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THE COMMUTING GENDER GAP AND FEMALES' LABOR SUPPLY AND EARNINGS IN THE EGYPTIAN LABOR MARKET

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Abstract

The length of commute time to work influence the access to employment opportunities and individuals' outcomes. Women are unable to take the same lengthy commute time to work as men resulting in a commuting gender gap. Using Egypt Labor Market Panel Survey for 2006 and 2012, this paper analyzes the determinants of the commuting time for men and women to identify the reasons behind the differences in commuting time according to gender. In addition, the effect of the worker's commute on the labor market outcomes is analyzed by examining the impact of commute time on working hours and wages by gender. Due to the potential endogeneity of the commuting time, instrumental variable estimation is used to determine the relationship between mobility and labor market outcomes. For women, the effect on the daily working hours is positive with a negative effect on the weekly labor supply. Commuting time has a negative effect on men's hourly wages but with a positive effect on their daily and weekly labor supply.

JEL Classifications: J16, J31, J61

Keywords: commuting time, labor market outcomes, gender-based differences

ملخص

تحلل هذه الورقة أثر انتقال العامل على نتائج سوق العمل بالنسبة للنساء من خلال دراسة تأثير وقت التنقل على ساعات العمل والأجور لدى النساء. وتحقيقا لهذه الغاية، يتم تحليل محددات وقت التنقل للرجال والنساء لتحديد أسباب الاختلافات في وقت التنقل حسب الجنس عامة؛ على وجه التحديد، حسب المستوى التعليمي والحالة الاجتماعية ومستوى فقر الأسرة المعيشية هي العوامل الرئيسية التي تم تحليلها. بعد ذلك، وبسبب التجانس المحتمل لوقت التنقل، يتم استخدام تقدير المتغير الميكانيكي لتحديد العلاقة بين حركة المرأة ونتائج سوق العمل.

1. Introduction

Commuting to work is done every day by millions of workers, enabling and increasing access to jobs that are not necessarily proximate to the residential location of the individual. Nevertheless, long commute times can have negative effects on workers' health and productivity especially in countries with lots of traffic congestions. Women are also less likely to take longer commutes especially after getting married. In addition to other factors, longer commutes makes work more inconvenient for women especially those with more household responsibilities. This is why the gender gap in commuting time is witnessed in most countries. Egypt is no exception to this trend; women suffer from limited geographic mobility as opposed to men who are willing to take longer commutes. In 2012, females commute 23 minutes on average while males commute 35 minutes. This means that there is a gender gap in commuting where females commute less by 34 percent.

Egypt Labor Market Panel Survey (ELMPS) for 2012 and 2006 is used to answer two main questions: first, what are the determinants of the commuting time of women in Egypt compared to men; the considered determinants are educational attainment, marital status and level of poverty. Second, the paper tries to answer what is the impact of the commuting time on the earnings and working hours by gender? This is particularly important since women work 2 hours less than men in 2012 on average and earn 13 percent less than men in the same year (OAMDI, 2013). This will guide us through to understand the causes of women's mobility disadvantage and help us to analyze the impact of the limited geographic mobility on women's labor market outcomes more thoroughly.

It is important to study this topic from a developing country perspective and to understand the effect of government policies on the labor market outcomes of women (i.e. the effect of government's spending on infrastructure, providing public transportation and building the new administrative city, etc.). This will help in introducing better policies and measures that could be adopted to close this gap and ease the pressure on women in the labor force. This is particularly important for married women too since they have the lowest commuting time, being unable to reconcile household responsibilities and their work.

Understanding the patterns and impact of gender differentials in commuting time is important for a number of reasons. There are associated psychological costs with travel. In addition, preference for short distance commutes due to household responsibilities can affect the job search area and lead to reducing the time available for the labor market and/or accepting jobs with lower wages (Giménez-Nadal and Molina, 2016). This might give an explanation for the low participation rates of women in the labor market. This is of great importance, since raising female employment to male levels is estimated to have a direct net impact on the Egyptian GDP of 34 percent. These gains are high due to the low female labor force participation and the high educational attainment of women (educated women has low labor force participation rate). (The World Bank).

My contribution to the literature is through trying to understand the determinants of the commuting time and the relationship between the commuting time and earnings and labor supply especially for women is crucial in Egypt (which to the best of my knowledge has been under researched in the context of MENA region countries and particularly Egypt). This is done while taking into account the potential endogeneity of the commuting time.

After this introduction, the remainder of the paper is organized as follows. Section 2 provides a review of the literature for the determinants and the impact of commuting time. Section 3 describes the data and the variables used. Section 4 introduces the empirical strategy. In section 5, the main determinants of the commuting time are identified and the relationship between commuting time and earnings and labor supply are discussed. Section 6 concludes.

2. Literature Review

2.1. Determinants of commuting time

The shorter commuting times of women has raised interest in understanding the determining variables that explain commuting time and the differences in commuting time between men and women. The determinants of commuting time that have been studied previously in the literature include the number of children, the age of the worker, number and age of children, wage, occupation, and the mode of transport. Other factors affecting the length of the commute time is the region of residence (Turner and Niemeier, 1997, Giménez-Nadal and Molina, 2015, Hazans, 2004 and McQuaid and Chen, 2012).

White (1986) looks at the commuting journeys of urban workers and what are the differences across gender. There are pronounced differences based on gender where women have shorter travel time to work, work on part time basis, being the secondary earner in the household and earning less than men on average. Neto et al., 2015 finds that females, in general regardless of household structure and marital status, have shorter commute times than males. Nevertheless, married females have even shorter commutes, particularly in dual-earner households. Similarly, having children puts a downward pressure on the commuting time of females and no effect on males. This shows that the household responsibility theory (HRT) is part of the explanation of the shorter commute times of women and that culture and attitudes are main determinants of females' commuting time in general. The HRT is one of the main theories explaining the gender differential in the commuting time. It renders the commuting gap to differences in the household division of labor; where women spend more hours on household responsibilities like cooking, cleaning, child care, etc. It is expected that married women will have shorter commute times compared to single women. This is justified by the fact that married women have more time constraints with more responsibilities around the house compared to unmarried women. This theory assumes that travel time to work is a source of disutility; commuters tend to minimize their commuting time and cost. Given this time limitation, the Household Responsibility Hypothesis states that married women have more household responsibilities and are unwilling to take longer commutes (Turner and Niemeier, 1997 and Giménez-Nadal and Molina, 2015).

In the same line, it is expected that women living in big households will have higher demands on their time devotion to housework and caring for other household members and hence will have shorter commutes. An alternate hypothesis would be that living in a big household will lead to a smaller share of housework for each individual and hence allows women more time for other activities (i.e. work, commuting and leisure activities). Hence, among other factors, this study will tackle the effect of the marital status of women, the number of individuals in the household and household wealth. All these factors are expected to have an effect on the length of the commute time of women in Egypt.

On the contrary to the HRT, He and Zhao, 2017 assumes that traveling to work can derive positive utility as it can provide access to a larger job market or a better and or cheaper residence location. Hence, it can be seen as an optimization and not minimization variable. Hence, individuals can have longer commutes if this allows them better access to jobs and higher income compared to more proximate jobs.

2.2. Effect of commuting time on labor supply

The impact of commuting time has been studied by labor economists and urban economists. However, there are divergent views on the direction of the impact on labor supply. This divergence stems from the modeling of the relationship between commuting costs and labor supply. Commuting time has an effect on the participation decision in the labor force, as it is seen as a fixed cost of lost time needed to travel to and from work. This fixed costs of entering the labor market increase as individuals live further away from work. In addition, these costs influence the individual's reservation wage (Cogan, 1981).

Other papers study the effect of commuting cost on labor supply. Kolesnikova, Black, and Taylor (2007) analyze the effect of commuting time on labor market participation rates of white married women, specifically the variation in women's labor supply across cities. The results indicate that female labor force participation is lower in cities with longer commuting times. Furthermore, the outcomes of women with young children are more sensitive to longer commutes. On the other hand, married men's outcomes were not affected by the length of commuting time. Abe (2011) explained the effect of commuting on the distribution of women's employment status and how it differs across districts in the Tokyo Metropolitan Area. The paper incorporated the women's choice between part-time and full-time work. It concludes that the slow increase in regular full-time work may be the result of high commuting costs measured by commuting time. Black et al., (2009) find that the response of female work time is more sensitive to change in commuting costs.

However, Gutiérrez-i-Puigarnau and Van Ommeren (2015) find that there is no negative relationship between commuting time and labor supply. On the contrary, commuting distance (used as a proxy for commuting time and cost) has a small positive effect on females' working hours in the short-run. This suggests that when an increase in commuting costs occur, women increase their daily working hours. The endogeneity of the commuting time is accounted for by using employer-induced changes in the commuting distance, using socio-economic panel data for Germany between 1997 and 2007. On the same line, Giménez-Nadal and Molina (2014) examine the effect of daily commuting on daily labor supply, using the Dutch time-use survey of 2000 and 2005. To account for endogeneity between commuting time and labor supply, they imputed the commute time using propensity score matching. They find an inverted u-shaped relationship between the commuting time and the working hours per day, suggesting that the relationship between commuting time and labor supply is non-linear. Hence, it is crucial to understand the direction and magnitude of the effect of commuting time on labor supply in the Egyptian context.

2.3. Effect of commuting time on wages

Commuting costs are considered a main determinant for accepting a job offer. If the commuting costs are high, then the individual may reject the job offer and prefer a closer job to his home (Berg and Gorter, 1997). Hence, travel time to work is seen as a disutility that they need to minimize.

However, Mitchelson and Fisher (1987) see commuting, on the contrary to migration, as a mechanism that is bringing wages and income in regional equilibrium (i.e. a utility). Since commuting allows people who do not have access to nearby jobs to accept further jobs that they can commute to. In addition, Bunting (1956) explains that commuting performs a crucial function in local labor markets, it sets the wages to an equilibrium. A time of an hour or an hour and a half of traveling from home to work is categorized to be within a normal commuting range.

White (1986) finds that the more time spent on commuting, the less time people have for leisure and work. This means that this loss of time has to be compensated by higher wage given the diminishing marginal utility of leisure consumption. Rupert, Stancanelli and Wasmer (2009) investigate the effect of commuting time on wages. They conclude that commuting time has a positive effect on wages for all groups.

Compensation for longer commutes can be seen in the housing market and the labor market. Individuals residing in suburbs or rural areas are to some extent compensated for their longer commuting time because of the lower housing prices in these areas. Hence, workers are assumed to be compensated at the labor market by getting higher wages for longer commutes and at the housing market by having lower housing prices (Zax, 1991 and White, 1986). It is argued that if workers with long commutes are not paying lower housing prices, then they must be compensated at the labor market with higher wages. Hence, it is necessary to control for either housing prices or for at least the residence area. White (1986) finds that commuting time increases earnings for white males and females and black females. Nevertheless, the housing market benefits are not evenly witnessed, where white males are compensated at the housing market for longer commutes while the females, whether black or white, are at a disadvantage. So, he finds that the effect of commuting time on earnings is positive while the effect of the interaction between commuting time and the proxies of housing prices are negative for the pooled sample. So, it can be said that the net effect of commuting is positive for white males while the majority of black females and some of the white females accept less earnings hence transferring the benefits of lower housing prices to the employer. He further explained that these differences might be due to labor market discrimination, differences in labor market power and residential segregation. White females are assumed to be the secondary earner of the household and are hence expected to be restricted to the commuting requirements of the head of the household. Their labor market choices are therefore limited with respect to travel time from home to work. Employers cover the costs for white males because they have access to other employment opportunities while white and black females have lower job opportunities.

Hamilton and Röell (1982) present that wages are lower in two cases; first when the job is located on the outskirts in remote locations where workers do not have long commutes; second when the workers reside in suburban sides where housing is cheaper. They estimate a wasteful commute that is five times higher than the optimal commute distance. This would not have been necessary to study if commuting is considered cheap. However, commuting costs are not only monetary (on the individuals and the government) but also on the environment. Hence, it is crucial to economize these costs. It can be seen that the empirical evidence of the effect of the commuting time on wages has been mixed.

3. Data

This section introduces the data, the sample and the main variables used in the empirical analysis to answer my two main research questions.

3.1 Sample

In order to identify the determinants and assess the impact of the commuting time, the study depends on data drawn from two waves of Egypt Labor Market Panel Survey (ELMPS): 2006 and 2012 (OAMDI, 2013) and data from CAPMAS for the number of accidents on the governorate level. The ELMPS is carried out by the Economic Research Forum (ERF) in cooperation with Egypt's Central Agency for Public Mobilization and Statistics (CAPMAS). ELMPS 2006 includes a total of 8,351 households comprising 37,140 individuals. While ELMPS 2012 includes 12,060 households with 49,186 individuals. This makes both rounds a nationally representative sample. The sample of 2012 includes 28,770 individuals who were interviewed in 2006 (77 percent of 2012 sample). In addition, the sample also includes 20,416 new individuals (Assad and Krafft, 2013).

ELMPS survey asks respondents about their earnings, working hours, and their commute time to work (my main variables) in addition to their level of job satisfaction in general and with respect to commuting time (Assad and Krafft, 2013). Hence, it is the best dataset to be used for the analysis in Egypt. The number of car accidents on the roads is a statistic that is obtained from CAPMAS annual report for the car and train accidents for the years 2012 and 2006. The control variables of the household characteristics will be calculated from ELMPS data.

Since the main concern is the effect of commuting time on earnings and labor supply, the sample is restricted by removing the non-wage workers. Our sample is confined only for those employed with market definition (reference of one week) and then restricted to wage workers only. This means that the following employment statuses are excluded: employer, self-employed, un-paid family worker and unpaid worker for others. Hence, the number of observations used is 17,658 (The number of wage workers is 10,147 in 2012 and 7,570 in 2006)[1].

Table 1 introduces the definitions of the variables included in the empirical analysis while Table 2 provides an overview of the descriptive statistics of all variables used in the empirical analysis. Females comprise 19 percent of the sample, the mean age is 35 years with an average of 11 years of schooling, 44 percent work in the public sector and 55 percent live in urban areas with an average household size of 5 individuals. The reviewed literature highlights that gender plays a crucial role in explaining labor market behavior in addition to commuting decisions. Table 3 shows differences in travel time to work, working hours and wages according to gender. Given these differences, the analysis focuses on the gender-specific effect of the commute time on labor supply and earnings.

3.2 The main concepts

3.2.1 Commuting time

Commuting time is measured as the time taken to travel from home to work for one way in

[1] Out of 80,390 individuals surveyed in 2006 and 2012. In 2012, the self-employed represent 10 percent of individuals surveyed, the unpaid family workers represent 8 percent while the employers represent 11 percent.

minutes[2]. The costs of commuting consist of monetary costs and time. Commuting time is said to be a better measure of the commuting costs than the commuting distance. This is based on the assumption that the time lost in commuting is the main component of travel cost (Gutiérrez-i-Puigarnau and Van Ommeren, 2015). Furthermore, commuting time is mainly a function of the mode of transportation and distance (Laird, 2006).

In Egypt, commuting time ranges from 0 to 720 minutes (table 2). The mean commuting time for all wage workers is 32 minutes (one-way), irrespective of gender. Out of wage workers, 17 percent commute for 60 minutes or longer. This suggests that the commuting cost is substantial because only a small number of workers are accepting relatively long commuting time. If the cost of commuting was small, then more workers would be willing to take longer commutes (Van Ommeren and Fosgerau, 2009).

There is a gender difference in commuting time in Egypt where males commute for 34.8 minutes on average compared with 23.4 minutes for females in 2012, a gap of 11.4 minutes (Figure 1). This is in line with the literature (i.e. Neto et al., 2015). Furthermore, these differences are present by marital status. Married women have lower commute times compared to single and widowed/divorced women. Single and widowed/divorced women have similar commuting times. However, married men have the highest commute times followed by single men while widowed/divorced men has the lowest commute time (Figure 2).

There are also differences in commuting time by educational level (Figure 3). For males, the commuting time increase with an increase in educational level. The highest commute time is witnessed for men with post-secondary education. For females, the story is different. The highest commuting time is for females with no schooling followed by those with basic education and then post-secondary education. The lowest commute time is for those with secondary education. Figure 4 shows the commuting time of women by both education level and marital status. Married women with secondary and post-secondary education has the lowest commute time while single women with post-secondary education has the highest commute time. So, there is no clear relationship between level of education and commuting for women as is seen for men while marital status is one of the major factors in determining women's travel time to work.

The lower commuting time for married women can be explained by the division of labor in the household. According to Assad, Krafft, & Selwaness (2017), the norm is that the husband acts as the main breadwinner while the wife does all tasks related to the housework. Hence, marriage results in an addition of a lot of housework for women which leads in a reduction for the time available for other activities. Married women working in the public sector continue their work until the retirement age given the flexible working conditions. On the other side, women working in the private sector usually leave their jobs after marriage. The un-flexibility of the work conditions available for women (i.e. flexible working hours, working from home, availability of transportation, etc.) can explain the low rates of female labor participation in Egypt.

[2] Commuting time is a recall question. In general, recall questions are perceived as not precise compared to time-use diaries. However, individuals usually remember perfectly how much time on average they spend every day traveling from home to work. Hence, the commuting time data is not affected by recall bias (Rupert, Stancanelli and Wasmer, 2009).

Women in rural areas commute less than those living in urban areas. On the contrary, men living in rural areas commute longer than those residing in urban areas (Figure 5). According to sector, females in the public sector commute 23 minutes compared to 28 minutes in the private sector. There are no differences in the commuting time for men according to the sector (table 5).

Figure 6 shows the distribution of the commuters according to categories of commuting time. It can be seen that there are extreme commute times ranging from 61 minutes until 720 minutes. For women, commuting 61 to 90 minutes represents only 2 percent and from 91 to 720 minutes represent only 1 percent. For men, the percentages are a little higher; those commuting 61 to 90 minutes represents 5 percent while those commuting 91 to 720 minutes represent 6 percent.

Figure 7 presents the average monthly wage for men and women by commuting categories. For normal commuting times (i.e. less than 61 minutes), an increase in average monthly wage is observed with an increase in commuting time for both men and women. For the extreme commuting times, average monthly wage is lower for those taking 61 to 90 minutes of travel time to work compared with higher wages for those taking more than 90 minutes to travel to work. So, we can descriptively say that higher wages induce people to accept jobs that have higher commute times.

3.2.2 Number of car accidents

One of the main problems in the estimation of the effect of the commute time on labor supply and earnings is the endogeneity problem. Hence, it is necessary to use instrumental variables. The instruments suggested in the literature are the mode of travel, Km of roads per capita in the governorate, and car density (Majeski (2016), Russo et al. (2011) and Niebuhr et al. (2009)). However, I believe that all these instruments might feature strength but not goodness in satisfying the exclusion restriction. This means that these factors have an effect on both the commute time and our dependent variables. To tackle this problem, the proposed study will use the number of accidents on the road as an instrumental variable.

The number of accidents is defined as the accidents that result from the unintentional collision of any vehicle that results in at least one of these: death, injury, or a ruin in the car. This data on the Governorate level arrives to CAPMAS from the Traffic Department, the Ministry of Internal Affairs. The number of car accidents in 2012 is 15,516 compared to 18,061 in 2006, a decline of 14 percent. The number of car accidents is expected to affect the commuting time but does not affect the labor market outcomes of women, in particular when controlling for other covariates. Hence, this instrument is meant to proxy for the commuting time. To make sure that this instrument is not contaminated by the effect of unobserved regional attributes, I control for governorates' characteristics in both the first stage and the second stage regressions. These are the level of unemployment rate on the governorate level and the share of educated calculated from CAPMAS (several reports). I cluster my errors on the governorate level since the value of the number of accidents is on the governorate level and hence is the same for all individuals in the governorate[3].

3.2.3 Labor market outcomes

The labor market outcomes studied in this paper are earnings and labor supply. Earnings is

[3] The sample contains 22 governorates with an average of 452 individuals per governorate in 2012 and 336 in 2006.

measured by hourly wage in a log format. The average hourly wage is 5 Egyptian pounds. The wages vary according to marital status where single women earn an hourly wage of almost 3 Egyptian pounds while married women earn 6 Egyptian pounds. Wages in urban areas are on average higher than those in rural areas. Monthly wages are lower for women compared to men in both areas (Table 6).

Labor supply is measured by daily working hours, weekly working hours and number of working days. Working hours in ELMPS is measured as the number of hours per day spent on market work. Working hours variable takes any value between a minimum of 1 hour and a maximum of 24 hours (OAMDI, 2012). In total, wage workers work about 8 hours per day and an average of 48 hours per week. There is a gender difference in working hours where females work 40 hours per week on average, compared to males who work 48.6 hours. There are no clear cut differences for the number of working days. There are some differences when comparing the working hours for the public and the private sector. Both genders work shorter hours in the public sector with relatively shorter hours for females. Males work 8 hours while females work 7 hours and a similar trend is seen in the weekly working hours.

3.2.4 Control Variables

I control for several variables in the regressions. Controlling for individual, household and work characteristics helps in improving the efficiency of the estimates. In addition, including control variables helps in verifying that my instrument provides exogenous variation by comparing the estimates before and after controlling. I control for the level of educational attainment since education is a determinant of wages and it is expected to have a positive effect on commuting time. Age is also a determinant of wages in the sense that it is considered a proxy for experience. It is expected to have a positive association with commuting time. On this token, a positive relationship is expected between age and commuting time. However, as individuals get older it is expected that they are less willing to take long commutes. For these two reasons, the age is introduced as categories in the equation for the determinants of the commuting time (Turner and Niemeier, 1997). I also use the residence area to control for differences of individuals between urban and rural areas.

The marital status, number of the individuals in the household and the level of wealth of the household are also controlled for. Household characteristics are important control variables as they might influence the working decision. The level of income of the commuter determines the mode of transportation, as the time value is determined by income level. So as the level of income increases, the individual is more prone to have shorter commuting times through the use of speedier modes of transportation (Wardman, 2001). In order to take this effect into account, I control for household income.

4. Empirical Strategy

Two main questions are investigated in this paper. The first is what are the determinants of the commuting time for females compared to males. The second question is how does commuting time affect the labor market outcomes of women especially their wages and labor supply in Egypt. For the first question, the differences in commuting patterns according to gender and geographic region are analyzed and if these patterns have changed between 2006 and 2012. To this end, Tobit models

are estimated[4], which measure the impact of individual characteristics on the commuting time in Egypt. In particular, the commuting time is regressed on age, education, marital status, education level, geographic area, sector of work, the level of household wealth and the number of individuals in the household. The model includes interaction terms of all explanatory variables with year dummies so as to allow tests of difference in commuting rates between 2006 and 2012. Being married and having a bigger household is expected to have a negative effect on the commute time of women. Higher education and lower levels of income are likely to increase the females' mobility.

With regards to the second question, one of the main issues in estimating such model is that commuting time may be endogenous with respect to labor supply and wages. In order to address this problem, quasi-experimental method is implemented specifically employing an instrumental variable for commute time using a two-stage least squares regression. In this regression, the endogenous explanatory variable is regressed on a separate variable known as the instrument. The instrument should be correlated with the causal variable of interest but uncorrelated with any other determinants of the dependent variable; this is called the exclusion restriction. Second, the predicted values of the endogenous variable are used in place of the endogenous variable in a second-stage regression. This method solves for the endogeneity problems and allows for an unbiased estimation of the impact of the endogenous variable on the dependent variable (Angrist and Pischke, 2008).

In order to choose the proper instrumental variable for this specification, I first identify the variables that satisfy the exclusion restriction. Hence, it is necessary to find a variable (an instrument) that is highly correlated with the commute time but is not correlated with the other independent variables affecting the labor market outcomes (i.e. labor supply and earnings). In order to do so, I reviewed a number of suggested instruments for commuting time in the literature. These are the mode of travel, kilometers of roads per capita in the governorate and car density (Majeski (2016), Russo, Teschi, Reggiani, and Nijkamp (2011) and Niebuhr, Granato, Haas, and Hamann (2009)). All these instruments are weak ones. I think that the best instrument is the number of accidents on the road. Since the number of accidents affect the commute time (an expected positive effect) but does not affect earnings or labor supply. While on the other side, the length of the roads affects both the commute time and the earnings of individuals since it might indicate that the neighborhood is developed and has the proper infrastructure which will increase the number of firms in this area and hence might put a positive pressure on earnings. On the same token, the mode of travel might indicate the level of development of the area. For instance, in rural areas, the main transportation method is public transportation and will be correlated with the lower level of earnings in these areas.

Using panel data control for individual unobserved heterogeneity which can be an important factor in shaping the behavior of individuals. Furthermore, I account for different commuting patterns and labor market characteristics according to the geographical region by running the regressions distinctly for urban and rural areas and also by full-time vs. part-time employment.

[4] The Tobit model is used due to the nature of the dependent variable (censored variable), where it must take positive values and has zero data.

5. Empirical Results

5.1 Gender Differences in Commuting Time

The objective of this section is to answer the question what are the determinants of the commuting time and what are the differences according to gender. In particular, the commuting patterns and determinants for males and females are identified. As mentioned earlier, the variables included in the Tobit model of commuting time are education level, marital status, age categories, region, sector of employment, household wealth and number of individuals in the household.

Table 7 demonstrates the coefficients from a Tobit model of commuting time (one-way from home to work). The model is run as a full interaction model to be able to dissect the differences between 2006 and 2012. This means that all the variables in the model are interacted with year dummies. In addition, the model is estimated for both males and females. The reference individual is defined as a 15-19 years single individual with no education living in rural areas, working in the private sector living on their own and residing in the first quartile of HH wealth.

Regarding the effect of age on commuting time, the regression results show that females aged 20-29 and 50-64 had longer commuting times compared to females aged 15-20 in 2012 while in 2006 all age categories had higher commuting time compared to the reference group[5]. For males, those aged between 20 and 49 had higher commutes than the reference group in 2012 and there was no effect of age on commuting time in 2006.

Females with basic education had higher commuting times than those with no education in 2012 and no significant effect of the other education categories. On the contrary, males with education (regardless of the education level) have longer commuting times compared to those with no education. This can be explained by the fact that higher educational attainment results in acquiring higher wages and thus can increase the affordability of commuting costs (He and Zhao, 2017). This result is not achieved for women because of their lower level of wages.

Marital status does not affect the commuting time of males in either 2006 or 2012. Married women are those with the shortest commute time in both 2006 and 2012 but the magnitude has declined a little bit in 2012. This shows that women with fewer household responsibilities have higher commutes compared to other women who are married.

The effects of the size of household on commuting time differs also according to gender. It is seen that men living in households that have three individuals tend to have longer commutes compared to those living alone. For females, living in households that have 3 or more individuals decreases their commute time relative to living on their own. This is related to gender roles where women take more household responsibility. This indicates that due to greater household responsibility, women choose shorter commutes. Regarding household wealth, males in the third, fourth and fifth quintiles have higher commute times indicating that commute time increases with increase in wealth. While for women, there is no difference in commuting time according to wealth.

Both men and women working in the public sector have shorter commutes than those working in the private sector in 2006. However, this effect disappears in 2012. Residing in urban areas

[5] The average age for single women is 27 years old, while for married women is 41 and for divorced women is 46 years.

decreases males' commuting time compared to living in rural areas and this trend is increasing over the years. For females, it is the opposite with females living in the urban areas commuting more than women in other areas in 2006 but this effect is not present in 2012. This can be explained by the fact that men living in rural areas are taking longer commutes, may be accepting jobs in nearby villages or towns while women residing in rural areas are less likely to do so. It also shows that more men in urban areas are living closer to their jobs while women do not necessarily live next to their jobs. This indicates that there are higher densities of jobs and employment opportunities in the urban areas for men only. In addition, when there are two workers in the household, it is usually difficult to choose a residence that has proximity to both workers' jobs.

5.2 The impact of commuting time

This section shows the main results of the effect of commuting time on various labor market outcomes. First, the first stage results and tests are introduced. Second, models for estimating the effect on hourly wage, working hours and number of working days are presented. Due to the potential endogeneity of the commuting time, I present the endogeneity-corrected results by using the number of accidents as an instrumental variable in a REIV model and also the uncorrected estimates obtained from an RE model.

5.2.1 First stage results

In this part, I present the first-stage estimates of the commuting time and the results of the strength and endogeneity tests. The first-stage regression coefficients are shown in Table 9. The instrumental variable (number of accidents) is statistically significant at the 1 percent significance level. In addition, the number of accidents has a positive effect on the commuting time as expected. Hence, I can say that the number of accidents has an effect on the endogenous variable.

The strength of the instrument is conducted through an f-test of instrument's significance. Columns (1) and (3) in Table 8 show the f-statistic of the significance of the number of accidents for the sub-samples of men and women. The F-statistic is significant at the 0.1 percent. In addition, the test statistics are higher than the critical values of Stock & Yogo (2005) and higher than the rule of thumb of 10 provided by Staiger & Stock (1997). Hence, I can conclude that the number of accidents is a strong instrument.

Columns (2) and (4) in Table 8 present the results of the endogeneity test which examines if the commuting time to work is endogenous. The null hypothesis of the exogeneity of the commuting time is tested. The chi-square statistic is calculated. It can be seen that the exogeneity of the commuting time cannot be rejected for women. On the other hand, the commute time might be endogenous for working hours of men but not for the wages. The model is hence estimated using OLS and 2SLS, in light of the results of the strength of the instrument and the endogeneity tests.

5.2.2 Labor market outcomes by gender

Table 10 presents the results of estimating the impact of the commuting time on earnings from RE and REIV models for male and female wage workers. In light of the reviewed literature, the effect of commuting time varies according to gender; hence it is useful to differentiate between male and female workers. Columns (1) and (3) show a significant positive relationship between commuting time and wage for both genders. However, the effect is not significant for women when the endogeneity of the commute time is taken into account. For men, the effect turns to a negative but

significant impact. One could say that the positive effect of the commuting time on the wages for women (column 1) is in line with the reservation wage and utility theories. The utility theory explains that women see the commuting time as a method that enables them to access more job opportunities that have better benefits. It is also seen that people are more willing to accept further jobs if the wages are higher. Hence, it could be seen that an increase in commute time results in an increase in hourly wages for women. Taking into account the possible endogeneity of the commuting time, the effect is still positive but insignificant for women. This can be explained by the self-selection of women. While for men, the endogeneity-corrected estimates indicate that an increase in commuting time results in a negative impact on their wages. This dissimilarity in the sign (for men) and significance (for women) of the effects suggest that the potential endogeneity of the commuting time is creating bias in the estimation of the effects on wages.

Table 11 presents the impact of the commuting time on the daily working hours by gender. Contrary to the impact on wages, here the results are robust to estimation method whether RE or REIV is used. It is found that the time devoted to commuting has a positive and statistically significant relationship with the daily working hours of both men and women. The magnitude of the effect is larger for men compared to women. This result shows that men devote more time for work in relation to the increase in commuting time. This can be explained that men prefer to stay longer at work to avoid commuting in the rush hours as explained earlier. On the other side, this effect is smaller for women as they cannot afford to stay longer at work so as not to take from the time devoted to their household responsibilities, in line with the Household Responsibility Theory.

Table 12 shows the impact of the commuting time on the weekly working hours for wage workers of both genders. It can be seen that the positive effect in the daily working hours is still positive and significant for men. While the positive effect for women is insignificant if we take into account the potential endogeneity of the commuting time (Column 2). This supports the previous results for the daily working hours. It confirms that men are more likely to work longer hours (on daily and weekly basis) when the commutes are long while women might work longer on a certain working day but not for the whole working week. Furthermore, this effect for women can be a result of a trade-off between longer working hours per day and less working days.

5.2.3 Sensitivity analysis

Table 14 and Table 17 show the impact of the commute time on the hourly wage by region and for full-time vs. part-time workers. The effect of commute time on earnings by geographical region is in line with the results for the wage workers sample. It can be seen that the commute time does not have an effect on women's wages either in urban or rural areas. On the other hand, men witness a significant decline in their hourly wage as a result of an increase in the commuting time only in urban areas with no such effect in rural areas. Men working full-time also witness the significant negative effect on their wages. This confirms our finding of a negative effect of commute time on men's wages and an unclear effect in the case of women.

Table 15 and Table 18 show the impact of the commute time on the daily working hours by region and for full-time vs. part-time workers. It can be seen that there is a positive significant effect on working hours per day that is witnessed only in urban areas. In addition, the magnitude of the

effect is still higher for women compared to men. Full-time men and women also increase their working hours in response to an increase in commuting. The same trend is witnessed for the effect of commuting time on the weekly working hours. There is no significant effect for part-time workers of both genders (Table 19).

Table 16 shows that men in both urban and rural areas increase their weekly working hours in response to an increase in commuting time. This shows that the results remain robust in other sub-samples.

6. Conclusion

Women in Egypt suffer from a commuting gender gap where they have limited geographical mobility compared to men. In this research, I try to identify the determinants and the impact of the commuting time of women using panel data from Egypt's labor market panel survey for the years 2006 and 2012. What are the determinants of the commuting time for women? The estimation results of the Tobit model show that women with fewer household responsibilities have shorter commutes compared to women with more responsibilities. It has been found that women in the age of being single have larger travel time to work. Married women have shorter commutes compared to single women. In addition, living in bigger households decreases the commute time of women compared to those living in smaller households. There are also differences by geographic regions where women living in rural areas have shorter commutes relative to those residing in urban areas.

In the empirical analysis of the impact of the travel time to work on labor market outcomes, I take into consideration that the commuting time, the working hours and the accepted wage level are selections that the individual make and hence I employ the use of a 2SLS model using number of accidents as an instrument for commuting time to address the reverse causality bias. The panel data used in this paper allows for identifying the effect of commuting time on labor market outcomes taking into account individuals' heterogeneity.

An increase in travel time to work result in decline of wages of men (especially in urban areas) while the effect for women is positive. This is in line with the utility and reservation wage theories which indicate that the commuting is seen as a method of access to better job opportunities that is accepted if it offers higher wages. The impact of the commuting time on the labor supply is generally positive for both men and women. However, the effect on the working hours of women is smaller with no significant effect on the weekly working hours and a negative effect on the number of working days. This shows that they respond to an increase in commuting time by working more hours per day and less days per week.

Policy Implications derived from my results regarding the impact of the length of travel time to work are as follows. On the individual level, changes in residential patterns might be necessary; individuals can decrease their commuting time by changing their residential location. The negative effect on women's weekly labor supply present in the decline in the number of days can be overcome by inducing employers to have more flexible working conditions and family-friendly policies for women like working from home. This can make it easier for women to accommodate their work and household responsibilities and overcome the time disadvantage. In addition,

companies can provide employees with transportation options that can help save on commuting time and costs. Policies that allocate land for businesses next to residential locations are needed especially in urban areas. In addition, there is a need to increase the availability, coverage and safety of public transportation coupled with improving the road infrastructure and their safety level to avoid traffic congestions. These policies can help in decreasing the commute time in general and increasing the labor supply of women in particular.

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Appendix

Table 1: Definitions of the variables

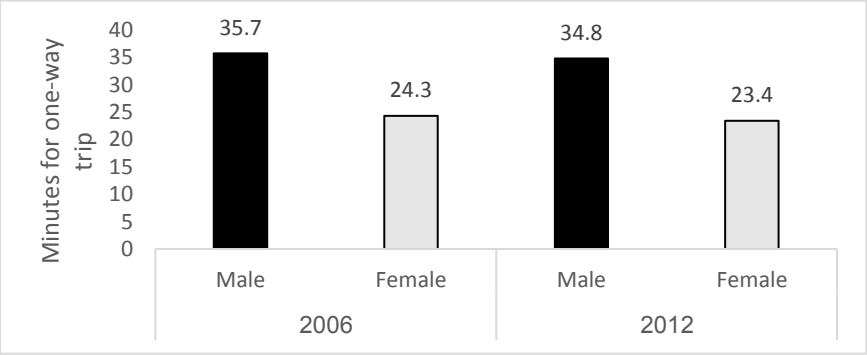
Variable name	**Definition**
Commuting time	Travel time to work (in minutes) in primary job for one way.
Age	Respondents' age has been grouped into five categories: 15-19, 20-29, 30-39, 40-49 and 50-64
Education	a four categories variable: 1) No education compromising of the illiterates and literates without any diploma, 2) Basic education compromising of elementary and middle school , 3) Secondary education including general and vocational high school 4) Post-secondary education includes post-secondary institute, university and post-graduate studies.
Wealth	Household wealth score segregated in quintiles
Household size	Number of individuals in the household
Urban	A binary variable which is equal to 1 if the individual is living in urban area and 0 otherwise.
Public sector	A binary variable which is equal to 1 if the respondent is employed in the public sector or the government and equal to 0 if employed in the private sector or a joint-venture.
Part time	A binary variable which is equal to 1 if the respondent is working less than 35 hours and 0 otherwise.
Married	A categorical variable which have three categories: single, married and divorced/widowed.
No. of Hours/Day	Number of working hours per day for market work
No. of Hours/week	Number of working hours per week for market work
Number of working days	Number of working days per week
Hourly wage	The log of hourly wage in primary job in Egyptian pounds
Monthly wage	The log of monthly wage in primary job in Egyptian pounds

Table 2: Descriptive Statistics for Outcome and Explanatory variables

	Mean	Std. dev.	min	max
Travel time to work	32.01	37.25	0	720
No. of Hours/Day	8.37	2.12	1	24
No. of Hours/week	47.48	14.61	1	126
Number of working days	5.66	0.95	1	7
Hourly wage	5.10	10.80	0	808
Monthly wage	935.38	1523.95	4	66240
Age	35.35	11.06	15	64
Years of schooling	10.50	4.83	0	23
Urban	0.55	0.50	0	1
Public sector	0.44	0.50	0	1
Part time	0.12	0.33	0	1
HH size	4.82	2.17	1	21
Female	0.19	0.39	0	1
Number of observations	17,346			

Source: Calculated by the author based on ELMPS data.

Figure 1: Commuting time by gender

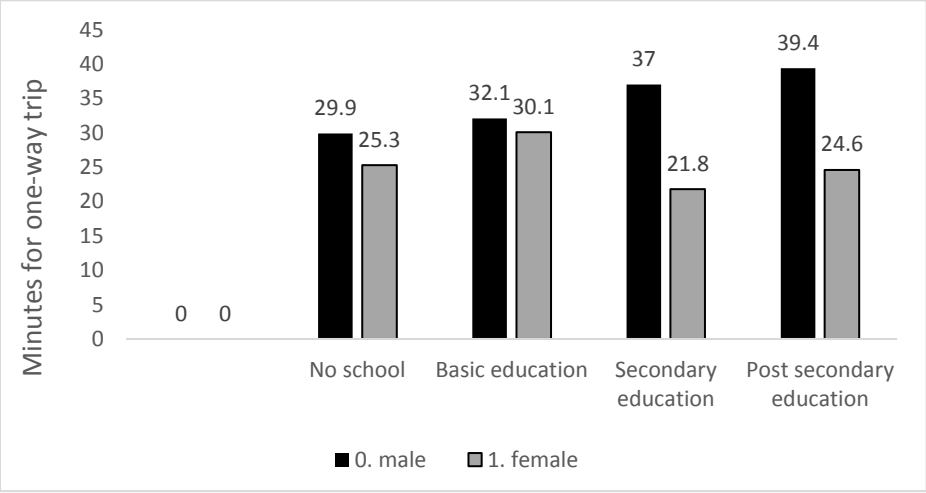


Source: Calculated by the author based on ELMPS data.

Figure 2: Commuting time by marital status and gender

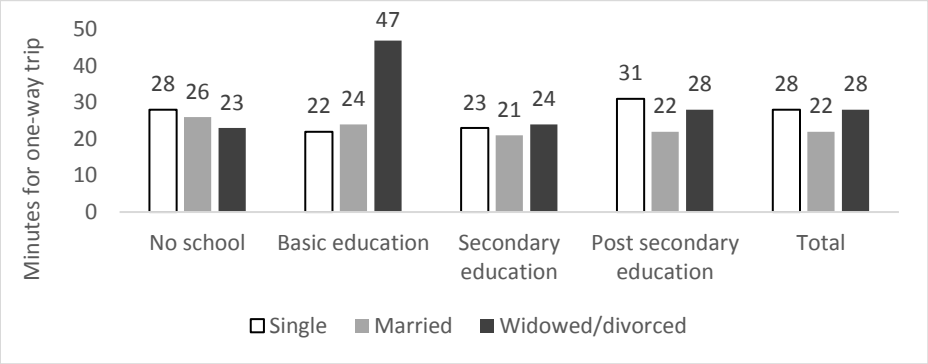
Source: Calculated by the author based on ELMPS data.

Figure 3: Commuting time by gender and education level



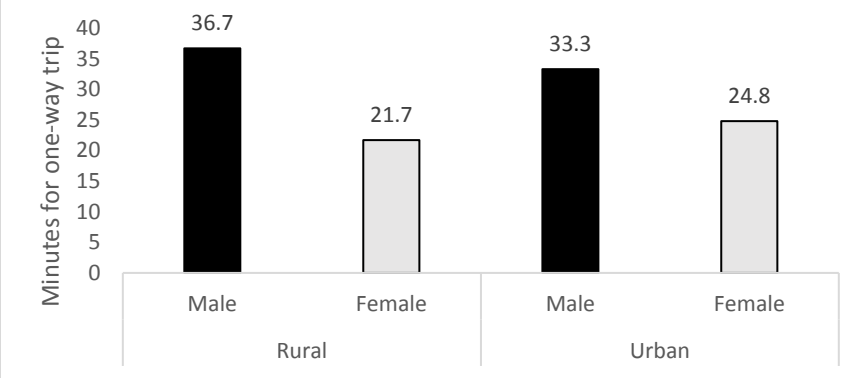
Source: Calculated by the author based on ELMPS data.

Figure 4: Females' commuting time by marital status and education level



Source: Calculated by the author based on ELMPS data.

Figure 5: Commuting time by geographic region and gender



Source: Calculated by the author based on ELMPS data.

Table 3: Means of main variables by marital status and gender

Marital status and gender	Commuting time	Working hours per day	Working hours per week	Working days	Hourly wage	Monthly wage
Single						
- Male	34.5	8.94	50.9	5.68	3.73	756
- Female	27.5	7.94	45.6	5.69	3.01	541
Married						
- Male	35.5	8.53	48.5	5.68	5.46	1012
- Female	22	7.12	39.5	5.53	5.66	888
Widowed/ divorced						
- Male	32.6	8.68	50.7	5.78	5.79	1224
- Female	27.5	7.49	40.4	5.38	6.53	973

Source: Calculated by the author based on ELMPS data.

Table 4: Means of main variables by sector and gender

Sector /gender	Commuting time	Working hours per day	Working hours per week	Working days	Hourly wage	Monthly wage
Private sector						
- Male	35.1	9.09	51.6	5.66	4.31	846
- Female	27.8	8.17	46.3	5.59	3.35	542
Public sector						
- Male	35.2	7.93	45.4	5.73	6.09	1103
- Female	22.5	7.06	39.1	5.53	5.81	918

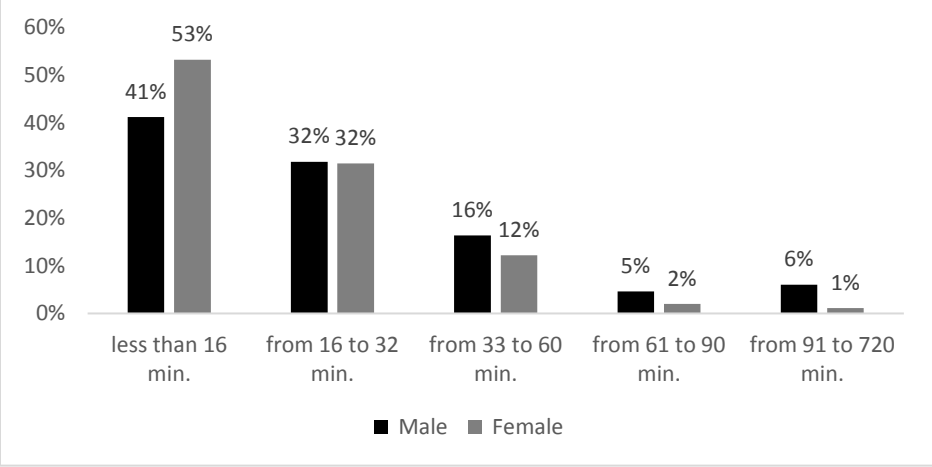
Source: Calculated by the author based on ELMPS data.
*The public sector here includes workers in the public sector and in the government while those in the private sector are workers in private, foreign and joint ventures.

Table 5: Means of main variables by working time and gender

Part time and gender	Commuting time	Working hours per day	Working hours per week	Working days	Hourly wage	Monthly wage
Full-time						
- Male	36.1	8.89	52	5.85	4.8	960
- Female	24.3	7.76	44.1	5.67	4.94	852
Part time						
- Male	27.7	6.61	25.6	4.28	6.63	813
- Female	21.4	5.48	26.6	5.02	6.34	701

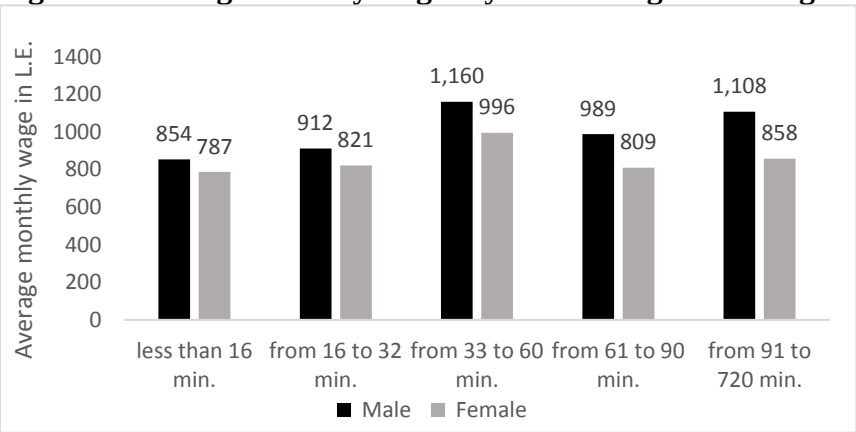
Source: Calculated by the author based on ELMPS data.

Figure 6: Distribution of commuters by commuting time



Source: Calculated by the author based on ELMPS data.

Figure 7: Average monthly wages by commuting time and gender



Source: Calculated by the author based on ELMPS data.

Table 6: Means of main variables by geographic region and gender

Region and gender	Commuting time	Working hours per day	Working hours per week	Working days	Hourly wage	Monthly wage
Rural						
- Male	36.7	8.51	48.3	5.67	4.4	820
- Female	21.7	7.11	39.5	5.53	4.76	743
Urban						
- Male	33.3	8.81	50.4	5.7	5.71	1097
- Female	24.8	7.45	41.6	5.55	5.41	865

Source: Calculated by the author based on ELMPS data.

Table 7: Coefficient estimates of commuting time by year

Dep. variable:	**Female**		**Male**	
One way commuting time in minutes	**2006**	**2012**	**2006**	**2012**
Intercept				
Age (ref. category: 15-19)				
20-29	8.441*	12.76*	7.812**	9.371***
	(3.38)	(5.99)	(2.66)	(2.68)
30-39	8.392*	11.57	6.790*	8.619**
	(3.63)	(6.04)	(3.06)	(2.98)
40-49	11.31**	10.1	1.553	8.922**
	(3.74)	(6.05)	(3.24)	(3.16)
50-64	10.19**	12.74*	3.705	5.593
	(3.95)	(6.14)	(3.38)	(3.23)
Education level (ref. category: no education)				
Basic education	0.111	7.582*	0.175	4.313*
	(3.67)	(3.35)	(1.86)	(1.73)
Secondary education	-3.362	-0.609	4.921**	6.318***
	(2.57)	(2.44)	(1.68)	(1.59)
Post-secondary education	-2.339	1.498	7.475***	7.446***
	(2.74)	(2.57)	(2.00)	(1.90)
Marital status (ref. category: single)				
Married	-5.012**	-3.876*	1.717	-0.428
	(1.87)	(1.63)	(1.84)	(1.62)
Widowed-divorced	0.387	-1.277	2.398	0.59
	(2.71)	(2.26)	(6.41)	(5.66)
Geographic region (ref. category: rural areas)				
Urban	2.912*	-0.105	-3.242*	-10.48***
	(1.40)	(1.23)	(1.34)	(1.20)
Sector of employment (ref. category: private sector)				
Public	-6.763***	-2.214	-3.168*	0.0158
	(1.72)	(1.51)	(1.43)	(1.28)

HH size (ref. category: 1 individual)				
2	13.46*	-4.474	18.34*	10.15
	(6.76)	(3.51)	(7.92)	(5.84)
3	3.737	-7.160*	10.97	11.73*
	(6.62)	(3.43)	(7.83)	(5.70)
4	5.799	-8.087*	13.42	9.324
	(6.62)	(3.42)	(7.73)	(5.62)
5 or more	3.694	-7.753*	13.7	6.568
	(6.64)	(3.40)	(7.69)	(5.57)
HH weatlh score (ref. category: 1st quartile)				
2nd quartile	1.476	-3.094	1.268	0.293
	(2.97)	(2.71)	(1.83)	(1.64)
3rd quartile	1.301	-1.841	0.0231	3.599*
	(2.88)	(2.62)	(1.90)	(1.70)
4th quartile	6.862*	-1.828	8.626***	5.033**
	(2.91)	(2.59)	(2.10)	(1.84)
5th quartile	5.079	-2.446	6.803**	9.485***
	(3.02)	(2.61)	(2.29)	(2.07)
Total number of observations	2,430.00		9,988.00	
Number of left-censored observations	8		94	
log-likelihood	-11,955.852		-56,610.657	

* *p<0.05, ** p<0.01, *** p<0.001*
Standard errors are between parentheses.
Source: Calculated by the author based on ELMPS data.

Table 8: Tests for Strength of Instrument (F-test) and Endogeneity (Chi-squared test)

	Female		Male	
	F-test for strength of instrument	**Chi-squared test of endogeneity**	**F-test for strength of instrument**	**Chi-squared test of endogeneity**
Outcomes	(1)	(2)	(3)	(4)
Log of Hourly wage	49.26***	2.15	54.69***	3.93
Working hours per day	43.74***	1.64	56.68***	28.22**
Working hours per week	49.94***	0.39	56.68***	27.85**

Notes: (i) The statistical significance is used as * p<0.05, ** p<0.01, *** p<0.001.
(ii) The instrument used for the commuting time to work is the number of accidents on the governorate level in Egypt.

Table 9: First-stage regression coefficients for the commuting time

	(1)	**(2)**
VARIABLES	**Males' commute time**	**Females' commute time**
Instrument: accidents	0.006***	0.005***
	(0.001)	(0.001)
Covariates:		
Age	0.535**	0.319
	(0.239)	(0.257)
Age squared	-0.008***	-0.005
	(0.003)	(0.003)
Education cateogry (Ref. cateogry: No education)		
Basic education	2.213**	3.374
	(1.112)	(2.236)
secondary education	6.658***	0.813
	(0.971)	(1.557)
Post-secondary education	10.130***	3.164**
	(1.103)	(1.581)
Marital status (Ref. cateogry: Single)		
Married	0.544	-2.904***
	(1.054)	(1.092)
Widowed-divorced	-0.026	-0.718
	(3.842)	(1.610)
HH size	-0.450***	-0.611***
	(0.156)	(0.219)
Urban area	-5.557***	1.666**
	(0.706)	(0.815)
Public sector	-1.036	-4.074***
	(0.821)	(1.021)
Constant	22.266***	20.416***
	(4.165)	(4.695)
Observations	13,959	3,288

Notes: (i)Standard errors in parentheses. (ii) *** p<0.01, ** p<0.05, * p<0.1

Table 10: The effect of commute time on earnings for wage workers

Dependent variable: Log of Hourly wage

	Female		Male	
Estimation Method	**RE**	**REIV**	**RE**	**REIV**
Explanatory variable	(1)	(2)	(3)	(4)
Commute time	0.001*	0.005	0.001***	-0.015***
	(0.001)	(0.005)	(0.000)	(0.005)
Age	0.036***	0.031***	0.021***	0.022***
	(0.010)	(0.010)	(0.005)	(0.008)
Age squared	0	0	0	0
	(0.000)	(0.000)	(0.000)	(0.000)
Education category (Ref. category: No education)				
Basic education	0.443***	0.415***	0.117***	0.146***
	(0.091)	(0.093)	(0.020)	(0.031)
secondary education	0.485***	0.465***	0.248***	0.335***
	(0.064)	(0.063)	(0.018)	(0.045)
Post-secondary education	0.838***	0.808***	0.532***	0.690***
	(0.066)	(0.068)	(0.023)	(0.061)
Marital status (Ref. category: Single)				
Married	0.270***	0.280***	0.166***	0.175***
	(0.047)	(0.050)	(0.020)	(0.029)
Widowed-divorced	0.185**	0.199***	0.097	0.112
	(0.075)	(0.073)	(0.077)	(0.111)
HH size	-0.052***	-0.041***	-0.028***	-0.033***
	(0.009)	(0.010)	(0.003)	(0.006)
Urban area	-0.038	-0.013	-0.022*	-0.085**
	(0.031)	(0.033)	(0.013)	(0.038)
Public sector	0.092**	0.146***	-0.130***	-0.124***
	(0.045)	(0.054)	(0.018)	(0.025)
Constant	-0.805***	-0.814***	0.371***	0.906***
	(0.181)	(0.208)	(0.083)	(0.140)
N	3304	3304	14010	14010

Notes: (i) The statistical significance is used as * p<0.10, ** p<0.05, *** p<0.01. (ii) First-stage estimations include the same control variables in addition to the number of accidents as the instrumental variable. (iii) Between parentheses are the bootstrapped standard errors, with 400 replications.

Table 11: The effect of commute time on working hours per day for wage workers

Dependent variable: Number of working hours per day

	Female		Male	
Estimation Method	**RE**	**REIV**	**RE**	**REIV**
Explanatory variable	(1)	(2)	(3)	(4)
Commute time	0.008***	0.022**	0.006***	0.061***
	(0.001)	(0.011)	(0.001)	(0.011)
Age	-0.03	-0.037*	0.032**	0.002
	(0.020)	(0.021)	(0.013)	(0.020)
Age squared	0	0.000*	-0.001***	0
	(0.000)	(0.000)	(0.000)	(0.000)
Education category (Ref. category: No education)				
Basic education	-0.291	-0.355	0.255***	0.126
	(0.277)	(0.264)	(0.064)	(0.083)
secondary education	-0.292*	-0.295*	-0.105**	-0.477***
	(0.154)	(0.151)	(0.053)	(0.095)
Post-secondary education	-0.605***	-0.646***	-0.432***	-1.025***
	(0.154)	(0.152)	(0.058)	(0.123)
Marital status (Ref. category: Single)				
Married	-0.441***	-0.404***	0.07	0.058
	(0.091)	(0.090)	(0.055)	(0.089)
Widowed-divorced	-0.203	-0.2	0.039	0.036
	(0.134)	(0.137)	(0.167)	(0.276)
HH size	0.014	0.025	-0.043***	-0.011
	(0.018)	(0.021)	(0.008)	(0.015)
Urban area	0.418***	0.386***	0.336***	0.614***
	(0.063)	(0.068)	(0.039)	(0.079)
Public sector	-0.817***	-0.763***	-0.982***	-0.926***
	(0.091)	(0.098)	(0.049)	(0.066)
Constant	8.735***	8.416***	8.420***	7.006***
	(0.401)	(0.502)	(0.221)	(0.439)
N	3288	3288	13959	13959

Notes: (i) The statistical significance is used as * p<0.10, ** p<0.05, *** p<0.01. (ii) First-stage estimations include the same control variables in addition to the number of accidents as the instrumental variable. (iii) Between parentheses are the bootstrapped standard errors, with 400 replications.

Table 12: The effect of commute time on working hours per week for wage workers

Dependent variable: Number of working hours per week

	Female		Male	
Estimation Method	**RE**	**REIV**	**RE**	**REIV**
Explanatory variable	(1)	(2)	(3)	(4)
Commute time	0.026**	0.061	0.026***	0.311***
	(0.011)	(0.077)	(0.003)	(0.057)
Age	-0.186	-0.238	0.212**	0.081
	(0.147)	(0.149)	(0.095)	(0.121)
Age squared	0.001	0.002	-0.004***	-0.002
	(0.002)	(0.002)	(0.001)	(0.002)
Education category (Ref. category: No education)				
Basic education	-1.023	-1.114	1.130**	0.564
	(1.820)	(1.792)	(0.453)	(0.543)
secondary education	-0.518	-0.424	-0.02	-1.904***
	(1.231)	(1.207)	(0.393)	(0.602)
Post-secondary education	-3.574***	-3.594***	-1.853***	-4.971***
	(1.223)	(1.210)	(0.420)	(0.741)
Marital status (Ref. category: Single)				
Married	-3.175***	-3.129***	0.349	0.248
	(0.611)	(0.628)	(0.395)	(0.515)
Widowed-divorced	-1.633*	-1.837**	0.797	0.957
	(0.916)	(0.930)	(1.332)	(1.561)
HH size	0.277**	0.256*	-0.150**	0.006
	(0.125)	(0.135)	(0.059)	(0.083)
Urban area	3.210***	2.866***	2.482***	3.897***
	(0.433)	(0.463)	(0.285)	(0.456)
Public sector	-5.634***	-5.497***	-5.031***	-4.892***
	(0.593)	(0.649)	(0.304)	(0.385)
Constant	50.598***	50.528***	46.966***	39.176***
	(3.038)	(3.697)	(1.663)	(2.430)
N	3288	3288	13959	13959

Notes: (i) The statistical significance is used as * p<0.10, ** p<0.05, *** p<0.01. (ii) First-stage estimations include the same control variables in addition to the number of accidents as the instrumental variable. (iii) Between parentheses are the bootstrapped standard errors, with 400 replications.

Table 13: The effect of commute time on working days for wage workers

Dependent variable: Number of working days per week

	Female		Male	
Estimation Method	**RE**	**REIV**	**RE**	**REIV**
Explanatory variable	(1)	(2)	(3)	(4)
Commute time	-0.002**	-0.006	-0.001***	-0.004
	(0.001)	(0.005)	(0.000)	(0.003)
Age	-0.005	-0.009	0.009	0.014**
	(0.010)	(0.010)	(0.006)	(0.007)
Age squared	0	0	-0.000**	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Education category (Ref. category: No education)				
Basic education	-0.01	0.022	-0.005	0.015
	(0.135)	(0.135)	(0.034)	(0.035)
secondary education	0.103	0.105	0.053*	0.083**
	(0.087)	(0.084)	(0.029)	(0.035)
Post-secondary education	-0.018	-0.002	0.036	0.073*
	(0.083)	(0.081)	(0.029)	(0.041)
Marital status (Ref. category: Single)				
Married	-0.087**	-0.105**	-0.011	-0.014
	(0.040)	(0.043)	(0.027)	(0.028)
Widowed-divorced	-0.106	-0.121*	0.008	0.011
	(0.065)	(0.064)	(0.080)	(0.085)
HH size	0.025***	0.017**	0.008*	0.006
	(0.008)	(0.009)	(0.004)	(0.005)
Urban area	0.102***	0.087***	0.054***	0.037*
	(0.032)	(0.031)	(0.017)	(0.022)
Public sector	-0.063	-0.075*	0.101***	0.089***
	(0.040)	(0.046)	(0.020)	(0.021)
Constant	5.771***	5.953***	5.468***	5.499***
	(0.208)	(0.242)	(0.109)	(0.137)
N	3306	3306	14005	14005

Notes: (i) The statistical significance is used as * p<0.10, ** p<0.05, *** p<0.01. (ii) First-stage estimations include the same control variables in addition to the number of accidents as the instrumental variable. (iii) Between parentheses are the bootstrapped standard errors, with 400 replications.

Table 14: The effect of commute time on earnings in urban and rural areas

Dependent variable: Log of Hourly wage

	Female		Male	
	Urban	**Rural**	**Urban**	**Rural**
Estimation Method		**REIV**		
Explanatory variable	(1)	(2)	(3)	(4)
Commute time	0.006	0.294	-0.006*	-0.026
	(0.004)	(1.971)	(0.003)	(0.122)
Age	0.031**	-0.222	0.035***	0.023
	(0.012)	(0.259)	(0.008)	(0.031)
Age squared	0	0.005	-0.000**	0
	(0.000)	(0.007)	(0.000)	(0.001)
Education category (Ref. category: No education)				
Basic education	0.492***	2.056	0.133***	0.183
	(0.126)	(19.810)	(0.034)	(0.355)
secondary education	0.528***	1.92	0.304***	0.413
	(0.087)	(16.407)	(0.035)	(0.844)
Post-secondary education	0.898***	2.406	0.664***	0.664
	(0.090)	(11.690)	(0.047)	(0.851)
Marital status (Ref. category: Single)				
Married	0.209***	1.57	0.195***	0.11
	(0.058)	(1.114)	(0.030)	(0.155)
Widowed-divorced	0.188**	-0.684	0.158	-0.169
	(0.081)	(3.454)	(0.098)	(0.728)
HH size	-0.042***	0.282	-0.029***	-0.039
	(0.011)	(1.310)	(0.006)	(0.061)
Public sector	0.129**	0.816	-0.076***	-0.137
	(0.058)	(1.205)	(0.026)	(0.479)
Constant	-0.860***	-8.732	0.185	1.452
	(0.231)	(75.746)	(0.134)	(4.249)
N	2340	964	7106	6904

Notes: (i) The statistical significance is used as * p<0.10, ** p<0.05, *** p<0.01. (ii) First-stage estimations include the same control variables in addition to the number of accidents as the instrumental variable. (iii) Between parentheses are the bootstrapped standard errors, with 400 replications.

Table 15: The effect of commute time on working hours per day in urban and rural areas

Dependent variable: Number of working hours per day

	Female		Male	
	Urban	Rural	Urban	Rural
Estimation Method	REIV			
Explanatory variable	(1)	(2)	(3)	(4)
Commute time	0.023**	-0.061	0.055***	0.068
	(0.011)	(0.638)	(0.013)	(0.108)
Age	-0.042	-0.044	-0.001	-0.015
	(0.026)	(0.387)	(0.025)	(0.073)
Age squared	0.001*	0	0	0
	(0.000)	(0.005)	(0.000)	(0.001)
Education category (Ref. category: No education)				
Basic education	-0.353	-0.598	0.084	0.137
	(0.325)	(4.096)	(0.110)	(0.284)
secondary education	-0.211	-0.913	-0.466***	-0.516
	(0.215)	(3.607)	(0.113)	(0.797)
Post-secondary education	-0.638***	-1.066	-0.975***	-1.057
	(0.217)	(3.174)	(0.165)	(1.005)
Marital status (Ref. category: Single)				
Married	-0.420***	-0.54	-0.046	0.23
	(0.103)	(2.856)	(0.107)	(0.198)
Widowed-divorced	-0.259*	-0.2	-0.014	0.214
	(0.150)	(4.106)	(0.326)	(0.851)
HH size	0.046**	-0.058	-0.014	-0.007
	(0.023)	(0.377)	(0.024)	(0.039)
Public sector	-0.897***	-0.676	-1.117***	-0.729**
	(0.101)	(2.395)	(0.088)	(0.299)
Constant	8.847***	11.453	8.069***	6.857
	(0.567)	(22.881)	(0.483)	(4.673)
N	2330	958	7088	6871

Notes: (i) The statistical significance is used as * p<0.10, ** p<0.05, *** p<0.01. (ii) First-stage estimations include the same control variables in addition to the number of accidents as the instrumental variable. (iii) Between parentheses are the bootstrapped standard errors, with 400 replications.

Table 16: The effect of commute time on working hours per week in urban and rural areas

Dependent variable: Number of working hours per week

	Female		Male	
	Urban	**Rural**	**Urban**	**Rural**
Estimation Method			**REIV**	
Explanatory variable	(1)	(2)	(3)	(4)
Commute time	0.067	-0.354	0.264***	0.358**
	(0.068)	(4.103)	(0.073)	(0.178)
Age	-0.284	-0.097	0.114	-0.099
	(0.179)	(2.594)	(0.168)	(0.208)
Age squared	0.003	-0.001	-0.002	0.001
	(0.002)	(0.040)	(0.002)	(0.003)
Education category (Ref. category: No education)				
Basic education	-3.696*	1.029	0.467	0.343
	(2.207)	(20.942)	(0.774)	(0.953)
secondary education	-2.048	-1.854	-2.007***	-2.097
	(1.529)	(26.239)	(0.756)	(1.559)
Post-secondary education	-5.629***	-3.818	-4.906***	-4.842***
	(1.536)	(25.448)	(1.011)	(1.755)
Marital status (Ref. category: Single)				
Married	-3.094***	-4.384	0.18	0.76
	(0.656)	(10.009)	(0.657)	(0.892)
Widowed-divorced	-1.587	-3.375	0.477	3.334
	(0.987)	(14.559)	(1.889)	(3.498)
HH size	0.389***	-0.222	-0.004	0.023
	(0.148)	(3.662)	(0.138)	(0.120)
Public sector	-6.486***	-4.591	-6.638***	-3.076***
	(0.646)	(14.586)	(0.528)	(0.802)
Constant	55.809***	61.826	45.321***	39.188***
	(3.765)	(134.406)	(3.085)	(7.063)
N	2330	958	7088	6871

Notes: (i) The statistical significance is used as * p<0.10, ** p<0.05, *** p<0.01. (ii) First-stage estimations include the same control variables in addition to the number of accidents as the instrumental variable. (iii) Between parentheses are the bootstrapped standard errors, with 400 replications.

Table 17: The effect of commute time on earnings for full-time and part-time workers

Dependent variable: Log of Hourly wage

	Female		Male	
Estimation Method	**Full-time**	**Part-time**	**Full-time**	**Part-time**
Explanatory variable	(1)	(2)	(3)	(4)
Commute time	0.007	-0.011	-0.014***	0.007
	(0.005)	(0.021)	(0.005)	(0.295)
Age	0.037***	0.016	0.025***	0.017
	(0.011)	(0.042)	(0.010)	(0.212)
Age squared	0	0	0	0
	(0.000)	(0.000)	(0.000)	(0.003)
Education category (Ref. category: No education)				
Basic education	0.356***	0.627*	0.143***	0.213
	(0.102)	(0.341)	(0.031)	(0.883)
secondary education	0.523***	0.141	0.344***	0.261
	(0.071)	(0.300)	(0.047)	(0.437)
Post-secondary education	0.826***	0.614**	0.693***	0.481
	(0.073)	(0.291)	(0.062)	(1.337)
Marital status (Ref. category: Single)				
Married	0.236***	0.382**	0.181***	0.098
	(0.054)	(0.167)	(0.031)	(0.889)
Widowed-divorced	0.103	0.599**	0.094	0.617
	(0.070)	(0.265)	(0.118)	(4.549)
HH size	-0.043***	-0.03	-0.032***	-0.032
	(0.010)	(0.046)	(0.006)	(0.149)
Urban area	-0.01	0.163	-0.079**	0.047
	(0.035)	(0.113)	(0.039)	(0.470)
Public sector	0.153***	0.119	-0.129***	0.044
	(0.052)	(0.183)	(0.027)	(0.442)
Constant	-1.016***	0.063	0.782***	0.562
	(0.238)	(0.918)	(0.155)	(8.545)
N	2722	582	12506	1504

Notes: (i) The statistical significance is used as * p<0.10, ** p<0.05, *** p<0.01. (ii) First-stage estimations include the same control variables in addition to the number of accidents as the instrumental variable. (iii) Between parentheses are the bootstrapped standard errors, with 400 replications.

Table 18: The effect of commute time on daily working hours for full-time and part-time workers

Dependent variable: Number of working hours per day

	Female		Male	
Estimation Method	**Full-time**	**Part-time**	**Full-time**	**Part-time**
Explanatory variable	(1)	(2)	(3)	(4)
Commute time	0.033***	0.004	0.056***	0.071
	(0.011)	(0.045)	(0.009)	(0.585)
Age	-0.064***	0.035	-0.013	-0.134
	(0.022)	(0.127)	(0.020)	(0.485)
Age squared	0.001***	0	0	0.002
	(0.000)	(0.002)	(0.000)	(0.006)
Education category (Ref. category: No education)				
Basic education	-0.325	-0.923	0.057	0.226
	(0.213)	(1.185)	(0.091)	(1.243)
secondary education	-0.438***	-1.402**	-0.557***	-0.213
	(0.142)	(0.697)	(0.101)	(1.065)
Post-secondary education	-0.777***	-1.216*	-1.065***	-0.653
	(0.144)	(0.680)	(0.127)	(2.503)
Marital status (Ref. category: Single)				
Married	-0.265***	-0.175	0.052	-0.609
	(0.101)	(0.292)	(0.083)	(1.234)
Widowed-divorced	-0.03	-0.272	0.003	3.302
	(0.128)	(0.665)	(0.286)	(6.702)
HH size	0.027	-0.008	-0.013	-0.171
	(0.020)	(0.079)	(0.014)	(0.269)
Urban area	0.189**	-0.159	0.513***	-0.615
	(0.074)	(0.201)	(0.076)	(1.137)
Public sector	-0.735***	0.474	-0.953***	-0.567
	(0.105)	(0.316)	(0.066)	(1.808)
Constant	9.255***	5.534***	7.797***	8.899
	(0.455)	(1.904)	(0.406)	(21.733)
N	2705	583	12451	1508

Notes: (i) The statistical significance is used as * p<0.10, ** p<0.05, *** p<0.01. (ii) First-stage estimations include the same control variables in addition to the number of accidents as the instrumental variable. (iii) Between parentheses are the bootstrapped standard errors, with 400 replications.

Table 19: The effect of commute time on weekly working hours for full-time and part-time workers

Dependent variable: Number of working hours per week

	Female		Male	
Estimation Method	**Full-time**	**Part-time**	**Full-time**	**Part-time**
Explanatory variable	(1)	(2)	(3)	(4)
Commute time	0.127**	0.076	0.249***	0.425
	(0.063)	(0.191)	(0.049)	(5.515)
Age	-0.449***	0.306	-0.046	0.379
	(0.123)	(0.306)	(0.106)	(5.690)
Age squared	0.004***	-0.003	0	-0.007
	(0.002)	(0.004)	(0.001)	(0.060)
Education category (Ref. category: No education)				
Basic education	-1.663	-0.851	-0.203	-10.076
	(1.404)	(2.918)	(0.508)	(11.972)
secondary education	-3.658***	3.138	-2.821***	-2.515
	(0.903)	(2.676)	(0.565)	(5.789)
Post-secondary education	-6.459***	2.883	-5.888***	-3.328
	(0.906)	(2.377)	(0.709)	(18.923)
Marital status (Ref. category: Single)				
Married	-2.036***	-0.553	0.1	-8.777
	(0.546)	(1.271)	(0.462)	(13.992)
Widowed-divorced	-0.259	-2.282	0.219	16.937
	(0.780)	(1.829)	(1.467)	(87.643)
HH size	0.337***	-0.216	-0.004	-0.886
	(0.122)	(0.378)	(0.075)	(1.754)
Urban area	1.139***	-0.38	2.649***	-33.373**
	(0.440)	(0.755)	(0.409)	(14.697)
Public sector	-5.754***	3.394***	-6.629***	7.866
	(0.654)	(1.164)	(0.351)	(21.935)
Constant	59.201***	15.200***	48.386***	34.799
	(2.814)	(5.825)	(2.255)	(263.758)
N	2705	583	12451	1508

Notes: (i) The statistical significance is used as * p<0.10, ** p<0.05, *** p<0.01. (ii) First-stage estimations include the same control variables in addition to the number of accidents as the instrumental variable. (iii) Between parentheses are the bootstrapped standard errors, with 400 replications.