be a single match or a set of multiple nearest neighbors. Note that the latter is rarely used, in particular, if the characteristics X contains continuous variables; the likelihood of multiple nearest neighbors is further reduced if the propensity score is estimated (Becker and Ichino; 2002).

The number of controls matched with observation $i \in T$ is denoted by N_i^C and the weights are defined by $w_j = \frac{1}{N_i^C}$ if $j \in C(i)$ and $w_j = 0$ otherwise. The formula can then be written as follows,

$$\begin{aligned}
\tau^M &= \frac{1}{N^T} \sum_{i \in T} [Y_i^T - \sum_{j \in C(i)} w_j Y_j^C] \\
&= \frac{1}{N^T} [\sum_{i \in T} Y_i^T - \sum_{i \in T} \sum_{j \in C(i)} w_j Y_j^C] \\
&= \frac{1}{N^T} \sum_{i \in T} Y_i^T - \frac{1}{N^T} \sum_{j \in C} w_j Y_j^C
\end{aligned} \tag{9}$$

where M stands for the nearest neighbor matching and N^T represents the number of women in the treated group. The weights w_j are defined by $w_j = \sum_i w_{ij}$.

We now turn our attention to the variances of these estimates. To derive these variances, the weights are assumed to be fixed and the outcomes are assumed to be independent across women.

$$\begin{aligned}
Var(\tau^M) &= \frac{1}{(N^T)^2} [\sum_{i \in T} Var(Y_i^T) + \sum_{j \in C} (w_j)^2 Var(Y_j^C)] \\
&= \frac{1}{(N^T)^2} [N^T Var(Y_i^T) + \sum_{j \in C} (w_j)^2 Var(Y_j^C)] \\
&= \frac{1}{N^T} Var(Y_i^T) + \frac{1}{(N^T)^2} \sum_{j \in C} (w_j)^2 Var(Y_j^C)
\end{aligned} \tag{10}$$

“Note that, to save on computing time, nearest neighbors are not determined by comparing treated observations to every single control, but by first sorting all records by the estimated propensity score and then searching for the closest control unit(s)” (see Becker and Ichino, 2002).

5. Empirical Results

This section presents the empirical results of the propensity score matching model. For the sake of robustness checking, I have tested different matching methods, including the single nearest neighbor, the five nearest neighbor and kernel matching. Sensitivity analysis shows that the results are quite robust. Since the results are very similar for all these methods, only those of the single nearest neighbor are analyzed in the present section. The results of the other matching methods are presented in detail in Appendix B.

A total sample of 1,144 women is used to estimate the model. As described above, these women have been selected based on particular criteria. Now, turning our attention to the two subgroups, 41 percent of the sample are treated versus 51 percent control.

To obtain the results presented here, I first started by estimating a model of selection into marriage (a probit model) that allows the estimation of a propensity score for each woman in the sample. Using this propensity score, each treated woman searches forward and backward for her match in the control group (using either a single or a five nearest neighbor or other matching method). Before calling the matching process, the data was randomly sorted and, interestingly, observations with identical propensity score values have been observed. In addition, with regards to the matching results, 674 of 675 treated units have been matched.

The following tables display the results obtained, specifically, those of the Average Treatment Effect on the Treated (ATT) as well as the Average Treatment Effect (ATE) and the Average Treatment Effect on the Untreated (ATU). Two outcomes are considered. On the one hand, I aim to identify the effect of marriage on market labor supply. On the other hand, the treatment effect on domestic labor supply is identified.

Table 11: Variable means and standard deviations by marital status

Variables	Single			Married			All		
	N	Mean	Sd. dev.	N	Mean	Sd. dev.	N	Mean	Sd. dev.
In 1998									
Age	469	20.49	4.78	675	19.99	3.43	1144	20.19	4.04
Age at marriage	-	-	-	675	23.49	3.64	675	23.49	3.64
Market labor supply	54	11.72	7.95	110	10.74	6.58	164	11.06	7.05
Domestic labor supply	469	18.79	17.65	675	23.48	16.97	1144	21.56	17.4
Nbr. of children in household	-	-	-	-	-	-	-	-	-
Dummy for market work	469	0.17	0.37	675	0.15	0.35	1144	0.15	0.36
Low household wealth	469	0.84	0.36	675	0.86	0.34	1144	0.85	0.35
High household wealth	469	0.16	0.36	675	0.14	0.34	1144	0.15	0.35
Household size	469	6.36	2.69	675	6.56	2.82	1144	6.48	2.77
In 2006									

continued ►

Age	469	27.55	4.9	675	27.09	3.52	1144	27.28	4.15
Market labor supply	166	45.6	12.5	121	41.04	10.78	287	43.68	12
Domestic labor supply	469	21.65	17.8	675	52.22	31.6	1144	39,69	30.74
Father's education	160	3.06	2.31	664	2.9	2.23	824	2.93	2.25
Mother's education	59	1.53	1.29	655	1.98	1.8	714	1.94	1.77
Nbr. of children in household	-	-	-	675	1.35	0.86	675	1.35	0.86
Dummy for market work	469	0.35	0.48	675	0.17	0.38	1144	0.25	0.43
Illiterate	469	0.08	0.27	675	0.09	0.29	1144	0.09	0.28
Less than intermediate educ.	469	0.12	0.32	675	0.13	0.34	1144	0.13	0.33
General intermediate education	469	0.01	0.09	675	0.01	0.12	1144	0.01	0.11
Technical intermediate educ.	469	0.3	0.46	675	0.39	0.49	1144	0.35	0.48
Above intermediate education	469	0.07	0.25	675	0.06	0.24	1144	0.06	0.25
University education	469	0.36	0.48	675	0.29	0.45	1144	0.32	0.47
Household size	469	5.3	2.18	675	3.55	1.37	1144	4.27	1.95
Cairo	469	0.21	0.41	675	0.15	0.36	1144	0.17	0.38
Alexandria	469	0.16	0.36	675	0.15	0.36	1144	0.15	0.36
Urban lower regions	469	0.19	0.39	675	0.15	0.35	1144	0.16	0.37
Urban upper regions	469	0.2	0.4	675	0.19	0.39	1144	0.19	0.39
Rural lower regions	469	0.13	0.33	675	0.22	0.42	1144	0.18	0.39
Rural lower regions	469	0.12	0.32	675	0.15	0.35	1144	0.13	0.34
Basic services in household	469	3.12	1.25	675	3	1	1144	2.86	1.17

Source: Author's calculations using the ELMS of 1998 and 2006.

Table 12 presents the results of the selection into the treatment model, i.e, the selection into marriage model (which corresponds to women who got married between 1998 and 2006). Clearly, the probability of being treated increases with the level of education. In other words, females with a less than intermediate level of education, as well as those having a general intermediate level of education, had higher probabilities of getting married between 1998 and 2006 relative to their illiterate peers. The model also

controls for age, working status in 1998 and parental household wealth in 1998. The probability of marriage increases with age and decreases with the parental wealth.

Table 12: Treatment selection: Model 1

	Coefficient	Std. Err.	T. Stat.
Age	0.641 ***	0.101	6.31
Age squared	-0.010 ***	0.002	-6.45
Less than intermediate education	0.256 **	0.155	1.65
General intermediate education	0.651 **	0.375	1.73
Technical intermediate education	0.336 ***	0.130	2.58
Above intermediate education	0.131	0.189	0.69
University education	0.102	0.141	0.72
Market work in 1998	-0.025	0.117	-0.21
Household Wealth in 1998: High	-0.132 ***	0.048	-2.73
Constant	-9.139 ***	1.492	-6.12
Log Likelihood	-736.588		
Pseudo R2	0.049		
Prob > chi2	0.000		
Nbr. of Observations	1140.000		

Note: i. Dependent variable is a binary variable that is equal to one if the woman married between 1998 and 2006 and, equal to zero if the female remained single at least until 2006.
 ii. *** statistically significant at the 1% level, ** statistically significant at the 5% level, * statistically significant at the 10% level.
 iii. The reference level of education is illiterate.
 Source: Author’s calculations.

In Table 13, we observe the distribution of the propensity score (PS). The mean of the PS is of 0.591 with a variance of 0.013.

Table 13: Propensity score distribution: Model 1

	Percentiles	Pr (Treated)		
1%	0.156	0.072		
5%	0.381	0.073	Mean	0.591

continued ►

10%	0.445	0.078	Std. Deviation	0.117
25%	0.539	0.078		
50%	0.604		Variance	0.013
75%	0.672	0.807	Skewness	-1.266
90%	0.723	0.812	Kurtosis	5.839
95%	0.749	0.82		
99%	0.779	0.821	N	1140

Source: Author's calculations.

Turning to the results of the matching, Table 14 shows the matching estimates for the two outcomes, these being the domestic and market labor supplies.¹ Results of the Average Treatment Effect (ATE) show the difference-in-difference in outcomes. In other words, the ATE shows the difference between the treated and the untreated women. Compared to untreated units, treated women spent on average about 30.079 hours more on domestic work and 7.551 hours less on market work. The Average Treatment Effect on the Treated (ATT) equals 31.442 and -8.667 for the domestic and market labor supplies respectively.

Table 14: Matching estimates: Model 1

Hours spent on domestic work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	52.231	20.789	31.442	1.797	17.5
ATU	21.672	49.781	28.109		
ATE			30.079		
Hours spent on market work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	7.368	16.037	-8.667	1.824	-4.75
ATU	16.208	10.275	-5.933		
ATE			-7.551		

Notes: i. These are the results of the single nearest neighbor matching.

ii. ATT is the Average Treatment Effect on the Treated, ATU is the Average Treatment Effect on the Untreated and ATE is the Average Treatment Effect.

iii. Number of treated: 674. Number of controls: 466.

Source: Author's calculations.

¹ These are number of weekly hours.

These results seem to confirm our hypothesis that marriage explains an important part of the low female market labor force participation in Egypt. Again, Egyptian married females need a more equitable allocation of domestic activities within their own households, as well as more efficient family-friendly policies in the labor market.

A second specification of the selection equation is presented in Table 15. Compared to Table 12, we observe that the value of the Pseudo R-squared is significantly higher using the second specification; 0.183 and 0.049 respectively for the Models 2 and 1. In Table 15, I also control for the region of residence as well as for the parent's level of education. Living in Cairo significantly decreases the probability of getting married between 1998 and 2006 by 25.3 percent. In addition, parental education, in particular the mother's education, clearly affects the probability of marriage.

Table 15: Treatment selection: Model 2

	Coefficient	Std. Err.	T. Stat.
Age	0.534 ***	0.107	4.99
Age squared	-0.009 ***	0.002	-5.10
Less than intermediate education	0.269 **	0.158	1.70
General intermediate education	0.551 *	0.392	1.40
Technical intermediate education	0.324 **	0.134	2.41
Above intermediate education	0.048	0.201	0.24
University education	-0.155	0.149	-1.04
Living in Cairo	-0.253 **	0.119	-2.13
Mother's education 2	1.544 ***	0.306	5.05
Mother's education 3	1.942 ***	0.348	5.57
Mother's education 4	2.093 ***	0.519	4.03
Father's education 2	0.799 ***	0.152	5.25
Father's education 3	0.774 ***	0.159	4.88
Father's education 4	0.325 *	0.236	1.38
Market work in 1998	-0.012	0.124	-0.10
High HH wealth in 1998	-0.306 ***	0.056	-5.46
Constant	-7.823 ***	1.576	-4.96
Log likelihood	-630.138		

continued ►

Pseudo R2	0.183		
Prob > chi2	0.000		
Nbr. of Observations	1140.000		

Notes: i. Cairo is a dummy variable equal to 1 if the woman is living in Cairo and zero otherwise.

ii. The reference group for the parental level of education is illiterate.

iii. Mother/father's education 2 is less than intermediate education. Mother/father's education 3 is intermediate education. Mother/father's education 4 is above than intermediate. The reference here is illiterate.

iv. *** statistically significant at the 1% level, ** statistically significant at the 5% level,

* statistically significant at the 10% level.

Source: Author's calculations.

Again, Tables 16 and 17 show, respectively, the distribution of the PS and the matching results for the second specification (Model 2). For the domestic labor supply as an output, the ATT is 25.797 with a T statistic of 8.45. The ATE equals 28.583. Then, controlling for more variables in the second specification not only allows for an improvement in the model's quality, but also modifies the matching results. Turning our analysis to the market work output, the ATT is -7.541 and the ATE is identified as (-7.841).

Table 16: Propensity score distribution: Model 2

	Percentiles	Pr (Treated)		
1%	0.099	0.025		
5%	0.211	0.031	Mean	0.591
10%	0.276	0.052	Std. Deviation	0.227
25%	0.439	0.056		
50%	0.590		Variance	0.052
75%	0.744	0.998	Skewness	-0.021
90%	0.942	0.998	Kurtosis	2.342
95%	0.979	0.999		
99%	0.995	0.999	N	1140

Source: Author's calculations.

Table 17: Matching estimates: Model 2

Hours spent on domestic work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	52.231	26.435	25.797	3.054	8.45
ATU	21.672	54.285	32.614		
ATE			28.583		
Hours spent on market work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	7.468	14.909	-7.541	3.642	-2.07
ATU	16.208	7.933	-8.275		
ATE			-7.841		

Note: These are the results of the single nearest neighbor matching.

Source: Author's calculations.

A third specification of the selection into marriage model was tested. This model only differs in the regions' distinction. Instead of controlling for only one dummy for region that equals 1 if the woman lives in Cairo and zero otherwise, I distinguish between five different regions. The results of Model 3 are presented in Tables 18, 19 and 20. Interestingly, the Average Treatment Effect (ATE) for market labor supply is -12.978 weekly hours, and, it equals 27.47 for the domestic labor supply.

Table 18: Treatment selection: Model 3

	Coefficient	Std. Err.	T. Stat.
Age	0.536 ***	0.108	4.96
Age square	-0.009 ***	0.002	-5.05
Less than intermediate education	0.286 **	0.161	1.78
General intermediate education	0.511	0.395	1.29
Technical intermediate education	0.354 ***	0.136	2.60
Above intermediate education	0.109	0.203	0.54
University education	-0.109	0.151	-0.72
Urban lower Region	-0.050	0.126	-0.40
Urban upper Region	0.001	0.122	0.01
Rural lower Region	0.457 ***	0.130	3.51

continued ►

Rural upper Region	0.237 *	0.147	1.61
Mother's education 2	1.469 ***	0.301	4.88
Mother's education 3	1.945 ***	0.349	5.56
Mother's education 4	2.057 ***	0.511	4.03
Father's education 2	0.848 ***	0.154	5.52
Father's education 3	0.778 ***	0.160	4.86
Father's education 4	0.311	0.237	1.31
Market work in 1998	-0.048	0.125	-0.39
High HH Wealth in 1998	-0.272 ***	0.059	-4.61
Constant	-8.061 ***	1.599	-5.04
Log likelihood	-623.453		
Pseudo R2	0.191		
Prob > chi2	0.000		
N	1140.000		

Notes: i. The reference category for region is Cairo and Alexandria.

ii. *** statistically significant at the 1% level, ** statistically significant at the 5% level,

* statistically significant at the 10% level.

Source: Author's calculations.

Table 19: Propensity score distribution: Model 3

	Percentiles	Pr (Treated)		
1%	0.112	0.034		
5%	0.208	0.043	Mean	0.591
10%	0.266	0.044	Std. Deviation	0.234
25%	0.416	0.063		
50%	0.591		Variance	0.054
75%	0.758	0.997	Skewness	-0.031
90%	0.946	0.998	Kurtosis	2.175
95%	0.980	0.998		
99%	0.993	0.998	N	1140

Source: Author's calculations.

Table 20: Matching estimates: Model 3

Hours spent on domestic work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	52.231	24.09	28.141	3.047	9.23
ATU	21.672	48.182	26.511		
ATE			27.47		
Hours spent on market work	Treated	Controls	Difference	S.E.	T-stat.
ATT	7.368	22.133	-14.765	3.612	-4.09
ATU	16.208	5.815	-10.392		
ATE			-12.978		

Note: These are the results of the single nearest neighbor matching.
Source: Author's calculations.

6. Conclusions

We have plenty of information and studies on the time that women spend in the labor market, but none on the submerged part of their time spent at home. Economists have made a huge effort to explain the market behavior of married women, such as, their patterns of participation, the number of hours worked, the determinants of wives earnings, occupational choice, and the gender wage differential. Although the present research is the first to analyze the allocation of time within the home sector, this allocation may have an impact on the well-being of the family that is no less important than changes in women's working haIt seems quite difficult to detect the effect of policy measures on actual individual behavior, especially with regards to work, child care and housekeeping. It is necessary, however, to calculate how much time is spent on each of the above activities. No money is involved in work like cooking, taking care of the children or house cleaning, though much time is needed for this kind of work. If women have to pay for the value of domestic work in order to reconcile family and working life, the risk that they will leave their labor market position as well as their independent incomes becomes higher.

Thus, Egypt, as most developing and developed countries, needs many regulation reforms to reduce the persistent gender bias in intra-household division of labor. For this, policies that support women's access to productive employment, with equal wages for equal jobs, taking full account of the burden of women's family and household responsibilities,

strongly need to be considered. An example of such kinds of jobs could be part-time jobs and also the supply of day care for children.

We expect the results of this study to be of great importance to policymakers and non-governmental organizations, especially when designing family policies. More specifically, effective public policies are needed to actively support the role of the family, i.e. of women, to substitute for the lacking welfare state to affect the division of paid and unpaid work. Policies affecting not only women's participation in the labor force but also people's attitudes towards the division of paid and unpaid work are needed. It turns out that the existing policies in Egypt are not sufficient in this respect.

This study aims at identifying how selection into marriage alters the time allocation of women. The objective is then to explore this new area of research in Egypt in order to gain insight into policy measures that can effectively influence women's time allocation. A matching model is estimated to identify how selection into marriage alters the time allocation of women. The empirical results show that marriage significantly affects both types of work. Married women spend weekly about eight hours less on market work relative to their single counterparts. And, interestingly, marriage as a treatment increases the domestic labor supply by thirty hours weekly on average.

More effective policies in Egypt would thus allow not only for the increase of women's participation in paid work, but also a more equitable division of labor within families. Best practice arrangements could be: employee sovereignty over working times, equal access to productive employment with equal wages for equal jobs (for men and women), promotion and benefits, and the reconciliation of paid work and family life. It is surely important to find appropriate forms of intervention for supporting the family, which should include financial support for beneficiaries, without undermining the structure of family life. Organized voluntarism could also play an important role, while informal networks, which have traditionally sustained the family, should be reinforced.

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Annex A: More About the Data

Time-use Data: Domestic Activities

- Housework: washing dishes, doing laundry, cleaning house;
- Food and drink: raising poultry, producing butter/ cheese, cooking;
- Home maintenance: helping in construction work;
- Care activities: caring for the sick/ the elderly, taking care of children;
- Shopping for the household;
- Agriculture activities, collecting water, collecting firewood.

Definitions

The Market Definition of Labor Force “includes all females engaged in economic activities for purposes of market exchange.” (Assaad and El-Hamidi, 2009).

The Extended Definition of Labor Force “ includes those engaged in the production and processing of primary products, whether for the market, for barter, or for their own consumption; the production of all other goods and services for the market; and, in the case of households that produce such goods and services for the market, the corresponding production for their own consumption. The extended definition includes many women engaged in animal husbandry and the processing of dairy of products for purposes of household consumption, in addition to those engaged in market activity.” (Assaad and El-Hamidi, 2009).

Domestic Activities is defined as the unpaid work done to maintain family members and/or a home. In the present study, we distinguish between two categories of domestic work. The first category is “housework” and the second is “child care.” In our data, “housework” includes agriculture activities, raising poultry, producing butter/cheese, cooking, washing dishes, doing laundry, cleaning house, collecting water, collecting firewood, helping in construction work, caring for the sick/ the elderly and shopping for the household. “Child care”, represents the time spent taking care of children.

The Extra-Extended Definition of Labor Force includes those considered as working according to the market definition, the extended definition, or engaged in domestic activities.

Independent Workers All women with irregular wage jobs, household enterprise workers, and the self employed with no household members.

Annex B: Sensitivity Analysis

Results of the Five Nearest Neighbor Matching

Table 21: Matching estimates using the five nearest neighbor method: Model 1

Hours spent on domestic work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	52.231	21.082	31.149	1.577	19.75
ATU	21.672	49.404	27.733		
ATE			29.753		
Hours spent on market work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	7.368	17.025	-9.657	1.441	-6.70
ATU	16.208	9.851	-6.357		
ATE			-8.308		

Notes: i. These are the results of the five nearest neighbor matching.

ii. The number of treated cases is 674 and the number of controls is 466.

Source: Author's calculations.

Table 22: Matching estimates using the five nearest neighbor method: Model 2

Hours spent on domestic work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	52.231	24.242	27.989	2.241	12.49
ATU	21..672	54.18	32.508		
ATE			29.836		
Hours spent on market work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	7.368	17.983	-10.615	2.536	-4.19
ATU	16.208	7.719	-8.489		
ATE			-9.746		

Notes: These are the results of the five nearest neighbor matching.

Source: Author's calculations.

Table 23: Matching estimates using the five nearest neighbor method: Model 3

Hours spent on domestic work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	52.231	25.079	27.152	2.330	11.65
ATU	21.672	52.443	30.771		
ATE			28.632		
Hours spent on market work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	7.368	16.019	-8.651	2.589	-3.34
ATU	16.208	6.054	-10.154		
ATE			-9.265		

Note: These are the results of the five nearest neighbor matching.

Source: Author's calculations.

Kernel Matching Results

Table 24: Matching estimates using the kernel matching method: Model 1

Hours spent on domestic work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	52.231	22.125	30.107	1.525	19.74
ATU	21.619	50.347	28.727		
ATE			29.545		
Hours spent on market work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	7.368	16.348	-8.979	1.347	-6.67
ATU	16.222	9.796	-6.427		
ATE			-7.94		

Note: These are kernel matching results.

Source: Author's calculations.

Table 25: Matching estimates using the kernel matching method: Model 2

Hours spent on domestic work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	52.231	24.861	27.369	2.33	11.74
ATU	21.672	53.625	31.953		
ATE			29.243		
Hours spent on market work	Treated	Controls	Difference	S.E.	T. Stat.
ATT	7.368	16.75	-9.382	2.648	-3.54
ATU	16.208	7.347	-8.861		
ATE			-9.169		

Note: These are kernel matching results.

Source: Author's calculations.

Table 26: Matching estimates using the kernel matching method: Model 3

Hours spent on domestic work	Treated	Controls	Difference	S.E.	T-stat.
ATT	52.231	24.948	27.283	2.393	11.40
ATU	21.672	51.826	30.154		
ATE			28.457		
Hours spent on market work	Treated	Controls	Difference	S.E.	T-stat.
ATT	7.368	16.952	-9.585	2.739	-3.50
ATU	16.208	6.882	-9.326		
ATE			-9.479		

Note: These are kernel matching results.

Source: Author's calculations.

Annex C: More On Labor Supply Determinants

Table 27: Determinants of domestic labor supply

	Single (16-64)	Married (16-64)	All
	Coefficient	Coefficient	Coefficient
Age in 2006	2,617***	1,412***	4,049***
Age squared in 2006	-0,034***	-0,023***	-0,047***
Age at marriage	-	0,212**	-
Household (HH) wealth in 1998	-1,360***	0,891**	-1,009***
Basic Services in 2006	-0,641	-0,753*	-1,622***
Less than intermediate education	14,185***	1,349	7,925***
General intermediate education	3,723	-0,802	10,953***
Technical intermediate education	8,473***	1,865	12,243***
Above intermediate education	9,460***	2,141	12,764***
University education	6,654***	-1,913	9,463***
Nbr. of children in HH	1,454*	4,890***	6,138***
Parent in the HH	-	-30,323***	-24,164***
Sister/Bro. in law in HH	-	-	-26,280***
Mother in law in HH	-	-15,750	-39,366***
Dummy for family project	1,021	-1,559	-0,891
Urban regions	0,667	-7,404***	-4,042***
Rural regions	-0,551	-4,176***	-1,887***
Constant	-22,570***	22,121***	-41,202***
Sigma	19,494	27,028	25,718
Log likelihood	-6868,7003	-18045,825	-33284,573
Pseudo R squared	0,0188	0,0109	0,0626
N	1835	3851	8554

Notes: i. Tobit Results.

ii. Dependent variable: weekly hours spent on domestic work.

iii. The reference level of education is illiterate. The reference region is Cairo/ Alexandria.

Source: Author's calculations.

Table 28: Determinants of market labor supply

	Singles (16-64)	Married (16-64)	All
	Coefficient	Coefficient	Coefficient
Age in 2006	-0,350	0,429	0,103
Age squared in 2006	0,003	-0,006*	-0,002
Age at marriage	-	0,097	-
Household (HH) wealth in 1998	-0,212	-1,159***	0,368***
Basic Services in 2006	-0,510	-0,120	-0,026
Less than intermediate education	-1,542	-0,387	-0,016
General intermediate education	20,031	-3,974	3,616
Technical intermediate education	1,412	-1,896	-2,061
Above intermediate education	-1,482	-2,592	-3,407***
University education	-8,518**	-1,659	-4,390***
Nbr. of children in HH	2,459	-0,517	-1,053***
Parent in the HH	-	-14,810	-0,362
Sister/Bro. in law in HH	-	-	-6,277
Mother in law in HH	-	-	-20,724
Dummy for family project	0,637	1,305*	1,855***
Urban regions	-3,816**	-2,988***	-3,678***
Rural regions	-8,665***	-4,823***	-6,308***
Constant	67,175***	61,426***	62,445***
Sigma	13,104	11,787	12,939
Log likelihood	-1244,3003	-3681,4066	-5886,6716
Pseudo R squared	0,0418	0,0253	0,0267
N	313	948	1480

Note: Tobit results.

Source: Author's calculations. bits.