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CHRONIC ILLNESS AND LABOR MARKET PARTICIPATION IN ARAB COUNTRIES: EVIDENCE FROM EGYPT AND TUNISIA

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Abstract

This study examines the effect of chronic illness on labor force participation in Egypt and Tunisia, using Labor Market Panel Surveys for both Egypt (ELMPS 2012) and Tunisia (TLMPS 2014). The study also investigates the reverse effect of labor force participation on incidence of chronic diseases. The endogeneity of chronic disease in labor force participation equation is addressed by estimating both chronic and labor force participation equations simultaneously using two-step instrumental variable probit models. In addition, the sample selection bias in labor participation force equation is addressed using Heckman selection procedure, as a robustness check. Moreover, we examined whether non-workers over reports their chronic illness status by adopting the Kredier' procedure of measurement biasness. Expectedly, across all specifications, the results indicate that chronic illnesses have a negative and significant effect on labor force participation for both Egypt and Tunisia. However, for the feedback effect, the results reveal that labor force participation has no significant effect on chronic illness, rejecting the so-called justification hypothesis for both Egypt and Tunisia. Furthermore, the analysis of measurement biasness in chronic illness shows that non-workers over report their chronic illness status in the two countries. Finally, the paper ends with some recommendations that aim to reduce the effect of chronic illness on labor force participation in Arab countries.

Keywords: Chronic diseases, Labor force participation, Egypt, Tunisia
JEL Classifications: I12, I15, J2, J4

ملخص

تبحث هذه الدراسة في تأثير الإصابة بمرض مزمن على المشاركة في قوى العمل في كل من مصر وتونس ، وذلك باستخدام مسوح الفرق لسوق العمل التي جرت في من مصر لعام2012 و في تونس لعام 2014 . كما تبحث الدراسة أيضا الأثر العكسي لمشاركة القوى العاملة في حدوث الأمراض المزمنة. يتم التعامل مع تجانس المرض المزمن في معادلة مشاركة القوى العاملة عن طريق تقدير كل من معادلات المشاركة المزمنة والقوة العاملة في وقت واحد باستخدام نماذج الإحتمالية الوظيفية المتغيرة المكونة من خطوتين. بالإضافة إلى ذلك ، يتم تناول تحيز اختيار العينة في معادلة القوى المشاركة في العمل باستخدام إجراء اختيارهيكمان ، للتحقق من مدى قوته. وعلاوة على ذلك ، درسنا ما إذا كان غير العاملين يبالغون في تقاريرهم عن حالة مرضهم المزمن من خلال اتباع إجراء كريدير في تحيز القياس. ومن المتوقع ، أن تشير النتائج عبر جميع المواصفات ، إلى أن الأمراض المزمنة لها تأثير سلبي وهام على المشاركة في قوة العمل في كل من مصر وتونس. ولكن قياسا بالتغذية المرتجعة ،تكشف النتائج أن أثر مشاركة القوى العاملة على المرض المزمن ليس كبيرا ، رافضة بذلك ما يسمى فرضية التبرير لكل من مصر وتونس. علاوة على ذلك ، يظهر تحليل تحيز القياس في الأمراض المزمنة أن غير العاملين بالغوا فى حالة مرضهم المزمن في كلا البلدين. وأخيراً ، تخلص الورقة إلى بعض التوصيات التي تهدف إلى الحد من تأثير الأمراض المزمنة على المشاركة في القوى العاملة في البلدان العربية.

1. Introduction

In light of high prevalence of non-communicable illnesses in developing countries, the impact of chronic illness on labor force participation has been an interesting topic that gained a considerable attention from both policy makers and researchers. Workers with chronic illness generate lower income and lesser gains from being employed (Blackaby et al., 1999; Kidd et al., 2000 and Baanders et al., 2002). Moreover, chronic illness increases workers absenteeism, hence impedes to participate fully in workforce compared to those who are healthier (Musich et al. 2006, Popkin et al. 2006 and Bartel and Taubman, 1979). In addition, the presence of these diseases affects different sides of health equation including chronically ill persons, families and health care providers. On the top of that, due to absence of financial protection schemes, chronic illnesses remain a devastating enemy to productivity and economic prosperity in developing countries. Indeed, illness reduces productivity and increases demand for already ineffective healthcare system in these countries.

Like other developing regions in the world, Arab countries suffer from high prevalence of chronic illnesses among population. In fact, due to the wide spread of mal-nutrition, obesity, smoking, and lack of consciousness regarding the importance of physical exercises, a large segment of population in Arab world became suffers from chronic illnesses such as, diabetes, respiratory, hypertension and cardiovascular. The incidence of these diseases becomes representing one of the main causes of a high mortality and morbidity among population and be a significant challenge for improving healthiness in the region. For example, the report by World Health Organization (WHO, 2002) indicates that chronic diseases are responsible for approximately, 78% from total mortality in Egypt. The same report was also revealed that chronic illnesses account for about 80% of death causes in Tunisia (WHO, 2002).

Incidentally, in Arab countries (particularly in Egypt and Tunisia), a large portion of workers are employed in the informal sector. Those workers rely primarily on physical labor and perform their works in unfavorable conditions. They mostly lack health insurance coverage that able to protect them from illness, and its other negative consequences such as catastrophic health spending. That is to say, due to the absence of health insurance coverage, health spending can easily become catastrophic generating severe livelihood effects on this segment of workers. Thus, the inception of sickness is likely not only to reduce work productivity but also drive them out of labor market. Furthermore, the high incidence of chronic illnesses increases absenteeism rates and, consequently, leads to significant loses in workers' incomes. Thus, good health status represents a very important asset for workers, the loss of which has serious implications on their labor supply decisions, their income, their assets, as well as on their productivity. Therefore, the burdens of illness coupled with high rates of unemployment exert devastating impact on labor force participation in the Arab countries.

Based on the above backdrop, many questions can be raised: (1) what is the impact of chronic illness on labor force participation decision in Arab countries? (2) Is there any feedback effect from labor force participation to participants' chronic illness status? (3) Does the impact of chronic illness on labor force engagement differ among different age groups? (4) To what extent does the impact of chronic diseases vary among male and female workers in Arab countries?

The contribution and policy relevance of the intended analysis are many folds. First, this study contributes to existing literature and policy formulation in Arab region, as to the best of our knowledge there are few empirical studies on the effect of chronic illness on labor force participation in the region. That is, there are a number of empirical studies that have focused mainly on detecting the effect of empirically acknowledged factors on labor market participation including educational, socio-economic and institutional characteristics of workers (e.g. Al-Qudsi, 1998 and Spierings et al., 2010). However, a little empirical work has been conducted to investigate the impact of chronic illnesses on labor market participation, despite the significance role of health status on labor decisions. Second, understanding the impact of chronic illness on labor force participation may provide policymakers in Arab countries and key stakeholders (i.e. regional and international labor organizations) with the basis on which labor market policy measures can be undertaken. These measures may possibly raise the involvement of chronically ill workers in labor market. Third, this study is timely and relevant if taken in the context of Arab spring, as the two countries under study (i.e. Egypt and Tunisia) have experienced historical uprisings in 2010 and 2011. Undoubtedly, absent of social protection and high unemployment rates among economically disadvantaged groups; represents the causal roots of these social and political movements. Fourth, the gender-differentiated effect of chronic illness on labor participation cannot be ignored as Arab females are more likely to expose to illnesses and suffer a lot from prolonged inequality in labor market opportunities. Thus, the outcome of this study perhaps would help in designing appropriate policies aiming at improving gender equality in Arab region. Finally, the results of this study will guide appropriate measures to improve and reform existing healthcare systems in the region. Adopting such reform and strategies would maximize the role that could be played by human capital in realizing development in Arab countries.

The paper is structured into five sections. Section 1 is an introduction, while Section 2 outlines the theoretical and empirical literature on the effect of chronic illness on labor market participation. Specifically, in this section, the literature on the consequences of ill-health on labor supply will be reviewed and critically assessed. Section 3 discusses data and research methodology. Section 4 presents some descriptive statistics on labor force participation and incidence of chronic diseases in the two countries along with the empirical results and discussions. Section 5 ends with a conclusion and policy implications.

2. Literature Review

Due to negative consequences of chronic illness on labor market and economic prosperity, the impact of chronic illnesses on labor market participation has captured the attention of large number of researchers. This is so, because chronic illness, represents an economic shock for those workers who diagnosed as chronically ill. Specifically, chronic illness shrinks workers' productivity, deplete assets, reduces income and cut expenditures on basic needs. Despite the extensive literature on the probable effect of ill health on labor market, most empirical results on this issue are obtained from studies that have focused on industrialized countries. In this regard, developing countries in general and Arab world in particular have been neglected. Therefore, investigating the impact of chronic illnesses on labor market engagement is likely to take different course in Arab countries settings.

The theoretical link between health and labor supply dates back to 1960s with the emergence of influential works of Becker (1964), Becker (1965), and Lancaster (1966) who argued that healthiness can be considered as an important endowment for human capital to enhance household's production. Many scholars have claimed that healthy people are more likely to engage in work and earn more income (Grossman, 1972; McIntyre et al., 2006 and Kankeu et al., 2013). In contrast, illness pushes workers to give more value to leisure compared to work and as such may opt to be out of labor market or reduce the hours of work supplied. Thus, the reduction in the stock of health increases the amount of time lost from incomes' generating activities because the time needed to care for one's health rises (Cai and Kalb, 2006). Quite complying with this argument, some scholars of the view that poor health or illnesses conditions do not automatically eliminates workers from participating in labor market, advocating that chronically ill workers are possibly encounter complications in joining and sustaining jobs (Baanders et al., 2002 and Bradley et al., 2012).

On the empirical side, most of empirical researches on labor supply have focused on the effect of educational attainment and other household's socio-economic characteristics as most important factors affecting labor force participation. In the same way, the effect of health status on labor participation has also gained a considerable attention in recent decades. Most of the empirical studies found that the presence of good health promotes labor force participation (e.g. Bridges and Lawson, 2008; Laplagne et al., 2007; Cai and Kalb 2006; Mete and Schultz, 2002 and Stern, 1989; Schultz and Tansel 1997 and Pitt and Rosenweig, 1990 and Kidd et al., 2000). Cai and Kalb (2006), for example, examined the impact of health status on labor force participation using data obtained from the survey of Household, Income and Labor Dynamics in Australia (HILDA). To account for potential endogeneity of self-assessed health in labor force participation specification, the authors estimated health and labor force participation equations simultaneously. Their results revealed that being with better health increases the probability of labor force participation for all age groups under consideration. However, the effect is larger for elders groups and for women. For the reverse effect, the authors' results indicate that labor force participation has a significant positive impact on the health of older females, and a significant negative effect on the health of younger males'. In contrast, for younger females and older males, the impact of labor force participation on health is found to be insignificant. Moreover, the null-hypothesis of exogeneity of health status to labor force participation has been rejected for all age groups.

In the same vein, Cai (2010) inspected the relationship between health and labor force participation decision using the first four waves of the Household, Income and Labor Dynamics in Australia Survey (HILDA). He used a simultaneous equation model as well as two-stage and full-information maximum likelihood estimation methods to examine the effect of health on labor supply. His finding demonstrated that health has a positive and significant effect on labor force participation for both males and females. Interestingly, the reverse effect from labor force status to health status was found to be different between males and females household's members. More specifically, the paper found that labor force participation has a negative effect on male health but a positive effect on female health. Furthermore, the exogeneity hypothesis on health variable has been rejected for both samples.

Similarly, Zhang et al. (2009) examined the impact of several chronic diseases on the probability of labor force participation using data from the Australian National Health Surveys. The authors used an endogenous multivariate probit model to account for the probable endogeneity of the incidence of chronic conditions such as diabetes, cardiovascular diseases and mental illnesses. Their results rejected the exogeneity of chronic illnesses, suggesting a strong interaction among such episodes in deciding respondents' labor status. Additionally, the marginal effects of exogenous, socio-demographic and lifestyle variables are assessed through their direct effects on labor market participation and indirectly via the chronic diseases. The treatment effects of chronic illnesses on labor participation are estimated using conditional probabilities and five-dimensional normal distributions. The estimated effects are found to be varying according to gender and age groups.

Gannon (2005) studied the effect of disability on labor participation in Ireland, using the Irish component of the European Community Household Panel Survey 1995–2000. The author used both static and dynamic panel data models to allow for any unobserved influences or state dependence in labor force participation. The paper indicated that the base effect of disability is overestimated by rates ranging between 40–60% for men and by 5–10% for women. The result also revealed that disabled men with a current severe limitation are only 9 percentage points less likely to take part in labor force compared to able-bodied men. For women sample, the result indicated that those with a severely limiting disability have a lower probability of participation by 26% points, compared to women with no disability.

In the context of developing countries, Nwosu and Woolard (2015) investigated the impact of health status on labor force participation in South Africa, using the first and third waves of the National Income Dynamics. Endogenous treatment of self-assessed health in a contemporaneous setting indicated the existence of a positive and significant impact of health on labor force participation in South Africa. However, the results by authors failed to reject the hypothesis of exogeneity of self-assessed health condition in labor force equation confirming the endogeneity of health status. Interestingly, their results showed that there is a positive and significant association between health status and labor force participation, even after four years following health assessment.

Similarly, Bridges and Lawson (2008) examined the link between health status and labor market participation decision in Uganda using National Household Survey (UNHS) for the years 2002-2003. Applying instrumental variables model to account for endogeneity problem of self-reported health, the authors found that health variable is highly significant and has a strong linkage with labor participation. Furthermore, their results showed that conditional on participation, ill health lowers likelihood of being in the formal labor market and that the negative effect is stronger for women than for men.

Mete and Schultz (2002) examined the consequences of health status on labor force participation decision of elderly men and women in Taiwan during the period from 1989 to 1996. He used instrumental variables (IV) to account for endogenous effect of health by adopting three instruments: parent longevity, birthplace, and childhood conditions. The results showed that individual's health has a positive and significant impact on labor force membership. The authors also found that the hypothesis that health is exogenous and measured without error is rejected.

For the case of Arab countries, Rocco et al. (2011) assessed the impact of chronic diseases on labor market-related decisions in Egypt, focusing on three decisions namely, employment status, labor supply, and the impact on wage rates. They found that the probability of being employed is 25 percentage points lower among people reporting chronic disease conditions (the average probability is about 50 percent) and the amount of working time supplied is reduced by 22 hours per week (out of, approximately, 40 hours). Their results also showed that the effect of chronic diseases is larger among more elderly, less educated and workers engaged in the informal sector. Instead, among people with a university degree, the probability of being employed is reduced in case of chronic conditions only by 10 percent.

The above discussion has made clear that there is a quasi consensus among researchers on the fact that bad health in general and chronic illness in particular, exerts a negative and significant effect on labor supply. However, despite the huge body of literature on the relationship between health and labor force participation, most of previous studies have focused on industrial countries with negligible attention been paid to developing countries in general and Arab countries in particular. Moreover, the only existing study on Arab world (i.e. Rocco et al., 2011 for Egypt) used relatively old data belonging to Egypt Household Health Utilization and Expenditure Survey (EHHUES) 2002. It has mainly focused on health conditions, health care utilization and expenditure and did not consider labor market directly. Thus, employing new dataset on Egypt may reveal some insights regarding the behavior of labor market, particularly in the midst of Arab spring. Unlike the study of Rocco et al, the intended study examines the link between chronic illness and labor force involvement; hence identifies the possible reverse causality of labor market outcomes on health status in Egypt. It is worth mentioning that, work or long working hours may negatively affect individuals' health, or individuals may use health conditions to justify their labor force status, a 'justification hypothesis' as known in the literature (Cai, 2010). Furthermore, while most of the previous studies focused on one country, this study uses a dataset from two Arab countries (Egypt and Tunisia) for the purpose of comparison. Given the fact that Egypt is the most populated country in Arab region, its inclusion in the intended investigation is likely to raise the generalizability of the findings to whole Arab countries.

3. Conceptual Framework and Research Methodology

3.1 Conceptual Framework

The underlying theoretical model for the labor force participation to be adopted in this study follows the neoclassical theory of utility maximization. This model, which it based on the seminal work of Becker (1964) & (1965), has been widely used in the existing literature (e.g. Mete and Schultz, 2002 and Rosenzweig and Schultz, 1982) Based on neoclassical theory, the model assumes that households seek to maximize their utility function defined over consumption commodities. Thus, the utility function (U) is assumed to be a function of consumption (C), leisure time (h) and other exogenous factors (Z) as expressed in the following equation:

$$U_i = U_i(C, h, Z) \ldots \ldots \ldots \ldots \ldots \ldots (1)$$

To maximize the above utility, an individual faces three constraints: time, budget and production constraints. First, the time constraint is as follows:

$$T = l + h \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

or

$$h = T - l \ldots \ldots \ldots \ldots \ldots \ldots (3)$$

T represents the individual's total time endowments, which must be allocated between work and leisure (non-work), working hours (l) and h is leisure.

Second, the budget constraint on individual cash income records the fact that an individual can purchase consumption items by working (income) and non-labor income (n). Assume that the real hourly market wage rate the individual can earn is given by w, and then the income constraint can be written as:

$$c = wl + n \ldots \ldots \ldots \ldots \ldots \ldots (4)$$

Third, to elaborate production constraint, suppose that input and output markets exits and competitive, meaning that production and consumption decisions are separable. Let the production function be:

$$Y = Y(L, H, Z) \ldots \ldots \ldots \ldots \ldots \ldots (5)$$

Where Y is output, L is as defined earlier, H is the individual's health status and Z is exogenous factors that influence production. Furthermore, let the competitive price of output be P, and corresponding linear production cost function be $C = wL$, where w is the opportunity cost of labor. The profit maximization labor usage is:

$$L^* = L(w, P; H, Z) \ldots \ldots \ldots \ldots \ldots \ldots (6)$$

Equation (6) implies that the optimum quantity of labor is a function of return to labor (w), market prices (P), individual's health status (H) and exogenous variables (Z) such as, individual and household characteristics.

Substituting equation (3) in (1) and (6), the utility maximization problem can be specified in the following lagrangian function:

$$l = U(c, T - (L(w, P; H, Z), Z) + \lambda[c - wL(L(w, P; H, Z) - n] \ldots \ldots \ldots (7)$$

Taking the first order conditions:

$$\frac{\partial l}{\partial c} = U_c - \lambda = 0 \ldots \ldots \ldots \ldots \ldots \ldots (8)$$

$$\frac{\partial l}{\partial l} = U_l - \lambda w = 0 \ldots \ldots \ldots \ldots \ldots \ldots (9)$$

By solving the first order conditions simultaneously, the labor supply function can be derived as follows:

$$L = L(w, p, H, Z, n) \ldots \ldots \ldots \ldots \ldots \ldots (10)$$

Based on the assumption of the competitive market, the market price and wages are given and constant. Therefore, the decision embarked by individual to engage in labor market is determined by exogenous factors (Z), health status (H), and non-labor income (n). This relation can be expressed by the following function:

$$L = L(H, Z, n) \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots .. \dots .. \dots \dots . (11)$$

Based on the above discussion, the factors that used in empirical analysis to explain the individuals' participation in labor market can be grouped into a set of explanatory variables, which may include: exogenous variables, individual's health status, and non-labor income as defined in previously.

In this study, our emphasis is directed to the role of chronic illness in shaping labor force participation decisions. As stated in the above reviewed literature, poor health exerts a negative impact on individual's decision to participate in labor market due to many reasons. First, ill health may reduce earning capacity and hours worked (Bartel and Taubman, 1979). Second, ill health reduces productivity, and through demand, the returns from work and, consequently, wages. Third, ill health may entitle the individual to have non-wage income such as disability benefits. Finally, poor health may also lower life expectancy, raising the present value of current wealth and induce earlier retirement (Disney et al., 2006).

Moreover, to understand the feedback effect of labor participation on chronic illness we adopt the following equation based on the above setting:

$$\mathrm{Ch} = \mathrm{L}(\mathrm{H}, \mathrm{Z}, \mathrm{n}) \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots .. \dots \dots \dots \dots . (12)$$

The dependent variable (Ch) is related to the same explanatory variables as indicated in equation (11), which are individuals characteristics, individual' health status, and households' characteristics.

3.2 Research Methodology and Data

3.2.1 Data

The data used in this study is sourced from the Open Access Micro Data Initiative (OAMDI) of Economic Research Forum (ERF) which focuses on the Labor Market Panel Surveys (LMPS) dataset. We use the 2012 round of the Egypt Labor Market Panel Survey (ELMPS 2012) and 2014 Tunisian Labor Market Panel Survey (TLMPS 2014). The ELMPS 2012 was conducted by the ERF in cooperation with Egypt's Central Agency for Public Mobilization and Statistics (CAPMAS). ELMPS 2012 is the third round of the longitudinal survey for labor market in Egypt, of which the first and second rounds were carried out in 1998 and 2006, respectively. The ELMPS 2012 survey comprises a sample of 12,060 households and 49,186 individuals. The survey contains information on labor market and demographic characteristics of households and individuals such as, parental background, education, housing, access to services, residential mobility, migration and remittances, time use, marriage patterns and costs, fertility, women's decision making and empowerment, job dynamics, employment, unemployment and earnings, as well as self-reported chronic disease incidence (Assaad and Kraft, 2013).

On the other hand, the TLMPS 2014 is the first round of a nationally representative longitudinal household survey that carried out by the ERF in partnership with the

Tunisian National Institute of Statistics (Assaad et al., 2016). The final samples of respondents who answered the questionnaires were 4,528 and 16,430 households and individuals, respectively. Similar to ELMPS, the TLMPS 2014 includes detailed information on socio-economic and labor market characteristics of households and individuals (aged 15-64). Specifically, the survey covers a wide-ranging labor market information including parental background, education and employment as well as information on the household's assets and resources. Also, TEMPS 2014 contains information on individual self-reported chronic disease incidence along with the major types of chronic diseases, such as, diabetes and blood pressure.

3.2.2 Measurement of Chronic Illness, Endogeneity and Sample Selection Bias

One of the problematic issues that faces the present analysis is that chronic illness are identified based on self-assessment instead of the objective measures. This evidently increases the likelihood for experiencing endogeneity in the intended analysis (Baker et al., 2004; Anderson and Burkhauser 1985; Stern 1989; Bound 1991; Bound and et al. 1999; Dwyer and Mitchell 1999; Campolieti 2002; Au et al., 2004 and Benitez-Silva et al., 2004). Thus, for many reasons, a huge attention has been paid to the measurement error and endogeneity problem that may arise from measuring self-reported health. First, individuals may have economic or psychological reasons to alter self-reported health to rationalize their labor market decisions. Second, participation may result in sickness for the employed people due to the stress and poor working conditions in which they perform work (Cai and Kalb, 2006). Third, given that health status is self-reported it is likely to be affected by measurement error (Bound, 1991). Finally, ill health may be associated with unobserved individual characteristics such as time, socio-demographic background and risk preference that affect labor market decisions. In this regard, evidence brought by Kreider (1999), showed that non-working women, high school drop-outs, non-whites and former blue-collar workers in the USA have a tendency to over report sicknesses which enact significant effects on their labor force status. On the whole, these relationships would possibly lead to endogeneity problem and measurement error. In the end, the emergence of these two problems might significantly hinder the analysis of the impact a chronic disease could have on labor force participation.

To account for the probable endogeneity that may associate with self-reported chronic health conditions, some empirical studies used objective measures either from generic health status measures or clinical measures (Au et al., 2004 and Zhang et al. 2009). Compared to participants, non-labor force participants are more likely to cite illness as the reason for not participating given the social stigma associated with non-participation and the fact that the receipt of certain public transfers depends on health status (Anderson and Burkhauser, 1984, 1985, Boskin, 1977; Currie and Madrian, 1999; Parsons, 1980). This potentially leads to a bias referred to as rationalization endogeneity. Such a bias may over-estimates the impact of health and underestimates the effect of financial variables on labor supply (Bound, 1991; Bound et al., 1995; Cai, 2010; Cai and Kalb, 2006). However, the objective measures of chronic disease are not without problems and they are likely to under-estimate the impact of health on labor supply (Cai and Calb, 2006). Nevertheless, some empirical studies such as, Bound (1991) and Cai and Calb (2006) suggest that the subjective health measures are more likely to associate with less bias compared to objective ones. This is so because these subjective measures are likely to be affected by two opposite sources of bias namely, rationalization endogeneity and error-in-variables which might cancel out. On the other hand, the objective health measures are likely to be biased downwards due to errors-in-variables bias (Bound, 1991).

Moreover, modeling the effect of chronic disease on labor force participation may raise the problem of selectivity bias. This is because, chronic illness cannot be observed among non-chronic agents, had they chosen to report the case. Similarly, labor participation cannot be observed among non-participants, had they chosen to participate.

3.2.3 The Empirical Models and Estimation Strategy

As indicated in previous discussion, modeling the effect of chronic illness on labor force participation confronts three econometrics problems namely, endogeneity, selection bias and measurement errors. First, to overcome the probable endogeneity between chronic illnesses and labor force participation, we follow Cai (2010), Cai and Clab (2006) and Stern (1989) by estimating two equations simultaneously. The first equation concerns with incidence of chronic disease and the second is for labor force participation. The estimation strategy is that in the first stage equation, we use a variable that represents chronic illness incidence (i.e., a binary variable) as a linear function of a vector of exogenous variables (e.g. the conventional individuals socio-economic characteristics and instrumental variables) and then use it as a proxy for chronic illness in the second equation of labor participation decision. According to previous literature (e.g. Cai, 2010, Cai and Kalb, 2006 and Stern, 1989) a simultaneous equation modeling approach with two correlated equations has been regarded as appropriate method for estimating the impact of health on labor force participation than a single equation with health status as an exogenous explanatory variables. Thus, the first equation in the form of bivariate probit model can be set up as follows:

$$Ch_i^* = Z_1'\beta^* + Z_2'\gamma^* + \varepsilon_{i,Ch} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

Ch represents the incidence of chronic illness, which is a function of a vector of exogenous variables (Z_1); instrumental variable (Z_2); and $\varepsilon_{i,Ch}$ is the disturbance term. Z_1 denotes the household and individual specific characteristic, while Z_2 contains the instrumental variables proxying the effects of chronic illness.

Second, the labor force participation equation is specified as follows:

$$L^* = Z_1'\alpha^* + Ch_i^*\delta^* + \mu_{i,L} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Hence, the latent value of being in the labor force relative to being out of the labor force is a function of latent chronic illness Ch* and a set of exogenous variables Z_1'. The disturbance terms $\varepsilon_{i,Ch}$ and $\mu_{i,L}$ are bivariate normally distributed with the following assumptions: $E(\mu_{i,L}) = E(\varepsilon_{i,Ch}) = 0, var(\mu_{i,L}) = var(\varepsilon_{i,Ch}) = 1; corr(\mu_{i,L}, \varepsilon_{i,Ch}) = \rho;$ if $\rho = 0$, it suggests that chronic diseases is exogenous.

Since there are only discrete measures of both labor force participation and chronic illness, the above models will be implemented via a non-linear transformation of the linear index model in equations (15) and (16) as follows:

$$Ch_i = 1\left[X'\square^* + \gamma^* Z_i + \varepsilon_{i,Ch} > 0\right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (15)$$

$$L_i = 1\left[X'\alpha^* + \delta^* Ch_i^* + \varepsilon_{i,L} > 0\right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (16)$$

From equation [16], an individual considers to participate in labor market if his underlying latent L index exceeds zero. An analogous explanation holds for chronic illness as shown in equation [15].

Equations (13)-(14) will be estimated as follows:

$$\Pr(ch = 1|X, Z) = \omega\left(X'\beta + \gamma Z_i + \varepsilon_{i,Ch}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (17)$$

$$\Pr(L = 1|X) = \omega\left(X'\alpha + \delta Ch_i + \varepsilon_{i,L}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (18)$$

For instance, the joint probability of a respondent being in Ch=1 and L=1 (using the above specifications) is:

$$\Pr(ch = 1, L = 1) = \omega_b(X'\beta + \gamma Z_i, X'\alpha + \delta Ch_i, \rho) \ldots\ldots\ldots\ldots\ldots. (19)$$

Where ω_b represents the bivariate normal cumulative distribution function. To ensure the exogeneity of chronic illness, we test whether the correlation coefficient, □ is statistically different from zero. If □ is statistically significant, it indicates the endogeneity of chronic illness. In contrast, the statistical insignificance of □ would suggest that estimating separate labor force and chronic illness equations may not yield inconsistent estimates.

To run the above estimation, the study uses three instrumental variable econometric techniques, namely: Bivariate probit, IV-probit; and a two-stage least square model (2SLS) model. These methods will be used for the purpose of comparison and robustness checks. In the first stage we regress chronic illness on a set of exogenous and instrumental variables, and in the second stage we replace chronic illness with its predicted value from the first stage. The outcome of interest is (L), a dummy variable which equals one if the respondent is a labor force participant and zero otherwise. Equally, in the chronic illness equation, the same procedure will be implemented to account for the endogeneity of labor force. However in the literature there is a claim that using IV-probit and 2SLS in a context of a binary dependent variable and a binary endogenous variable can result in inconsistent estimates (Newey, 1987). That is, IV-probit method assumes continuous endogenous repressors, and the 2SLS assumes continuous dependent variables, but our dependent variables (i.e. chronic-illness and labor force participation) are binary. Nevertheless, a considerable portion of the econometrics literature proved that IV-probit and the 2SLS estimation could yield reasonable results (e.g. Newey, 1987, Angrist, 1991, Acosta, 2006, Angrist and Evans, 1998). Moreover, the 2SLS estimation procedures will allow us to test for over-identification of the instruments and whether the instruments are weak.

Moreover, to achieve the objective of detecting the reverse effect of labor force participation on workers' health status, the above estimation procedures will be also executed for the chronic illness equation. Following this procedure, labor force participation will be treated as endogenous determinants for chronic illness.

Second, regarding the problem of selectivity bias, the study adopts Heckman (1979)' two-step selection procedure. In the first step, we estimate the probit model (i.e. hecprobit) of binary choice equation for people participating in labour force, and calculate Mill's ration $\hat{\lambda}$ for the whole sample. This step will be estimated using the following probit equation:

$$L_i = \Pi_i'\theta^* + a_i L_i \dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (19)$$

Where Π_{i1}' is a vector of explanatory variables including Z_1' and Z_2' as specified previously, and also contain L^* needed to achieve identification. It should be noted that, direct estimate of health equation is difficult because many relevant health inputs are unavailable from typical household labour surveys, (Schultz and Tansel, 1997). Rather, a reduced form of health equations can be estimated assuming that the latent outcome, L_i, is not observed but we know an indicator of the category in which this latent variable falls, thus; the marginal probability of a positive response with covariate vector Π_{i1}' can be represented as;

$$p(\Pi_i') = \Pr(Y = 1; \Pi_i') = \Pr(\Pi_i'\theta + \varepsilon > 0) = 1 - \Phi(-\Pi_i'\theta) \dots\dots\dots\dots \quad (20)$$

Where $\Phi(\Pi)$ is the standard normal cumulative distribution. Based on the estimation results of the Probit model, we can obtain the inverse Mill's ratio $\hat{\lambda}$ for the whole sample as:

$\lambda_i \approx \dfrac{\phi(\Pi_i'\theta / \sigma)}{\Phi(\Pi_i'\theta / \sigma)}$, where ϕ and Φ are respectively, the probability density functions of standard normal distribution and cumulative distribution. The coefficient on the inverse Mill's ratio term (lambda) is used to test the null that there is no selection bias, conditional on the assumptions of the model. Accordingly, $\hat{\lambda}$ will be introduced in the equation of labor force participation L_i^* as follows:

$$L_i^* = Z_1'\alpha^* + Ch_i^*\gamma^* + \sigma\hat{\lambda} + \mu_{i,L} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (21)$$

Finally, to account for the possibility that people outside of the labor force participation may misreport their health status we follow Kreider' (1999) procedure based on estimation of two-stage instrumental variables probit model. In this framework, first we estimate the labor equation assuming that "true" chronic status is observed only when an individual is in the labor force. Second, we estimate the "biased" model, which assumes that everyone in our sample is accurately reporting their chronic illness status. Therefore, the model of labour participation (i.e, true) will be fitted for workers only and then compared with biased model of both workers and non-workers. Thereafter, we compare between the chronic impact of 'true' and 'biased' models.

Based on the conceptual framework developed in the previous section in addition to the existing literature (e.g. Cai, 2010 and Cai and Kalb, 2006), the explanatory variables include a vector of individual characteristics, individual's socio-economic characteristics, individual's health status. Specifically, individual's characteristics include, education, gender, age, level of urbanization, region and employment status. The household's characteristics include factors such as, the size of the household, number of children in the household. Finally, health status is measured by the incidence of chronic illness, which is binary variable (i.e. take value of one if the worker chronically ill and zero otherwise).

However, it should be noted that one of the serious challenges that confronts the application of two-stage instrumental variables (IV) method is the selection of appropriate instruments. This has been the case because there is a great controversy in the existing literature regarding instrumentation of self-reported health status. Some studies have used health conditions and/or some measures of physical functioning as instruments (e.g. Dwyer and Mitchell, 1999 and Campolieti, 2002). They view that health conditions or limitations in physical functioning affect the participation in labor market only through their effects on underlying health capital. On the other hand, some researchers adopt objective health measures such as, life expectancy and presence of young children (e.g. Parsons, 1982; Sterns, 1989 and Cai, 2010). Unfortunately, such objective measures are not available in LMPS dataset. Therefore, to mitigate the problem of IV identification, we follow the existing literature (e.g. Cai and Calb, 2006; Cai, 2010), employing different instrumental variables for each equation. Labor force participation is instrumented by demographic characteristics such as, dependency ratio, household size and wage-employment. On the other hand, the self-assessed chronic illness is instrumented by some variables that assumed to affect health such as, health conditions and water quality. Since using probit models (i.e. bivariate and IV-probit) do not entails testing the validity of instruments, we adopt a 2SLS estimation procedure as a roubastness check and because it allow us to test validity of the instruments. Moreover, the over-identification restrictions are tested using Sargan and Basmann tests.

Furthermore, the above estimation procedures will be implemented using different specifications. This step will be carried out in order to check for the robustness of the results and to see the extent to which these results match the research objectives. First, the full samples models (i.e. male and female) are estimated for the two countries using IV-probit, biprobit and 2SLS estimation procedures. Second, to investigate gender effect of chronic disease, we estimate separate regressions for male and female samples in the two countries. Finally, the estimation will be run for (15-39) and (40-64) years age, to determine whether the effect of chronic disease incidence varies among different age groups.

4. Empirical Results and Discussion

This section presents the empirical results and discussion. The section is divided into two sub sections. Sub-section 4.1 reports some descriptive statistics on labor participation and chronic illness in both Egypt and Tunisia along with the variables used in the empirical analysis. Sub-section 4.2 presents the econometric results pertaining to the impact of chronic diseases on labor force participation as well as the feedback of labor participation on chronic illness.

4.1 Descriptive Statistics

First, Table 1 below documents the respondents' labor force status against self-reported health situation among male and female in both Egypt and Tunisia. The table reveals that for the male respondents, there is a positive relationship between labor force participation and health status in both countries. This implies that the improvement in the health of males increases their participation in labor force. For the female respondents, the table also indicates a positive association between health situation of females and their existence in labor force, even their majority are out of labor force.

In the same way, Table 2 tabulates the employment situation against self-reported health by age groups and gender for Egypt and Tunisia. The reported statistics show that there is a positive association between employment and health status. However, the statistics also exhibits some contradicting facts on labor engagement and health status. That is, in both countries, most of respondents with very good and good health status are engage in jobs. The table also reveals that in the two countries the young people who enjoy very good health have less opportunity to engage in labor market compared to elders, suggesting that unemployment is very high among young age cohort, even for those with good health. These contradicting results indicate that health situation is not the most important factor affecting employment in Arab countries. These facts that a large portion of old respondents with bad health are more employable compared to those with good health.

In the same manner, Table 3 below indicates the incidence of chronic disease by age group and gender in Egypt and Tunisia. The Table reveals that there is higher spread of chronic disease in these countries, as about 19.4% and 18.6% of population suffer from chronic disease in Egypt and Tunisia, respectively. Expectedly, the table indicates that the old population is more likely to suffer more from chronic disease compared to their young counterparts. Interestingly, the incidence of chronic illness is higher among female than male respondents in the two countries.

Table 4 below provides the definition of the variables employed in the empirical analysis together with their means and standards deviation for both Egypt and Tunisia samples. As can be read from the table, the reported statistics indicate that the mean of chronic illness is relatively high in the two countries. At outset, the table reveals that the average of participation in labor force is higher in Egypt compared to Tunisia. As mentioned earlier, the table shows that the percentages of population who suffer from chronic diseases are 19.4% and 18.6% in Egypt and Tunisia, respectively. However, the standard deviation of chronic illness in Egypt is close to that of Tunisia, indicating a similar prevalence of chronic diseases. The mean of age is about 24 and 34 years for Egypt and Tunisia, respectively. This implies that Egypt hosts a relatively big number of youth compared to Tunisia. The table also indicates that the mean and standard deviation of male, head and married respondents in Egypt is close to those of Tunisia; suggesting a relative similarities in demographic characteristics in the two countries. However, the average of male is close to 50% in both countries, indicating relative gender balance in sample representation.

In addition, the average years of schooling in Egypt are relatively higher than in Tunisia. The mean of household size in Egypt is also higher than in Tunisia with high standard deviation as well. Moreover, the number of children in Egyptian households is greater than those in Tunisia, confirming the large household size in Egypt. The average of owning house in Egypt is close to that of Tunisia, supporting the similarities in socio-economic characteristics in the two countries. Finally, the mean and standard deviation of urban dummy variable is relatively similar in both Egypt and Tunisia. On the whole, these descriptive statistics represent a solid ground for comparison between the two countries regarding the impact of chronic diseases on labor force participation.

4.2 Econometric Analysis

In this sub-section we report the estimation results of the models adopted to investigate the effect of chronic illness on labor force participation and the reverse effect of labor participation on chronic disease. As stated in methodology section, this study attempts to address three methodological problems, namely: endogeneity, sample selection bias and measurement bias. Accordingly, the analysis in this sub-section consists of three parts as follows. Sub-section 4.2.1 presents the estimation results of two-stage instrumental variable procedures for both Egypt and Tunisia, while sub-section 4.2.2 reports the estimation results of Heckman selection bias. Finally, sub-section 4.2.3 examines whether non-workers misreport chronic illness status adopting Kreider (1999)' procedure.

4.2.1 Estimation Results of Labor force participation and Chronic Illness Models

To account for the potential endogeneity of chronic illness and labor force participation, we estimate the underlying equations simultaneously using the two-stage instrumental variable approach based on probit and 2SLS estimation procedure[2]. As stated in methodological procedures, we instrumented the participation by three variables: household size, dependency ratio and wage-employment. On the other hand, the chronic illness is instrumented by water quality and health situation[3]. These instruments are chosen based on first-stage F statistics as well as the over-identifying tests (see Appendix). The results of F-statistics of first-stage for all estimated models suggest that our instruments are good predictors of the endogenous variables. Moreover, Sargan and Bosmann tests of over-identification indicate that our instruments are not correlated with the error of the main regression and, therefore, they are valid. Moreover, the coefficients of rho (□) in labor participation equations based on biprobit estimation are statistically different from zero for both Egypt and Tunisia, indicating that chronic illness is endogenous to labor participation. This result also supports the rejection of the hypothesis that chronic illness is exogenous to labor force participation. Thus, we conclude that chronic variable is endogenous to labor force participation, which justifies the adoption of two-stage estimation methods. On the other hand, the coefficients of rho in chronic disease equations are found to be insignificant, suggesting that labor force participation is exogenous to chronic illness. The estimation results of labor force participation and chronic equation for full sample of both Egypt and Tunisia are presented in table 5 and 6, respectively.

As can be read from Table 5, the results of all three models indicate that respondents' labor force status is significantly predicted by the presence of chronic illnesses, age, being a household head, gender, marital status, years of schooling, wealth, owning own

[2] The estimation is run using STATA 14. The commands used are ivprobit, ivregress 2sls and biprobit for IV-probit, 2SLS and bivaraite probit, respectively.

[3] Health situation is measured by self-assessment health (takes value of one for bad health and zero otherwise)

house as well as regional locations. Specifically, the results show that the coefficient associated with chronic disease variable is negative and highly significant indicating that living with chronic conditions (i.e. Asthma, Arthritis, Back problems, High blood pressure, Migraine headaches, Diabetes, Heart disease, Cancer) decreases respondent's engagement in labor force in both Egypt and Tunisia. These results confirm the results of previous empirical studies on the impact of health on labor force participation (e.g. Cai, 2010, Cai and Clab, 2006 and Rocco et al., 2011, Stern, 1989 and Bond, 1991).

The results also indicate a significant influential impact of demographic characteristics on respondents' labor participation since the relevant variables are mostly significant and carry anticipated signs. For instance, the coefficient in front of household head variable is positive and statistically significant implying that being a household head increases respondent's likelihood to join labor force compared to those who don't. Similarly, compared to single and female respondents, married and males respondents are more likely to engage in labor force. As expected, respondents having more years of schooling are significantly more likely to enter labor force compared to those with less education. Increases in years of schooling are likely to raise the probability of engaging in labor via several channels. For instance, educated people are expected to be well equipped with skills and knowledge that help in undertaking the missions assigned to them when taking jobs, thus, increases respondents' labor force participation. Education can also influence the probability of joining labor force indirectly by helping people build wide and strong networks that could possibly trigger work's involvements. Moreover, educated people are expected to be more healthier compared to unschooled ones, thus, have more probabilities to join labor force participation.

Agreeing with prior expectations, the coefficient of wealth is found to be negative and statistically significant in Egyptian sample, demonstrating that less likelihood to take part in labor force for wealthy respondents compared to those with lesser wealth. Nevertheless, the coefficient of wealth in Tunisian sample is found to be positive but it is not significant in all models.

The reported results also show that at the country's level, urbanization contributes insignificantly in raising the probabilities of enrolling in labor force among respondents. Yet, this contribution turns out to be mattered for some regions. For instance, compared to the country's biggest urban center (i.e. greater Cairo region), being living in lower and upper urban Egypt is significantly responsible for increasing probabilities of entering labor market. With only two exceptions, respondents' regional locations seem to be having no effect on respondents' labor market decisions in Egypt. This argument can be advocated by the fact that only in urban upper and urban Lower Egypt regions a positive correlation between the likelihood of taking part in labor market and respondents' regional characteristics can be detected.

Concerning the Tunisian sample, the table shows that only south west and central west variables are negative and statistically significant indicating that the probabilities of being out or in labor force are highly affected by respondent who residing in south west or central west region compared to respondents living in greater Tunisia. However, respondents residing in remaining regions are found to be less likely to join labor force compared to respondents living in greater Tunisia.

Regarding the results concerned with reverse impact of labor force participation on chronic disease, Table 6 below, reports the estimation results of IV-probit, 2SLS and bivariate probit for chronic equation for both Egypt and Tunisia. The F statistics of first stage based on 2SLS as well as Sargan and Bosmann tests indicate that there is no problem with identification restrictions.

These results reveal some variations regarding the effect of independent variables on chronic disease in these two countries. For example, for the Egyptian respondents, the results indicate that age, being male, being head of household, years of schooling, residing in Alexandria and urban upper Egypt are significantly associated with less likelihood to be having chronic disease(s). Moreover, and as expected, the chronic disease-status is more likely to be affected by educational attainment. The negative and significant coefficient associated with the years of schooling variable confirms that an increase in respondents' education decreases the likelihood of hosting chronic illnesses compared to those with less schooling. However, most of the explanatory variables in Tunisian sample are not significant, except age and owning house. Interestingly, the coefficients of labor force participation variable in both Egyptian and Tunisian models are found to be insignificant in all specifications even at conventional levels indicating that labor involvement doesn't worsen respondents' chronic-disease status. Overall, the identical results obtained from the three estimation procedures (i.e. IV-probit, 2SLS and pibotbit) for both Egypt and Tunisia as well as for the two equations understudy, confirm the robustness of our analysis.

Secondly, to obtain more insight with respect to the influence of chronic illness on labor force participation in Egypt and Tunisia, the pooled sample has been divided into two subsamples according to gender. We use the same instruments as in the full sample specification. The estimation results of IV-probit model for labor force participation equation pertaining to these subsamples are presented in Table 7.

For the Egyptian sample, the table shows that the coefficient of chronic disease is negative and significant in both males and female samples as expected. This means that irrespective of gender, respondents who suffered from chronic conditions are more likely to give up labor force participation. Likewise, for Tunisian sample, the results indicate that the chronic disease is negative and statistically significant in both specifications. This result confirm the results of full samples in both Egypt and Tunisia, brings evidence that being troubled with chronic diseases decreases the probabilities to participate in labor force among respondents from both sexes.

Surprisingly, the table points out that for Egyptian respondents the coefficients of years of schooling are found to be negative and positive for male and female samples, respectively. This result implies that an increase in years of schooling raises the probability of females to demand work while reduce it for males. However, in Tunisian sample, the effect of education attainment is found to be insignificant for both males' respondents.

Wealth turns out to be having different effects on respondents' labor force status when splitting pooled sample according to gender. Specifically, the significant and positive and negative coefficients of wealth variable in both males and females specifications, respectively, suggest that wealthy males tend to experience greater reductions in labor market’s participation than females counterparts. This finding may has several explanations. First, due to their exposure to prolonged economic and social discrimination, the magnitudes of females’ wealth are expected to be less than that of male respondents. Second, wealthy females are more likely to inherit wealth from clans in the forms of properties and thus they don’t need to leave jobs to manage it. Third, wealthy females are expected to be more educated, having more commands on the assets they own and incomes they earn and free from the dominance of males mainly husbands who are mostly prohibit wives’ work. Possessing such advantages would perhaps increase females’ command on life’s aspects such as marriage, pregnancy as well as labor. Accordingly, compared to poor females, whose labor is mostly unpaid and socially unrecognized, wealthy females respondents are more likely to seek employment.

It is worth noting that, the coefficient of urban variable is insignificant vindicating that the degree of urbanization appears to have no say in determining both female and male respondents’ labor force status. As the results in the table indicate, in males’ specification, owning a house variable carries insignificant coefficient indicating that house ownership have no effect on males’ likelihood to participate in labor force. However, this finding is reversed for the case of females. In females’ regression, the coefficient of house ownership variable is negative and statistically significant, demonstrating that being owner of a house decreases the probability of seeking work among female respondents.

Third, in accordance with the reverse effect of labor participation on chronic illness by gender, Table 8 reports the estimation results of IV- probit of chronic equation for males and females in both Egypt and Tunisia. For Egypt and Tunisia, in both specifications, the coefficients of labor participation variable are not significant suggesting that being participating in labor have no statistically significant inverse impact on respondents’ chronic-illness status. The results also show the impact of age on the respondents’ chronic illness status is insignificant across both sexes in Tunisia. The insignificant coefficients of age squared variable in both specifications indicate that the progress in age plays no role in altering the probabilities of hosting chronic diseases by respondents form both sexes.

A agreeing with pooled sample outcome, being having one or two children appear to have no impact on the probability of hosting a chronic case for both females and males specifications. However, this result is not in line with results on Egypt in which having such number of children increases the probabilities of chronic diseases among female respondents. Different from Egypt but consistent with pooled sample outcomes, the coefficients of years of schooling variable in Tunisian sample carries insignificant sign in both gender specifications, telling that educational attainment doesn’t exercise a powerful effect on respondents chronicity status.

Fourth, to understand whether the effect of chronic disease on labor force participation varies according to age group, Table 9 reports the estimated coefficients of IV-probit regressions applied for the samples of respondents with ages between 15 and 39 as well as the respondents with ages greater than 39 and less than 65.

It is interesting to note that the coefficients of chronic disease variable in the regressions of both age categories is negative and statistically significant suggesting that living with a chronic disease(s) directly lowers the probabilities of searching or taking up a job among all age groups in both countries. This result lends a great support to the similar conclusion obtained for the pooled and gendered samples.

Regarding the impact of demographic and regional variables, the table indicates that most of the estimated variables are consistent with previous results of pooled samples for both Egypt and Tunisia. For instance, the likelihood for registering in labor market increases with the rise respondents' squared age. In addition, being a household head and being male increases the chance for joining labor force among respondents who their ages in the range of these two categories. However, the magnitude of the coefficients come with these variables in the two specifications indicate that being a household head and male increase the likelihood of joining labor market among younger respondents more than it does for elders. Moreover, the coefficient of years of schooling is found to be positive and statistically significant in both young and elder specifications of the two countries, supporting the results of pooled samples.

Finally, Table 10 provides the results on the reverse impact of labor force involvement on chronic disease status of respondents between 15 and 39 years of age along with respondents between 40 and 64 years of age. This finding is in line with the analysis of pooled, males and females samples models in the two countries. Just as with the previous results obtained on Egyptian and Tunisian pooled samples, the coefficient associated with labor force participation variable indicates that seeking employment has no feedback effects on the probabilities of accommodating chronic disease by respondents in both specifications.

Regarding the impact of demographic and regional variable, the results of Egyptian models indicate that age, squared age, years of schooling and head of household are all statistically significant and carry the expected signs. Compared to elders, young respondents' chronic disease status is more likely to be affected by the number of children. That is, the probability of incurring chronic diseases is higher for those having children relative to those who live without children in each of these age groups regressions, with a level of significance generally increasing as the respondent become having more children. The estimated coefficient of years of schooling variable is found to be negative for the young age specification in both Egyptian and Tunisian case. Such results suggest that education, via helping respondents to adopt healthy lifestyles and behave healthily on life's matters, make respondents less likely to be conquered by chronic disease(s).

In accordance with Tunisian case, the results shows that most of independent variables are insignificant, confirming the results of full sample analysis. Moreover, compared to their unmarried counterparts, married respondents in the age ranging between 15 and 39 years are statistically less likely to report chronic illnesses. However, the same doesn't hold true for married respondents between 40 and 65 years of age. The coefficient in front of married variable is negative and statistically insignificant, indicating that the chronic status of married is not different from that of married respondents occupying this range of age.

Younger respondents (in between 15 and 39 years of age) who live in urban areas are found to have lower probabilities to report chronic illnesses. However, residing in urban area doesn't play a significant role in deciding the chronicity status of respondents in between 40 and 65 years of age. This conclusion gives further support to the outcomes emerges across all specifications pertinent to Tunisian case. However, it encounters the outcomes obtained for Egyptian pooled sample as well as the sample belonging to the same age groups.

4.2.2 The Results of Heckman Selection Bias

To address the potential problem of sample selection bias, equation 21 is estimated using the Heckman tow-step selection procedure. Here we focus on the selection bias in labor participation equation for the full samples of two countries. The estimation results of outcome and selection labor participation equations for both Egypt and Tunisia are reported in Table 11.

The results reveal that the coefficients of lambda are statistically different from zero in all specifications, supporting the existence of sample selection bias. Hence, independent estimations of each step would yield biased results. Therefore, Heckman selection model is appropriate in this case.

The results obtained by Heckman regressions are very similar to those obtained using the two-stage instrumental variable procedures. Importantly, Heckman regression again provides further support to the previously obtained conclusion that chronic diseases negatively affect labor force participation in both Egypt and Tunisia. The rest of the Heckman regression estimates are also agree with previous results. For instance, compared to married female respondents, married males are more likely to participate in labor force. In similar vein, the presence of two or more children exerts an adverse effect on labor force participation in both samples under consideration. The coefficients in front of two and more child variables are negative and statistically significant indicating that having this number of children is more likely to decrease the probabilities to search for job opportunities among respondents. Also an increase in the years of schooling reduces the likelihood of working extra hours during the week, but increases respondents' labor force participation.

4.2.3 The Results of Measurement Bias- according to Kredier Procedure

Finally, to address the problem of whether individuals out labor market may over reporting chronic illness status, Table 12 presents the results on the variation in chronic impact for both 'true' and 'biased' models. The 'true' model reflects the sample of labor force participants only, whiles the 'biased' model is estimated for the full sample[4]. As our concern is the chronic illness variable, the table presents only the chronic coefficients for both models for full, male and female samples, respectively, in both Egypt and Tunisia.

[4] The results is generated from estimation of labor force equation using bivariate probit for non-workers sample (i.e. true model) and for the full sample (i.e. biased model). We focus mainly on chronic coefficient. The impact of explanatory variables in both models is similar to that reported in table 5. However, the estimation results for these models can be obtained from the authors on request.

The reported results indicate that there is a difference between the coefficients of chronic illness (i.e. the effect of chronic on labor force participation) among 'true' and 'biased' models. Specifically, the coefficients of chronic illness in full and male samples in 'biased' model are greater than the coefficients of chronic in true models in both Egypt and Tunisia. This indicates that there is problem of over-reporting chronic diseases situation. Exceptionally, the coefficients of chronic illness in 'true' models of female samples are less than the coefficients of 'biased' model, implying that there is no over-reporting among females in both Egypt and Tunisia. This also means that males tend to over-report their chronic illness situation, while female do not. Interestingly, differences in chronic effects are considerably high in the Egyptian samples. This evidence supports many of previous studies (e.g. Kreider, 1999, Fomba et al. 2013). Therefore, our findings support the problem of measurement biasness in chronic diseases (i.e, justification hypothesis) in both Egypt and Tunisia.

5. Conclusion

This study aims basically to examine the impact of chronic illnesses on labor force participation in Egypt and Tunisia using data from the 2012 round of the Egypt Labor Market Panel Survey (ELMPS 2012) and 2014's Tunisian Labor Market Panel Survey (TLMPS 2014). The study also attempts to investigate the reverse effects of labor force participation on respondents' chronic illnesses status in both countries. For robustness check, the estimation has been implemented by age groups and gender. To account for endogeneity of chronic disease in labor force participation specifications, two-stage instrumental variable procedures have been used to estimate the chronic and the labor force participation equations simultaneously. The Heckman selection model has been implemented to address the problem that could possibly arise from the sample selection bias. Furthermore, the paper examines the issue of measurement biasness in self-assessed chronic condition variable by adopting Kreider's selection procedure.

The results indicate that across all specifications, the prevalence of chronic diseases poses a negative and significant impact on labor force participation in both Egypt and Tunisia. Specifically, in the pooled samples pertaining to both countries, the findings show that chronic illness significantly decreases labor force participation among respondents. Moreover, the statistically significant and negative impact of chronic illnesses on the probabilities of being participating in labor force has been also hold when the data disaggregated according to gender and age groups. These findings bring further support to the common results obtained by previous authors who suggest that illnesses have significant negative effects on individual's labor force engagement (e.g. Cai, 2010; Cai and Clab, 2006; Stern, 1989 and Bond, 1991). Moreover, the empirical results reject the exogeneity hypothesis of chronic diseases, implying that chronic illness is endogenous to labor force participation equation. Finally, the results indicate that chronic illness has higher effect on labor force participation in the full sample than its effect in the sample of workers, indicating that individuals out of labor market overreporting their chronic illness status in both Egypt and Tunisia.

Undeniably, the obtained findings are applicable to Egypt and Tunisia but they can call the attention to the economic burden of chronic illness in the whole Arab region. The findings also raise the red flag for the financial burden resulting from dropping chronically ill people out of labor markets. Definitely, the decreases in labor force participation due to illness impose negative consequences on economic growth of these countries. Therefore, the study recommends that in order to sustain healthiness of people involving in labor market, enhancing health care systems is essential. Accordingly, more investments in health sector need to be initiated.

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Table 1: Labor force status and self-reported health for Male and Female (%)

	Very good	Good	Fair	Bad	Very bad	All	Very good	Good	Fair	Bad	Very bad	All
	Egypt						Tunisia					
Male (No. observations)			(15,179)						4,389			
% In labor force	79.01	82.20	84.46	69.38	60.87	81.15	77.80	77.62	74.04	44.14	16.92	74.62
% Out of labor force	20.99	17.80	15.54	30.62	39.13	18.85	22.20	22.38	25.96	55.86	83.08	25.38
Female (No. observations)			(14,917)						5,041			
%In labor force	24.02	24.55	23.16	16.47	12.00	24.01	30.43	23.22	20.57	13.08	2.56	24.32
%Out of labor force	75.98	75.45	76.84	83.53	88.00	75.99	69.57	76.78	79.43	86.92	97.44	75.68

Table 2: Employment and Self-reported Health by Age Group (%)

	Very good	Good	Fair	Bad	Very bad	All	Very good	Good	Fair	Bad	Very bad	All
	Egypt						Tunisia					
All age groups (15-64 years)			15,419						4,400			
Employed	87.37	91.00	94.70	96.27	88.24	90.42	80.89	84.23	92.77	89.31	75.00	84.32
Unemployed	12.63	9.00	5.30	3.73	11.76	9.58	19.11	15.77	7.23	10.69	25.00	15.68
Age (15-29)			5,920						1,282			
Employed	80.31	84.44	79.32	96.00	00.0	82.57	63.74	63.87	71.93	88.89	50.00	64.32
Unemployed	19.69	15.56	20.68	4.00	100.0	17.43	36.26	36.13	28.07	11.11	50.00	35.68
Age (30-49)			7,176						2,180			
Employed	93.17	93.64	95.51	94.23	100.0	93.73	90.00	89.66	93.12	86.67	66.67	90.04
Unemployed	6.83	6.36	4.49	5.77	00.00	6.27	10.00	10.34	6.88	13.33	33.33	9.96
Age (50-64)			2,323						938			
Employed	98.5	99.00	99.12	97.22	100.0	98.88	97.11	96.26	95.08	87.93	83.33	95.51
Unemployed	1.50	1.00	0.88	2.78	0.00	1.12	2.89	3.74	4.92	12.07	16.67	4.49
No. observations			15,419						4,400			

Table 3: Decomposition of Chronic Disease for full Sample, Gender and Age Group (%)

	Egypt			Tunisia		
	Yes	No	No. observation	Yes	No	No. observation
All age groups	19.43	80.57	32,626	18.56	81.44	11,535
14-29	3.66	96.34	14,184	1.98	98.02	3,286
30-49	16.01	83.99	10,927	8.04	91.96	4,016
Above 50	54.18	44.82	7,515	29.58	70.42	4,233
Male	17.68	82.32	16,001	17.05	82.95	5,302
Female	21.12	78.88	16,625	19.94	80.06	6,093

Table 4: Descriptive Statistics for the Variables Used in the Analysis

Variable	Definition	Egypt		Tunisia	
		Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
Participation	1 = if individual is labor force participant (of age 15-64) and 0 = otherwise	0.347	0.476	0.318	0.465
Chronic illness	1= if reports a chronic disease and 0= otherwise	0.194	0.396	0.186	0.389
Hours	Weekly hours worked at most recent job	46.813	0.451	41.991	0.432
Age	Age of person in completed years	26.308	19.932	34.370	22.545
Head	1= if he/she is the head of the household and 0= otherwise	0.245	0.430	0.275	0.446
Male	Gender of the head of household (1 = male; 0 = female)	0.498	0.500	0.480	0.500
Married	1= if he/she is the head of the household and 0= otherwise	0.431	0.495	0.450	0.498
Year of schooling	Year of schooling	7.421	5.303	5.845	5.113
Household Size	Number of household ‘members	4.979	2.203	4.463	1.732
One child	1 = if has one child and 0 = otherwise	0.204	0.403	0.171	0.376
Two child	1 = if has two child and 0 = otherwise	0.250	0.433	0.180	0.385
More than tow child	1 = if has more than two child and 0 = otherwise	0.308	0.462	0.198	0.399
Wealth	Wealth score	-0.054	0.916	-0.179	0.831
Own house	1 = if own house and 0 = otherwise	0.558	0.497	0.556	0.497
urban	1= urban, 0= otherwise	0.436	0.496	0.430	0.495
	Egypt’ region (greater Cairo is reference)				
Alexandria	1= Alexandria, 0= otherwise	0.080	0.272		
Urban lower	1= Urban lower, 0= otherwise	0.110	0.313		
Urban upper	1= Urban upper, 0= otherwise	0.555	1.383		
Rural lower	1= Rural lower, 0= otherwise	0.280	0.449		
Rural upper	1= Rural upper, 0= otherwise	0.282	0.450		
	Tunisia’ regions (greater Tunis is reference)				
North west	1= North west, 0= otherwise			0.149	0.356
South west	1= South west, 0= otherwise			0.053	0.224
Central west	1= Central west, 0= otherwise			0.163	0.370
North east	1= North east, 0= otherwise			0.151	0.359
South east	1= South east, 0= otherwise			0.104	0.305
Central east	1= Central east, 0= otherwise			0.225	0.417
No. observation		40,668		11,274	

Table 5: Estimation Results of LFP Equation- Full Sample: Egypt and Tunisia

Dependent Variable: Labor force participation												
Variable	Egypt						Tunisia					
	Ivprobit model		2SLS model		Biprobit model		Ivprobit model		2SLS model		Biprobit model	
	Coefficien	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Chronic Illness	-1.84***	0.12	-0.32***	0.02	-2.40***	0.07	-1.62***	0.21	-0.46***	0.05	-2.28***	0.15
Age	-0.17***	0.00	0.04***	0.00	0.02**	0.01	-0.16***	0.03	-0.03***	0.01	0.05***	0.01
Age square	3.60***	0.07	0.00***	0.00	0.01	0.00	3.41***	0.50	0.67***	0.10	0.05**	0.00
Head of household	0.46***	0.03	0.14***	0.01	0.01	0.05	0.39***	0.12	0.09***	0.03	0.30	0.20
Male	1.65***	0.02	0.46***	0.01	0.32***	0.06	1.72***	0.12	0.58***	0.03	0.18	0.21
Married	-0.03	0.02	0.01	0.01	-0.19***	0.05	-0.24	0.17	-0.08*	0.04	-0.25	0.28
Year of schooling	0.02***	0.00	0.01***	0.00	0.02***	0.00	0.34***	0.06	0.08***	0.02	0.17*	0.10
Wealth	-0.01	0.01	-0.01***	0.00	-0.10***	0.02	0.04	0.04	0.01	0.01	-0.06	0.06
Own house	-0.01	0.02	-0.02***	0.00	-0.11***	0.05	-0.06	0.06	-0.01	0.01	0.08	0.09
Urban	0.42	0.30	0.04	0.06	0.34***	0.12	0.03	0.07	0.01	0.02	-0.18**	0.09
Alexandria	-0.05	0.04	-0.01	0.01	-0.06	0.12						
Urban lower	0.06	0.04	0.02**	0.01	0.14	0.10						
Urban upper	-0.02**	0.01	0.01	0.00	-0.04	0.03						
Rural lower	0.54*	0.30	0.08	0.06	0.42***	0.08						
Rural upper	0.40	0.30	0.06	0.06	0.23***	0.10						
North west							0.03	0.12	0.00	0.03	-0.18	0.19
South west							-0.40***	0.15	-0.09***	0.03	-0.53**	0.22
Central west							-0.28**	0.12	-0.06**	0.03	-0.11	0.21
North east							0.05	0.10	0.01	0.02	0.31	0.21
South east							-0.10	0.12	-0.02	0.03	-0.20	0.19
Central east							0.09	0.10	0.03	0.02	-0.17	0.17
Constant	-20.46***	0.46	-0.76***	0.06	0.82***	0.24	-19.64***	2.72	-3.47***	0.55	0.94	1.03
Wald Chi2 (prob)	1262.86 (0.0000)				12976.35(0.000)		1275.90(0.0000)				12976.35(0.000)	
No. of observations	32,626		32,626		32,626		11,274		11,274		11,274	

***, ** and * denotes significance at the 1, 5 and 10 percent level, respectively

Table 6: Estimation Results of Chronic Equation- Full Sample: Egypt and Tunisia

Dependent Variable: Chronic Illness												
Variable	**Egypt**						**Tunisia**					
	Ivprobit model		**2SLS model**		**Biprobit model**		**Ivprobit model**		**2SLS model**		**Biprobit model**	
	Coefficient	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**
Participation	3.19	2.48	0.49	0.47	-0.40	0.08	0.40	1.63	0.02	0.26	-02.13	0.14
Age	0.04***	0.01	0.02***	0.00	0.07***	0.01	0.11**	0.06	0.01	0.01	0.09	0.06
Age square	0.09	0.16	-0.22***	0.03	0.003***	0.00	0.02**	0.00	-0.12	0.16	0.00	0.00
Head of household	0.21***	0.05	0.04***	0.01	0.16***	0.04	-0.16	0.22	0.00	0.04	0.00	0.21
Male	-0.39***	0.11	-0.08***	0.02	-0.12***	0.05	-0.23	0.26	-0.05	0.04	-0.03	0.22
Married	-0.08	0.05	-0.03*	0.01	-0.08*	0.04	-0.17	0.27	-0.02	0.05	-0.22	0.25
Year of schooling	-0.02***	0.00	-0.03***	0.00	-0.01**	0.00	0.00	0.01	0.00	0.00	0.01	0.01
One child	-0.01	0.04	0.001	0.01	-0.01	0.04	-0.07	0.12	-0.02	0.02	-0.05	0.11
Two child	0.01	0.04	-0.01	0.01	-0.01	0.04	-0.15	0.13	-0.03	0.02	-0.17	0.12
More than two child	0.06	0.05	0.00	0.01	0.05	0.04	0.03	0.14	-0.01	0.02	0.05	0.13
Own house	0.03	0.03	0.01	0.01	0.00	0.03	-0.29***	0.09	-0.04***	0.01	-0.26***	0.08
Insurance	-0.08	0.05	-0.02*	0.01	-0.02	0.03	-0.03	0.10	0.00	0.02	-0.04	0.07
Urban	-0.18	0.43	-0.03	0.08	-0.20	0.41	-0.01	0.11	-0.01	0.02	-0.06	0.09
Alexandria	-0.12**	0.06	-0.03**	0.01	-0.14**	0.06						
Urban lower	-0.10	0.06	-0.02*	0.01	-0.08	0.05						
Urban upper	-0.12***	0.02	-0.02***	0.00	-0.12***	0.01						
Rural lower	0.12	0.43	0.02	0.08	0.11	0.41						
Rural upper	-0.29	0.43	-0.06	0.08	-0.26	0.41						
North west							-0.17	0.20	-0.02	0.03	-0.15	0.17
South west							0.25	0.37	0.03	0.06	-0.15	0.20
Central west							0.04	0.20	0.01	0.03	0.00	0.19
North east							0.28*	0.17	0.04	0.03	0.27*	0.16
South east							0.33*	0.20	0.05*	0.03	0.15	0.17
Central east							0.55**	0.16	0.09***	0.03	0.41***	0.15
Constant	-5.58**	2.35	0.62	0.44	-0.30	0.46	-4.84**	2.05	0.49	0.86	-1.93	1.40
Wald Chi2 (prob)	1653.25 (0.000)		R2= 0.12				114.70(0.0000)		R2=0.07		2221.61(0.0000)	
No. of observations	32,626		32,626		32,626		11,274		11,274		11,274	

***, ** and * denotes significance at the 1, 5 and 10 percent level, respectively

Table 7: Estimation Results of IV-Probit for Labor Force participation Equation by Gender

Dependent Variable: Labor force participation								
Variable	**Egypt**				**Tunisia**			
	Males		**Females**		**Males**		**Females**	
	Coefficient	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**
Chronic Illness	-2.400***	0.140	-0.770***	0.210	-1.894***	0.212	-0.532***	0.312
Age	-0.190***	0.010	0.190***	0.010	0.202***	0.045	0.128***	0.030
Age square	3.770***	0.090	0.000***	0.000	-0.002***	0.001	-0.001***	0.000
Head of household	0.350***	0.060	-0.030	0.050	0.993***	0.177	-0.057	0.132
Married	0.540***	0.060	-0.310***	0.040	0.445	0.353	-0.519***	0.157
Year of schooling	-0.030***	0.000	0.060***	0.000	-0.002	0.010	0.064***	0.008
Wealth	-0.050***	0.020	0.010	0.020	0.073	0.065	-0.021	0.049
Own house	0.030	0.030	-0.060**	0.030	0.046	0.084	-0.169**	0.069
Urban	-0.080	0.510	4.560	174.570	-0.145	0.096	0.014	0.078
Alexandria	-0.130**	0.060	-0.010	0.060				
Urban lower	0.000	0.060	0.120**	0.050				
Urban upper	-0.050***	0.010	0.020	0.010				
Rural lower	0.020	0.500	4.740	174.570				
Rural upper	-0.150	0.510	4.710	174.570				
North west					0.220	0.169	0.285**	0.122
South west					-0.183	0.202	-0.349*	0.187
Central west					-0.390**	0.160	-0.301***	0.141
North east					0.169	0.158	0.054	0.119
South east					0.120	0.168	-0.410***	0.149
Central east					-0.074	0.145	0.211*	0.111
Constant	-18.430***	0.690	-9.780	174.570	-3.959***	1.029	-3.618***	0.659
Wald Chi2 (prob)	4435.51 (0.0000)		1599.54 (0.0000)		209.93(0.0000)		169.44(0.0000)	
No. of observation	16,001		16,625		5,180		5,957	

***, ** and * denotes significance at the 1, 5 and 10 percent level, respectively

Table 8: Estimation Results of IV-Probit for Chronic Equation by Gender

Dependent Variable: Chronic Diseases								
Variable	**Egypt**				**Tunisia**			
	Males		**Females**		**Males**		**Females**	
	Coefficient	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**
Participation	-4.533	13.660	-0.429	1.377	-2.352	3.258	2.791	2.318
Age	0.037***	0.009	0.059**	0.022	0.145*	0.077	4.826*	3.093
Age square	0.075	0.181	-0.056	0.427	0.114	1.679	-0.001	0.001
Head of household	0.201***	0.072	0.291***	0.110	-0.413	0.375	0.308	0.409
Married	-0.072	0.105	-0.027	0.104			0.127	0.438
Year of schooling	-0.011**	0.005	-0.018***	0.009	-0.004	0.013	-0.005	0.023
One child	-0.045	0.052	0.191**	0.089	-0.029	0.145	-0.030	0.326
Two child	-0.006	0.064	0.159**	0.099	-0.045	0.162	-0.154	0.335
More than two child	0.106	0.106	0.100	0.107	0.169	0.159	-0.201	0.419
Own house	0.006	0.051	0.011	0.073	-0.213**	0.111	-0.258	0.220
Insurance	-0.018	0.059	0.032	0.128	-0.043	0.116	0.057	0.249
Urban	-0.135	0.454	-0.677***	0.139	-0.019	0.119	0.020	0.313
Alexandria	-0.173**	0.083	-0.064	0.128				
Urban lower	-0.078	0.067	-0.209**	0.120				
Urban upper	-0.128***	0.018	-0.135	0.034				
Rural lower	0.042	0.463	0.569***	0.103				
Rural upper	-0.328	0.452						
North west					0.057	0.242	-0.267	0.489
South west					0.311	0.463	0.207	1.144
Central west					0.247	0.254	-0.235	0.541
North east					0.475**	0.222	0.096	0.370
South east					0.512**	0.241	0.568	0.650
Central east					0.802***	0.227	0.111	0.335
Constant	1.750	13.086	-1.543	2.231	-1.882	9.644	-20.506**	10.364
Wald Chi2 (prob)	1213.82(0.0000)		446.68(0.0000)		85.21(0.0000)		32.29(0.0203)	
No. of observation	16,001		16,625		5,180		5,957	

***, ** and * denotes

Table 9: Estimation Results of IV-Probit for Labor Force Equation by Age Group

Dependent Variable: Labor force participation								
Variable	**Egypt**				**Tunisia**			
	Age 15-39		**Age 40-64**		**Age 15-39**		**Age 40-64**	
	Coefficient	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**
Chronic Illness	-1.651***	0.175	-1.703***	0.153	-1.677***	0.673	-1.665***	0.240
Age	-0.192***	0.015	-0.667***	0.047	0.161	0.119	0.501***	0.157
Age square	3.713***	0.189	16.517***	1.196	-0.002	0.002	-0.005***	0.002
Head of household	0.689***	0.039	0.400***	0.066	0.610***	0.156	0.389*	0.226
Male	1.737***	0.031	1.387***	0.068	1.711***	0.155	1.593***	0.226
Married	-0.065*	0.035	0.209***	0.062	-0.427	0.314	0.049	0.249
Year of schooling	0.009***	0.003	0.056***	0.004	0.181*	0.095	0.532***	0.100
Wealth	-0.055***	0.016	0.012	0.025	0.220***	0.068	-0.073	0.056
Own house	-0.029	0.026	-0.061	0.044	-0.097	0.098	-0.028	0.084
Urban	0.349	0.333	0.407	0.788	0.136	0.104	-0.097	0.094
Alexandria	-0.023	0.053	-0.046	0.076				
Urban lower	-0.006	0.051	0.265***	0.074				
Urban upper	-0.012	0.013	-0.006	0.020				
Rural lower	0.381	0.332	0.823	0.788				
Rural upper	0.340	0.332	0.548	0.790				
North west					0.039	0.182	-0.035	0.159
South west					-0.417*	0.245	-0.486**	0.202
Central west					-0.381**	0.178	-0.251	0.177
North east					0.258	0.167	-0.141	0.141
South east					-0.059	0.186	-0.212	0.158
Central east					0.108	0.149	-0.004	0.135
Constant	-20.545***	0.909	-96.798***	7.061	-4.055***	1.892	-13.071***	3.876
Wald Chi2 (prob)	7671.76(0.0000)		2878.31 (0.0000)		547.07(0.0000)		613.46(0.0000)	
No. of observation	20,850		11,301		5,225		5,833	

***, ** and * denotes significance at the 1, 5 and 10 percent level, respectively

Table 10: Estimation Results of IV-Probit for Chronic Equation by Age Group

Dependent Variable: Chronic Illness								
Variable	**Egypt**				**Tunisia**			
	Age 15-39		**Age 40-64**		**Age 15-39**		**Age 40-64**	
	Coefficient	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**	**Coefficient**	**S.E.**
Participation	-1.789	2.680	-3.583	4.055	-3.280	4.078	-0.025	1.616
Age	0.097***	0.032	0.022	0.060	0.574	0.950	-0.058	0.209
Age square	-0.850**	0.449	0.324	1.525	-0.007	0.014	0.001	0.002
Head of household	0.260***	0.078	0.221***	0.097	0.494	0.448	-0.140	0.292
Male	-0.023	0.117	-0.202	0.213	-0.100	0.606	-0.308	0.318
Married	-0.228**	0.099	-0.004	0.094	-1.252**	0.724	-0.086	0.346
Year of schooling	-0.029***	0.006	-0.001	0.006	0.051*	0.030	0.006	0.011
One child	-0.009	0.075	-0.013	0.066	-0.097	0.443	-0.098	0.137
Two child	0.163*	0.071	-0.117*	0.066	-0.289	0.461	-0.138	0.147
More than two child	0.284***	0.075	-0.081	0.069	0.436	0.431	-0.088	0.164
Own house	-0.016	0.049	-0.022	0.058	-0.550**	0.278	-0.221**	0.099
Insurance	-0.071	0.065	0.032	0.096	0.281	0.345	-0.093	0.118
Urban	-0.868*	0.523	0.483	0.969	-0.759***	0.335	0.086	0.112
Alexandria	-0.298***	0.105	-0.045	0.094				
Urban lower	-0.051	0.089	-0.086	0.091				
Urban upper	-0.115***	0.025	-0.135	0.023				
Rural lower	0.218	0.521	-0.585	0.969				
Rural upper	-0.136	0.522	-0.997	0.970				
North west					-0.994**	0.543	-0.010	0.214
South west					-0.949	0.948	0.362	0.431
Central west							0.362*	0.231
North east					-1.063**	0.588	0.500***	0.192
South east					-0.299	0.489	0.419**	0.228
Central east					-0.007	0.363	0.635***	0.193
Constant	3.751	3.063	-0.865	10.289	-8.797	16.933	-0.653	4.798
Wald Chi2 (prob)	280.02 (0.0000)		262.22(0.0000)		24.87 (0.1287)		62.86(0.0000)	
No. of observation	20,850		11,301		5,225		5,833	

***, ** and * denotes significance at the 1, 5 and 10 percent level, respectively

Table 11: Estimated Results of Heckman Selection Model

Variable	Egypt				Tunisia			
	Outcome Equation		Selection Equation		Outcome Equation		Selection Equation	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Participation	-0.0335***	0.0118	-0.2540***	0.0296	-0.1330***	0.0433	-0.3471***	0.0841
Age	-0.0861***	0.0168	0.2435***	0.0045	-0.0771	0.0731	0.1842***	0.0275
Head of household	-0.0094	0.0141	-0.0029***	0.0001	0.2294***	0.0652	-0.0022***	0.0003
Male	0.1229***	0.0186	0.5088***	0.0314	0.3004**	0.1239	0.3802***	0.1103
Married	-0.0019	0.0130	1.6956***	0.0259	-0.0122	0.0956	0.827***	0.1075
Year of schooling	-0.0570***	0.0086	0.1331***	0.0277	-0.0046	0.0364	-0.0766	0.1582
Household size	0.0134	0.0136	0.0799***	0.0025	-0.0048	0.0523	0.0833***	0.0070
One child	-0.0134	0.0116	0.0269***	0.0063	-0.0128	0.0386	0.0127	0.0248
Two child	-0.0334**	0.0130	-0.1069***	0.0275	0.0665	0.0438	0.0345	0.0825
More child	-0.0467***	0.0154	-0.1029***	0.0312	0.0475	0.0518	0.1216	0.0918
Wealth			-0.0560***	0.0131			-0.0532	0.0567
Own house	-0.0192**	0.0083	-0.2421***	0.0381	0.0127	0.0245	0.0969	0.1112
Urban	-0.0415	0.0971	0.2197	0.2931	0.0770***	0.0266	0.0771	0.0634
Alexandria	-0.0142	0.0160	0.0167**	0.0407				
Urban lower	-0.0517***	0.0152	0.0851**	0.0395				
Urban upper	-0.0254***	0.0036	0.0158	0.0097				
Rural lower	-0.1458	0.0969	0.3511	0.2925				
Rural upper	-0.2033**	0.0970	0.3058	0.2928				
North west					-0.0267	0.0451	-0.0029	0.1064
South west					-0.1925***	0.0708	-0.5927***	0.1516
Central west					-0.2611***	0.0505	-0.4015***	0.1097
North east					-0.0048	0.0415	0.0428	0.0979
South east					-0.0905**	0.0475	-0.1945*	0.1109
Central east					-0.0855**	0.0392	-0.0254	0.0910
Constant	4.3371***	0.1204	-6.6955***	0.3060	3.4643***	0.3261	-5.3568***	0.5961
lambda	-0.1343***	0.0143			0.2695***	0.0921		
rho	-0.3253		-0.32532		0.5744		0.5744	
sigma	0.4130		0.4130		0.4693		0.4693	
No. observations	11,274		11,274		32,626		32,626	

***, ** and * denotes significance at the 1, 5 and 10 percent level, respectively

Table 12: Chronic coefficients of "Biased" and "True" Models

Chronic coefficient	Egypt			Tunisia		
	Full sample	Males	Females	Full sample	Males	Females
True model	-1.839	-1.998	-0.845	-1.489	-1.528	-0.891
Biased model	-0.994	-0.938	-1.287	-1.149	-1.160	-1.033

Appendix

Table 1: Tests for weakness of the instruments (Ho: Instruments are weak)

F test- Full sample		
Model	**F statistics**	**Prob**
Participation	1125.03	0.0000
Chronic illness	10.02	0.0000

Table 2: Tests of overidentifying restrictions (Ho: Overidentifying restrictions are valid)

Sargan Tests of overidentifying restrictions- Full sample		
Model	**Sargan**	**Prob**
Participation	0.238	0.6255
Chronic illness	0.165	0.8162
Bosmann Tests of overidentifying restrictions- Full sample		
Model	**Bosmann**	**Prob**
Participation	0.238	0.6255
Chronic illness	0.157	0.8193

Table 3: Exogeneity Test (Ho: weak exogenous)

Wald test of exogeneity- Full sample		
Model	**Rho**	**Wald Chi2 (prob)**
Participation	-0.527	3.19 (0.0742)
Chronic illness	-0.587	1.09 (0.1232)