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Trends in female participation in the Greek labor market

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Abstract

The present thesis investigates long-term trends in female participation in the Greek labor market. Female labor force participation in the Greek labor market lags behind that of the most developed countries in the OECD and of the European Union (EU). However, female labor force participation in Greece increased by over 20 percentage points between the beginning of the 1980s and 2011 while it increased further during the recent economic crisis. The analysis presented herein decomposes the growth in the female participation rate between 1993 and 2016. The dataset used is the Greek Labor Force Survey (GLFS). The model type used is binary age-period-cohort Logit model. A number of assumptions are made to identify the three effects separately. There are two types of the statistical model estimated. Model I uses an unemployment by education level variable as a proxy variable for the period effects. Model II assumes that cohort effects are declining over time and uses a logarithmic transformation of the year of birth as a proxy for the cohort effects. The results suggest that the increasing rate of female participation is mostly due to cohort effects (about 46% of the increase is due to unobserved cohort effect) and the education level improvement (about 33% of the increase is due to education effects). The third in importance variable that has influenced the change in participation rates are age effects (reflecting the change in the age composition of the population) explaining around 12% of the total increase in the participation decision. Period effects in the form of the unemployment, on the other hand, have exercised a negative influence on the participation rate as in 2016 the unemployment rate is higher than in 1993, and the unemployment coefficient estimate is negative.

Περίληψη

Η παρούσα διπλωματική εργασία ερευνά τις μακροχρόνιες τάσεις στη συμμετοχή των γυναικών στην ελληνική αγορά εργασίας. Η συμμετοχή των γυναικών στην αγορά εργασίας στην Ελλάδα υστερεί συγκριτικά με τις πιο ανεπτυγμένες χώρες του ΟΟΣΑ και της Ευρωπαϊκής Ένωσης (ΕΕ). Παρόλα αυτά, το ποσοστό συμμετοχής των γυναικών στην ελληνική αγορά εργασίας έχει αυξηθεί πάνω από 20 μονάδες μεταξύ της δεκαετίας του 1980 και του 2011, ενώ αυξήθηκε περαιτέρω στην περίοδο της

οικονομικής κρίσης. Η παρούσα ανάλυση μελετά την αύξηση του ποσοστού συμμετοχής των γυναικών στην ελληνική αγορά εργασίας μεταξύ του 1993 και του 2016. Τα δεδομένα προέρχονται από τις Έρευνες Εργατικού Δυναμικού της ΕΛΣΤΑΤ για την αναφερόμενη περίοδο. Ο τύπος μοντέλου που χρησιμοποιείται για εκτίμηση είναι ένα δυαδικό μοντέλο λογιστικής παλινδρόμησης. Εκτιμώνται δύο τύποι του στατιστικού μοντέλου. Το Υπόδειγμα Ι χρησιμοποιεί μια μεταβλητή για την ανεργία ανά εκπαιδευτικό επίπεδο για να προσεγγίσει τα period effects. Το Υπόδειγμα ΙΙ υποθέτει ότι η επιρροή των αποτελεσμάτων κοόρτης φθίνουν διαχρονικά. Τα αποτελέσματα δείχνουν ότι το αυξανόμενο ποσοστό συμμετοχής των γυναικών στην αγορά εργασίας οφείλεται κυρίως στα αποτελέσματα κοόρτης (περίπου κατά 46%) και στη βελτίωση του εκπαιδευτικού επιπέδου των γυναικών (περίπου κατά 33%). Η τρίτη κατά σειρά μεταβλητή που επηρέασε την γυναικεία συμμετοχή είναι η αλλαγή στην ηλικιακή δομή η οποία εξηγεί περίπου το 12% της συνολικής αύξησης. Η οικονομική συγκυρία από την άλλη φαίνεται να πιέζει το ποσοστό συμμετοχής προς τα κάτω, καθώς το ποσοστό ανεργίας το 2016 είναι μεγαλύτερο από ό,τι το 1993 και η μεταβλητή για την ανεργία έχει αρνητικό πρόσημο.

Contents

1. Introduction 7
2. Theoretical background 10
2.1. Static labor supply models 10
2.1.1 Models of individual labor supply 10
2.1.2 Household models 11
2.2. Dynamic labor supply models 12
2.3. Review of the empirical literature on labor supply 15
2.4. Static labor demand models 18
2.4.1. Cost optimization 18
2.4.2. Profit maximization 19
2.4.3. Cost of Labor 19
2.5. Review of the empirical literature on labor demand 20
2.4. Dynamic labor demand models 22
2.4.1. Form of adjustment costs 22
2.4.2. Specification of adjustment costs 22
3. Descriptive analysis 24
3.1 Trends in Greek female participation rate, 1961-2011 24
3.2 Economic and social changes and female participation rates 25
4. Econometric Research 36
4.1. Model presentation 39
4.2. Estimation 40
5. Conclusions 47
References 48

List of Figures

Figure No.	Title	Page
1	Female participation rates 15-64 years old	8
2	Greek Labor force participation rate age 15-64 years old	8
3	Fertility rates (births per woman), Greece, 1960-2015	30
4	Ratio of female to male regular monthly payments in manufacturing firms with over 10 employees, Q3:1976-Q2:1998	32
5	Average monthly salaries of full-time men employed in firms with less than 10 employees	33
6	Average monthly salaries of full-time women employed in firms with less than 10 employees	34
7	Ratio of female to male monthly salaries in firms with less than 10 employees, 2003-2015	35
8	Female participation rates by birth cohort and age (%).	38
9	Estimated probabilities of participation by cohort	44
10	Estimated probabilities of participation by age	44

List of tables

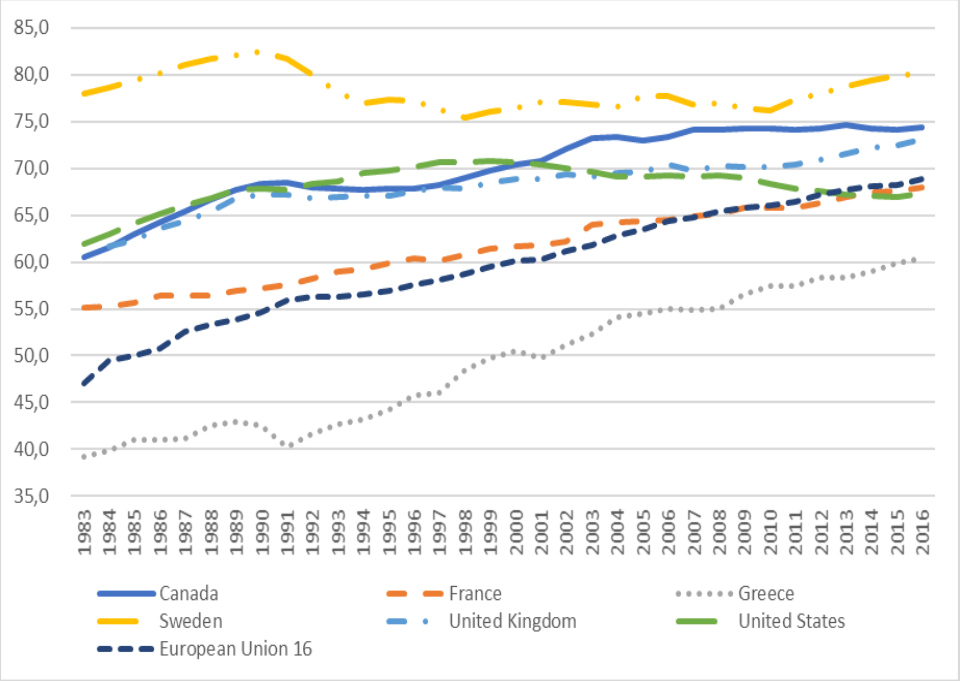
Table No.	Title	Page
1	Female labor force participation rates by age groups, 1961-2011	25
2	Gross National Income per head in EUR thousands, Greece, 1961-2011	26
3	Distribution of female population (20 years old and over) by level of completed education	27
4	Distribution of employed females aged 15-64 by status in employment, 1971-2011	27
5	Gross added value at current prices, 1961-2011 EUR (billion)	28
6	Percentage of employed women by ocuppational categories, 1961-2011	29
7	Distribution of the population by age group (%)	31
8	Summary Statistics of the sample used	37
9	Logit estimates of equation (2) (Model I)	42
10	Logit estimates of equation (2) (Model II)	45
11	Decomposition of female participation growth 1993-2016	46

1. Introduction

The current thesis discusses and analyses the rate of female participation in the Greek labor market in three different periods. The purpose is to understand the factors impacting on the female participation decision. The decision depends on amongst other factors the market wage, the education level of the woman, her age, her family status, the existence or otherwise of children a woman has to take care of, their number and their age in other words factors that impact on her reservation wage. Additional variables that may influence the participation decision of married or cohabiting women are the education level and the salary of the male partner. The analysis that follows is focused on the trends that these variables show and how they interact with participation.

The female participation rate in Greece is low compared to the most developed countries of the OECD or the EU (Figure 1). Thus, while in 2016 the female labor force participation in Greece stood at 60.4%, in Canada, France and Sweden it was well over 70%. However, as in other developed countries the female participation rate in Greece has increased significantly over time. In fact, the gap between Greece and the EU has decreased somewhat compared to where it stood in the 1980s. Furthermore, within Greece the gap between male and female labor force participation rates has declined significantly over time (Figure 2).

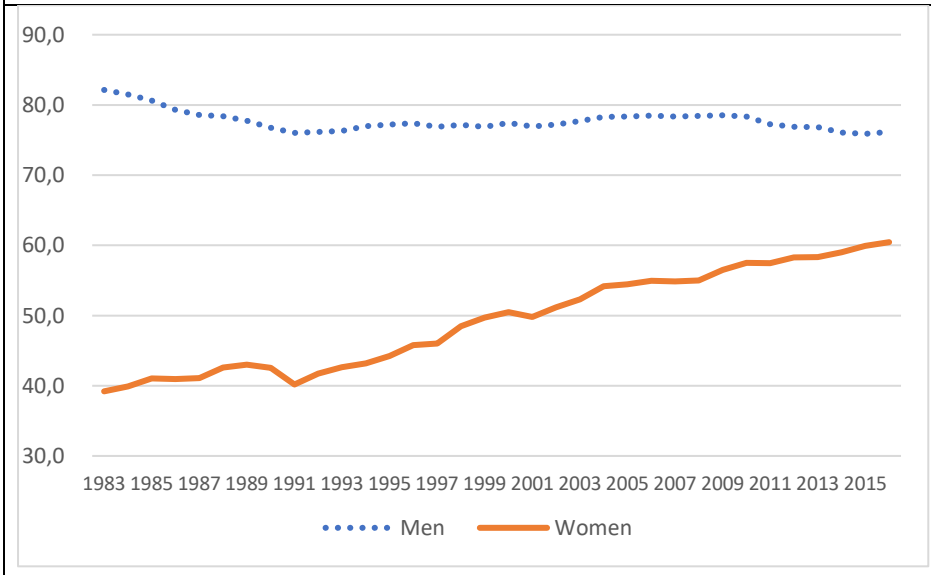
Figure 1 Female participation rates 15-64 years old



Source: OECD Database, Labor Force Statistics accessed on 14/11/17

Figure 2

Greek Labor force participation rate age 15-64 years old



Source: OECD Database, Labor Force Statistics accessed on 14/11/17

The increase in women's wages, their improved educational attainment, improvements in household technology, the availability of market substitutes for housework, the more extensive use of contraceptive pills and changes in attitudes are among the factors identified as impacting on female labor force participation (see, *inter alia*, Blau and Kahn, 2017 and the references therein for developments in the USA and Meghir *et al*., 1989, Lyberaki, 2008 and Nicolitsas, 2006 for Greece).

The rest of the thesis is organized as follows Chapter 2 outlines the main theoretical models of labor supply and labor demand and previews the empirical literature on these topics. Chapter 3 contains a descriptive analysis of the trends of the variables of interest (e.g. participation rate, demographics, occupational positions, educational attainment, fertility rates and wages). Chapter 4 presents the econometric results from the estimation of reduced form model(s) for female participation in Greece and Chapter 5 summarizes and concludes.

2. Theoretical background

In the Introduction we referred to a number of factors that are expected to have an impact on the decision of the individual to participate in the labor market. In this section, we show how these factors are derived from the labor supply theoretical framework. The theoretical framework used to investigate labor supply is rich and constantly expanding. We distinguish below between static models of labor supply and dynamic models of labor supply. Furthermore, we look further into individual and household labor supply models. As the wage, which is a determining factor of labor supply, is an endogenous variable that is shaped by labor demand and labor supply, we also sketch the framework of labor demand and the underlying decisions that firms make which may impact on labor participation. Again, the analysis is distinguishes between static models of labor demand and the dynamic models that refer to adjustment costs. The presentation below draws from Borjas (2016), Cahuc and Zylberberg (2004), Ehrenberg and Smith (2014) and sources specified therein.

2.1. Static labor supply models

2.1.1 Models of individual labor supply

In the basic static model each individual has a utility function of the form:

$U(C,L)$, where C is consumption and L is leisure. Each individual aims to maximize her utility under the budget constraint

$$C + wL \leq R_0$$

where w and R_0 stand for the wage and the potential income of the individual if she spends her entire time allocation working.

If optimization leads to an interior solution then the individual works up to the point at which the marginal rate of substitution between consumption and leisure equals the wage. As preferences are monotonic the budget constraint always binds.

$$U_L(C^*,L^*)/U_C(C^*,L^*) = w \text{ and } C^* + w L^* = R_0$$

If the wage is less than the marginal rate of substitution between leisure and consumption the individual will not participate in the labor market. The cut-off point (w_R) below which the individual does not work, is known as the *reservation wage*. The reservation wage is essentially a function of the form of the utility function and of the non-labor income an individual possesses. The form of the utility function will be influenced by consumers' tastes and thus a change in, for example, social norms might change the reservation wage. Assuming that leisure is a normal good, a decrease in non-labor income will lead to decrease in the demand for leisure and thus an increase of labor supply. A decrease in the wage, on the other hand, will make leisure cheaper and thus more of it will be consumed.

For individuals participating in the labor market, the above problem results in an interior solution. For non-participants we have a corner solution. Taster shifter variables (e.g. cultural factors, education, demographics) and/or an increase in the market wage can impact on the status of individuals from non-participants to participants.

2.1.2 Household models

The above assume that the individual takes only her own consumption into account. However, individuals live in families and this may alter the decision-making process. The change in the decision-making process might even lead to a labor supply curve in which certain segments (at low wages) are negatively sloping as, due to the added worker effect, a decline in the wage level (and thus low disposable income) might push family members who were not previously working to enter into the labor market.

Family labor supply has been analyzed along the lines of two models: either following a *Unitary model* which assumes that the family is a sole agent with its own utility function and the implication that family income is pooled, or following the so-called *Collective model* which assumes that individuals take decisions subject to the constraint(s) that the existence of a family entails.

Unitary model

The family utility function is of the type

$U(C,L_1,L_2)$ where C, L_1, L_2 are total consumption, leisure of first and leisure of second family member respectively. The utility function is maximized subject to the constraint $C + w_1L_1 + w_2L_2 \leq R_1 + R_2 + (w_1+w_2)L_0$, where w_i is the wage that each member is paid, R_i is the non-wage income for each member and L_0 is the total amount of time available.

Empirically the assumption of income pooling that is implied by the unitary model cannot be accepted (see, for example, Fortin and Lacroix, 1997).

Collective model

The most used type of the collective model is that proposed by Chiappori (1988, 1992). The main difference with the unitary model is the introduction of the principle of *methodological individualism* which implies that members' preferences are not just summed up.

More specifically, in the Collective model the constraint the consumer is faced with contains a *sharing rule* with all the other terms remaining unchanged. The constraint is of the form

$C_i + w_iL_i \leq w_iL_0 + \Phi_i$ where Φ_i is the sharing rule and

$\Phi_i + \Phi_2 = R_1 + R_2$

As can be seen there is a different approach regarding the budget constraint and the non-wage income of the individual.

From the empirical results it can be deducted that the collective model compared to the unitary model has the advantage of not adopting the income pooling hypothesis. Moreover, using this model it is possible to extract individual consumption, which was not possible with the use of the unitary model. Knowing the labor supply and an individuals' income a researcher can deduce the sharing rules. So, there is the possibility of observation of the consequences of public policy for each member of the household separately.

2.2. Dynamic labor supply models

The static models of labor supply help us understand the decisions individuals make about the time which he/she will offer for work without taking into consideration the

entity of time. In the dynamic models the entity of time enters and the theory shows how the decisions that an individual takes in some time affect her/his status at some later stage. Also, in these models it can be seen how exogenous shocks affect individuals and can be presented the thinking method individuals use when they have to make a retirement decision.

In the basic dynamic model each individual has a utility function of the form

$U(C_t, L_t, t)$ where C_t, L_t are consumption and leisure indicated in time t and

$t=1,\ldots,T$ are consecutive time periods. Furthermore, it is assumed that the individual can save with interest rate r_t.

Each individual aims to maximize her utility subject to the budget constraint

$A_t = (1 + r_t)A_{t-1} + B_t + w_t(1 - L_t) - C_t$ where A_t, B_t and w_t stand for the assets, non-wage income and wage respectively.

If optimization leads to an interior solution then the individual works up to the point at which marginal rate of substitution between consumption and leisure equals to the wage in each time period.

$U_L(C_t^*, L_t^*)/U_C(C_t^*, L_t^*) = w_t$ and

$\lambda_t = (1 + r_{t-1})\lambda_{t-1}$ where λ_t is the Lagrange multiplier.

The second equation, known as the *Euler equation*, shows that the multiplier depends on the interest rate.

From an empirical point of view the multiplier λ_t is an interesting term as it is shown that it can be separated into a fixed individual effect (λ_0) and an age effect. It is the value of the fixed individual effect that shows us the result that a *temporary* or a *permanent* effect has on labor supply. More specifically, empirical studies have shown that a permanent change in wages has no effect on labor supply whereas a temporary (or *transitory*) change in a particular wage affects labor supply as the agents have to adjust their supply of labor for this temporary change.

Discouraged worker effect and added worker effect

Labor force participation rates vary between business cycles. When the unemployment rate is high, many unemployed individuals abandon their effort to find a job due to high unemployment. This is called the *discouraged worker effect* and may explain - to some extent - a decline in the participation rates when unemployment is high or the increase in participation rates when unemployment is low. Thus, some individuals might give up job search in periods of high unemployment due to difficulties in finding a job at the expected wage.

It is possible, however, that high unemployment rates are associated with a loss of income for the household due to, for example, the dismissal of some members of the household. This would lead household members who were previously not participating to enter the labor market. This is the so-called *added worker effect*.

Decision to Retire

Most countries in the OECD have public and private pension systems in place which enable workers to receive income after they decide to retire from the labor market. This pension system creates incentives for each worker if he decides to retire earlier or later. Most pension systems set an age after which the worker must end her working life, called the *normal age.* An individual can retire before the normal age, although she will receive a lower pension compared to the case she retires at the normal age. If she decides to continue working today, then she uses the *option value.*
Let's assume worker decides to retire at date $s \geq \tau$ where τ can be considered as the age of the person and let's further assume that after retirement $L_t = 1$
She has a utility function of the type

$U = U(C_{et}, L_{t,} t) + U(C_{rt}, 1, t)$ where C_{et}, C_{rt} stand for consumption before and after retirement. Individual aims to maximize her utility, as specified above, subject to the budget constraints

$A_t = (1 + r_t)A_{t-1} + B_t(0) + w_t(1 - L_t) - C_{et}$ if $\tau \leq t \leq s - 1$ and

$A_t = (1 + r_t) A_{t-1} + B_t(s) - C_{rt}$ if $s \leq t \leq T$ where $B_t(0)$, $B_t(s)$ stand for non-wage income

while she is working and expected income after she retires.

At the optimum solution of the above maximization problem the individual's *welfare* is $V_\tau(s)$.
An individual chooses the retirement date by aiming to maximize her welfare $V_\tau(s)$ subject to the constraint

$T_m \geq s \geq \tau$ where T_m is the normal retirement age.

Empirical studies on the decision to retire have shown that more often concerning private pensions, workers tend to retire prior to the normal age; see, for example, Lumsdaine *et al.* (1990) and Gruber-Wise (1999, 2001) due to financial incentives given by the firms.

2.3. Review of the empirical literature on labor supply

The primary target of empirical models is the estimation of the wage elasticity of labor supply. This elasticity has different definitions for different types of the basic individual model. At the empirical level these theoretical distinctions are accomplished through different constructions of the non-labor income variable. At the empirical level, it designates the non-wage income, although in dynamic models more variables impact on wages.

Basic static econometric model

The basic model used in econometric analysis is of the form

$ln\ h = a_w\ ln\ w + a_R\ ln\ R + x\theta + \varepsilon$
where x is a vector of control variables, R is non-labor income and θ is the vector of parameters to be estimated. We focus on the estimation of a_w which is the Marshallian wage elasticity. Often it requires the use of instrumental variables in order to deal with

the endogeneity of the wage which occurs either from the variables that impact *w* or from measurement errors.

Dynamic model

In dynamic models a two-stage method is used to estimate wage elasticity because the utility function is temporary separable. In the first stage, a potential income Ω_t is denoted by maximization of individual's utility. In the second stage, there is the maximization of indirect utility obtained subject to a budget constraint.

The utility of an individual is of the form

$U_t = U(C_t, 1-h_t, t)$ where C_t, h_t stand for consumption and hours worked at time *t*. If optimization reaches to an interior solution indirect utility is obtained of the form $V(\Omega_t, t)$ where Ω_t stands for potential income.
The second maximization of indirect utility is under a budget constraint of the form
$\Omega_t = (1 + r_t)A_{t-1} + B_t - A_t$
If optimization reaches an interior solution, then they are the same solutions as in the theoretical background analyzed before.

In dynamic models, wage elasticity has several forms because wages depend on more preferences than in the static models of labor supply.

Frischian elasticity

We referred above to the split of the multiplier to a fixed effect (λ_0) and an age effect.

The fixed effect can be eliminated in the case of panel data by taking first differences
$\Delta \ln h_t = \rho + \Delta x_t\theta + \alpha_w \Delta \ln w_t + \Delta\varepsilon_t$
This equation gives the possibility of estimating the Frischian wage elasticity and comment on changes on wages.

Empirical studies on female participation

There are several studies concerning female participation in the labor market. Researchers tried to study and justify the changes in the female participation rates by studying elements that may have influenced the women's decision to participate in labor market.

It has been observed that in USA the labor market participation rates for women has risen significantly during the past century. The participation rate increased from 53.6% for single women and 21.6% for married women in 1950 to 78.7% for single and 69.6% for married women in 2001 (see Ehrenberg and Smith, 2014). One reason was the changes in the economic system and specifically the changes applied with the Tax Reform System in USA in 1986. It was found that for both women with and without children to care for participation rates were rising. Specifically, for women with at least one child to care for, the probability of participating in the labor market has risen by 1.9% (see Eissa and Liebman, 1992). Another factor studied that may have influenced the female participation rates was culture. It was found that for the case of the USA culture was an important element for the first generation of immigrants in cases such as family structure and women's role in market and is a reason for the gap between men's and women's participation rate in the market – a gap that was from 2.2% for Sweden's up to 89.4% for Afghanistan's immigrants with many countries between these extremes. After the second-generation immigrants the importance of culture in the decision to participate in the job market for women is minimized but still exists (see Antecol, 2000). For the European countries similar results were gathered for the most countries studied along with the same preferences as with the USA's market. It was found that the female participation rate increased from 10% to 30% the last decades (see Balleer, Gonzalez-Salvador and Turunen, 2014). Besides their marital status or culture, another element that may have influenced their decision may have been their education level and also the partner's education level. Studies found that the increasing education level both for women and their partners that came along with the diminishing effect of children played an important role to the increasing rate. This effect was more notable for younger women and it was diminished as age increased in the Dutch labor market (see Goldin, 2006 and Euwals, Knoef, van Vuuren, 2011).

For the Greek labor market, it has been found that the increased education level, the cultural transformation, the reformed legislation and the increasing incomes led the female participation rates rising from 39% in 1961 to 46.2% in 2001 for women aged 15-64 years old (see Lyberaki, 2008 and Nicolitsas, 2006). Lyberaki stresses the role played by the relocation of immigrant women workers in Greece in pushing the labor force participation rate of domestic women higher. Despite the positive influences of those changes in increasing the female participation rate, we cannot fail to notice the divergence of Greece with the other European countries in women's participation rates. It was noticed that Greece found it more difficult to reform its market, both inside (business environment) and outside (institutions), and that has led Greece to have lower female participation rates than the most of the other European countries. In numbers, Greece had a female participation rate of 60.4% in 2016 when the EU-15 countries has a female participation rate of 68.6% as data from Eurostat state. The same points will be concluded if anyone compares Greece with the OECD's most significant countries as shows Figure 1 in the Introduction.

2.4. Static labor demand models

In the static labor demand models we refer to the short-run, when capital inflows are fixed and there are no adjustment costs. There are two stages for the optimization of the firm. First, the firm optimizes its costs (*substitution effects)* and at a second stage it chooses the combination that maximizes its profits (*scale effects).* The optimization problem can be used with the same way if there are more than two inputs.

2.4.1. Cost optimization

The firm uses a production function of the form:

$F(K,L)$ where K and L stand for the inflows of capital and labor and has a cost function of the form:
$C(w,R) = w\,L + RK$ where w and R stand for the prices of labor and capital . Each firm aims to minimize its costs under the budget constraint
$F(K,L) \geq Y$ where Y is a given quantity of production.
If optimization leads to an interior solution, then the firm chooses the minimal cost function possible under a production limit $C(w,R,Y)$.

Also, the ratio of the prices of labor and capital equals the marginal rate of substitution. As preferences are monotonic the budget constraint always binds.

$F_L(K^*,L^*)/F_K(K^*,L^*) = w/R$ and $F(K^*,L^*) = Y$

2.4.2. Profit maximization

After the definition of the minimum cost function for the firm, then the second step is to choose the quantities of production that maximize its profits.

The firm uses a profits function of the form:

$\Pi(w,R,Y) = P(Y)Y - C(w,R,Y)$ where $P(Y)$ stands for the inverse demand function.

If optimization leads to an interior solution, then the marginal productivity of each factor is equal to its real cost multiplied with the markup.

$F_L(K,L) = \lambda w/P$ and $F_K(K,L) = \lambda R/P$

When the market case is that of perfect competition ($\lambda = 1$) then the equality of marginal productivity of each factor and its price is confirmed.

2.4.3. Cost of Labor

It has been assumed up to this point that there is homogeneity between the working hours and the quality of work during the working time. This is not always the case, as there is imperfect substitutability of workers and hours worked. So, each firm has to find the optimal working hours that minimize its cost of production.

The total cost of production function is of the form:

$C = [\Omega T + (1 + x)\Omega(H - T) + Z]N + RK$ if H > T i.e. there is overtime or

$C = (\Omega H + Z)N + RK$ if H < T i.e. there is no overtime

where Ω, T, R, x and Z stand for the wage for normal hours, the standard workweek, the utilization cost of capital, the overtime premium and fixed costs. Each firm aims to minimize this costs subject to the constraint

$F[K, Ne(H)] \geq Y$ where $e(H)$, N and Y stand for efficiency, number of hours worked and a given production level respectively.

If optimization leads to an interior solution, then the firm gets the optimal working hours for each case of possible or no overtime, that depends on the elasticity of efficiency (ε^{e}_{H}).

2.5. Review of the empirical literature on labor demand

The empirical studies on the static models of labor demand show that there are two methods used. In the first method a specific production function is assumed and on this basis it is set a cost and profit function. In the second method, it is *a priori* set a cost function without a specific production function.

Basic production function types

The most common used production function type is the *Cobb-Douglas:*

$Y = AK^{\theta(1-\alpha)}L^{\theta\alpha}$ where K, L and θ stand for capital, labor and degree of homogeneity of production function and with $0 < \alpha < 1$. Based on the theoretical analysis before with the optimization method is obtain a similar type cost function:

$C(w,R,Y) = (w/\alpha)^{\alpha}(R/1 - \alpha)^{1-\alpha}(Y/A)^{1/\theta}$

The basic problem that studies meet in the use of the Cobb-Douglas function is that it assumes that elasticity of substitution between the two inputs is equal to one and that is

a too restrictive term. In order to surpass this problem it is preferred a less restrictive type of production function named *Constant Elasticity of Substitution function (CES).*

The CES production function is of the type:

$Y = [(\alpha_L L)^{(\sigma-1)/\sigma} + (\alpha_K K)^{(\sigma-1)/\sigma}]^{\theta\,\sigma/\sigma-1}$ where σ is the elasticity of substitution and $\sigma,\alpha_K,\alpha_L>0$. Again with the use of the methods explain in the theoretical literature before it is obtain a cost function of the type:

$C(w,R,Y) = [(w/\alpha_L)^{1-\sigma} + (R/\alpha_K)^{1-\sigma}]^{1/1-\sigma}\ Y^{1/\theta}$

Basic cost function types

Empirical studies tried to find the best fit cost functions considered its properties (homogeneity, concavity etc.) and found two mostly used types of cost function. The first type is called *Generalized Leontief Function* and is of the form:

$C(w_1..w_n,Y) = Y^{1/\theta}\Sigma_{i=1}^{n}\Sigma_{j=1}^{n}\alpha_{ij}(w_i)^{1/2}(w_j)^{1/2}$

With the use of Sheppard's lemma it can be seen that the elasticity of substitution is of the form:

$\sigma_{ij} = \alpha_{ij}(w_i w_j)^{1/2}/2s^i s^j$ and which not a constant and depends on the share of each input to total cost too(s^i,s^j). This property of the Leontief function makes it more desirable to use than a CES production function. Besides the Leontief function there is one more commonly used cost function named *Translog cost function* because it is used a transcendental logarithmic form:

$lnC = \alpha_0 + \Sigma_{i=1}^{n}\alpha_i lnw_i + 1/2\Sigma_{i=1}^{n}\Sigma_{j=1}^{n}\alpha_{ij}lnw_i lnw_j + 1/\theta lnY$

With the use of Sheppard's lemma again elasticities of substitution can be extracted

$\sigma_l^{\,j} = \alpha_{ij} + s^i s^j/s^i s^j$ and $\sigma_i^{\,i} = \alpha_{ii} - s^i + (s^j)^2/(s^i)^2$ and here again the elasticities are not constant.

2.4. Dynamic labor demand models

In the dynamic perspective of labor demand theory the basic term that distinguished from the static models is that of *adjustment costs.* In the dynamic models firms are getting reorganized in the long run due to several reasons (such as technology changes, market constraints etc.). These reorganization changes are expressed through adjustment costs.

2.4.1. Form of adjustment costs

The basic distinction regarding adjustment costs are between *internal* and *external.* Internal adjustment costs exist when the working process in a firm is reorganized and during this process there is a loss of efficiency. This type of costs cannot be easily evaluated. The external adjustment costs exist when these costs are distinct and thus a value can be placed on them. A change in the working hours -so in the wage too- consists on a mixture of internal and external costs. Another distinction on adjustment costs that influence wages is that of *hiring* and *separation* costs. There are several studies on this matter that show that in countries with a stricter legal system on job security (such as France) the separation costs are much bigger than the hiring costs. From the other side, in countries that the legal system is more relaxed on job security (see USA) the opposite is true.

2.4.2. Specification of adjustment costs

Quadratic costs

The quadratic expression of adjustment costs are of the form:

$b\,(\Delta L_t - a)^2$ where $a,b > 0$ and $\Delta L_t = L_t - L_{t-1}$,

This expression was suggested by Holt *et al.* (1960) but had the shortcoming of suggesting a positive adjustment cost even in the absence of variation in employment. Then came a study by Eisner and Strotz (1963) who suggested setting $a = 0$ but again there were two related problems: there was no separation between hiring and firing costs and also it supposes a gradual adjustment of employment with a change in the level of employment.

Asymmetric Convex Costs

Pfann and Palm (1993) suggested that adjustment costs were asymmetric (between an increase and a decrease in employment) and more specifically proposed the form:

$C(\Delta L) = -1 + exp(\alpha \Delta L) - \alpha \Delta L + b/2 (\Delta L)^2, \alpha > 0, b > 0$

Linear Costs

The linear form of asymmetric adjustment costs is:

$C(\Delta L) = C_h \Delta L$ if $\Delta L \geq 0$ and

$C(\Delta L) = C_f \Delta L$ if $\Delta L \leq 0$ where C_h and C_f stand for respective unit costs of hiring and firing.

Lump-sum Costs

Many costs aren't linked to the size of the adjustment. This discontinuity in adjustment costs is surpassed with the use of lump-sum costs, which help to explain many cases in empirical studies such as the hiring and firing in groups that exist in some countries such as in France.

***

The analysis on both the static and the dynamic models of labor demand will help the reader to understand the full perspective of labor market and how the tools are combined for the optimal set of wages.

The estimation of structural labor supply and demand models are demanding in terms of the data required. When such data do not exist, researchers proceed by estimating reduced form models in which only exogenous variables enter as independent variables. This is the route we are going to follow in Chapter 4.

3. Descriptive analysis

The Greek economy has undergone profound changes during the last five decades. These changes culminated in the entrance of Greece in the Euro Area (EA) at the dawn of the 21st century. Taking this event as a landmark we could distinguish three phases in Greece's economic development: the first includes the years up to 2000, when Greece met the criteria to enter the EA. The second phase covers the years between 2001 up to 2007 (inclusive), when Greece had positive growth rates. The third phase refers to the period post 2007 and until 2016 inclusive during which GDP has been declining in every year, with the exception of 2014, and Greece has been under a financial assistance program. The Greek labor market also changed along during these three phases and the presentation below tries to give more details about developments in the participation of women in the labor market.

3.1 Trends in Greek female participation rate, 1961-2011

While census data do not come at very high frequency they permit us to draw a picture over the long run and it is with this data that we start the analysis. Using such data we can see that between 1961 and 2011 the female labor force participation rate has increased significantly, although it still lags behind both the EU average and the rates in the largest EU countries (as Figure 1 in the Introduction suggests). Between 1961 and 1971, the female participation rate declined for all age groups (see Table 1). Between 1971 and 1981 the overall female participation rate remained constant at below 30% although developments varied by age group: there was a decline in the participation rate for those below 20 years old – as girls stayed in school for longer – and an increase for individuals in other age groups.

Table 1 Female labor force participation rates by age groups, 1961-2011						
Age	**1961**	**1971**	**1981**	**1991**	**2001**	**2011**
15-19	46.8	28.7	23.3	17.4	11.8	6.4
20-24	52.2	37.1	39.3	48.8	52.1	46.1
25-29	43.6	32.7	37.7	54.5	67.0	73.9
30-34	38.6	30.7	33.7	51.3	64.3	72.9
35-44	37.1	30.5	30.9	44.6	60.2	69.5
45-54	34.5	28.1	27.3	29.4	45.7	56.3
55-59	27.3	-	20.0	17.1	26.0	32.1
60-64	21.0	-	13.4	10.2	12.8	14.7
15-59	40.3	-	30.3	37.9	49.6	56.1
15-64	39.0	29.1	29.1	35.2	46.2	52.3
Source: ELSTAT, Population Census, 1961-2011						

From 1981 the participation rate started to increase and by 2011 the female participation rate is over 20 percentage points higher than in 1981. The largest increase took place between 1991 and 2001 when the participation rate increased by over 10 percentage points. The only age group for which the participation rate declined is the 15-19 group, for which the rate decreased from 46.8% in 1961 and 23.3% in 1981 to 6.4% in 2011. For all other age groups there is an increase between 1981 and 2011. In fact, for individuals aged between 35 and 54, the participation rates more than doubled.

3.2 Economic and social changes and female participation rates

An important year for the Greek economy was 2001, the year in which Greece entered the EA and changed its currency to the euro. Table 2 below shows that the gross national income per head rose substantially during the decade before EA entrance.

Table 2 Gross National Income per head in EUR thousands, Greece, 1961-2011	
1961	0.6
1971	1.6
1981	5.1
1991	8.5
2001	14.1
2011	18.1
Source: European Commission, AMECO Macro-economic Database	

Gross national income per head increased by 3.4 thousand euro between 1981 and 1991 (from 5.1 to 8.5 thousand) while between 1991 and 2001, per capita income was higher by 5.6 thousand euro, double the difference of the previous decade.

These changes affected not only the economic status of the country, but also the social norms of the country (e.g. attitudes with respect to education). Economic development gave the trigger for reforms in the labor market too, many of which are related to female labor market participation. One of the most important institutional changes was the one that took place in the second half of 1970, when in the 1975 Constitution it was stated that regardless of gender or other reason, all employees have the right to get the same salary given work of the same value (see Nicolitsas, 2006). From the mid-70's more institutional interventions have taken place in order to rationalize the labor rights of females.

Table 3 suggests that those aged 30-39 in 2011 have completed a much higher education level than those who belonged to this age groups twenty years before and are now 50-59. The data above show that the education status of women has changed as the economy of Greece developed. Women get higher education and that is a factor that explains up to a point the rise in the rate of labor participation.

Table 3: Distribution of female population (20 years old and over) by level of completed education								
Age	No education	Preschool	Primary	Lower Secondary	Upper secondary	Higher	Post-secondary	Total
80+	15.2	27.6	41.4	4.4	7.8	0.7	2.6	100.0
70-79	11.3	23.8	42.7	5.6	10.9	1.2	4.2	100.0
60-69	2.4	6.3	53.0	7.5	17.9	2.8	9.8	100.0
50-59	1.1	1.5	35.0	10.7	28.9	5.4	17.1	100.0
40-49	0.9	0.7	15.7	13.0	36.2	7.0	26.2	100.0
30-39	1.0	0.6	7.3	10.1	35.9	14.2	30.7	100.0
20-29	1.1	0.7	5.1	6.5	43.1	11.1	32.1	100.0
Source: ELSTAT, Population Census, 2011								

Table 4 Distribution of employed females aged 15-64 by status in employment, 1971-2011					
Year	Employers	Self-employed	Unpaid family members	Employees	Total
1971	1.0	12	59.7	27.3	100.0
1981	1.0	11.8	29.1	58.1	100.0
1991	4.3	18.2	12.1	65.4	100.0
2001	8.0	10.9	10.7	70.4	100.0
2011	5.1	16.8	2.6	75.5	100.0
Source: ELSTAT, Population Census, 1971-2011					

Besides the fact that, as already mentioned earlier, female labor force participation has increased significantly over time, employed women also occupy better positions in the labor market. The typical woman worker today is more likely to be an employee in contrast to a woman in the 1970s who was more likely to be an unpaid family member (see Table 4). As already mentioned, the factors behind this change are not only economic but also social as the Greek society has changed a lot through the last four decades. Women are no longer only responsible for the housework given they also receive a much better education, especially in the last 20 years as Table 3 shows.

The change in employment status referred to above is also connected with the changes in economic composition as the Tertiary sector (that one related to Services), in which women are more likely to be employed compared to manufacturing, has been expanding

to the expense of the Primary sector (the sector covering Agriculture, Forestry, Fishing etc..) and the Secondary sector (Mining, Manufacturing, Construction). In 2011, the Tertiary sector produced about 75% of the economy's gross added value, when in 1961 it produced around 56% (see Table 5).

Table 5 Gross added value at current prices, 1961-2011 (EUR billion)

Sector/Year	Primary	Secondary	Tertiary
1961	0.7	1.3	2.6
1971	1.4	4.9	7.4
1981	5.3	17.5	25.9
1991	7.4	28.7	49.5
2001	7.9	44.5	98.1
2011	6.1	44.5	147.5

Source: European Commission, AMECO Macro-economic Database

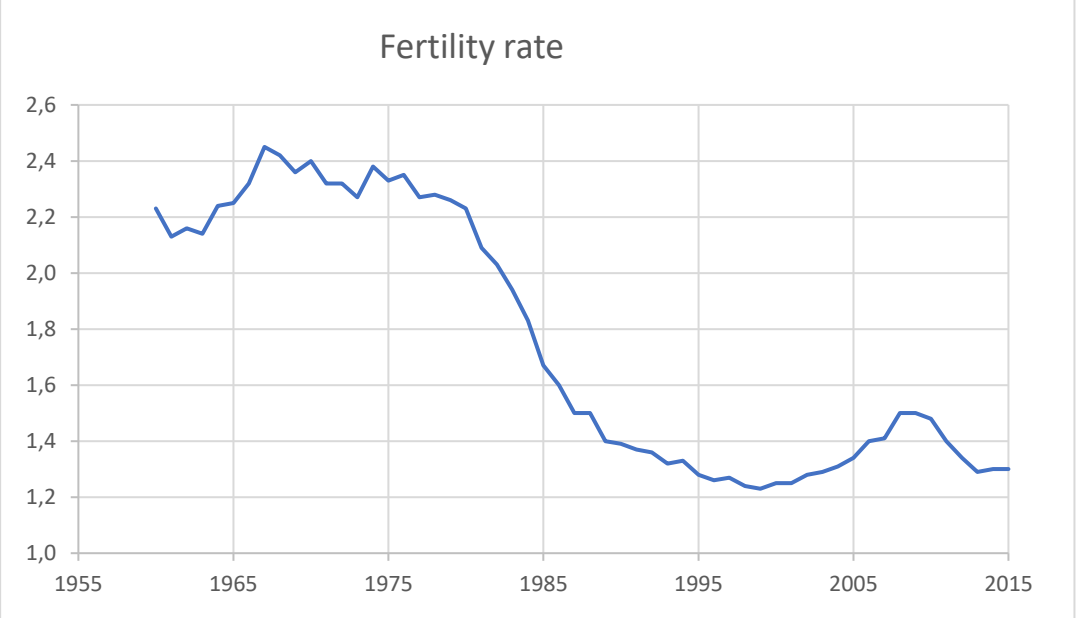
As expected this change in the composition of output had an impact on employment distribution across sectors. More specifically, we note a shift of employment from the Primary sector to the Tertiary sector. There is an exponential increase from 1961 to 2011 in the percentage of female employment in the Tertiary sector (the category (2) in table 5). The percentage in 2011 (36.8%) was about four times bigger than in 1961 (10,2%).

In 1961 82.2% of women were employed in occupations that did not need any special skills - most of them in agriculture and livestock-related activities- and only about 18% of them were employed in professions that needed higher educational levels. As data suggest the percentage of women employed in occupations demanding higher skills rose a lot, and by 2011 this was about four times higher than in 1961 (77.3%). That is in accordance with the argument that women through the last decades get better education and this is also reflected in the quality of their jobs. This issue is strongly connected to the education matter discussed before. As Table 6 shows, there is a big shift of female employment from occupations that don't require high-level skills to professions that require higher educational level.

Table 6 Percentage of employed women by occupational categories, 1961-2011						
	1961	1971	1981	1991	2001	2011
Occupations that typically demand a higher level of education						
Professional and technical (1)	3.7	7.1	14.2	21.1	31.4	24.4
Service and sales (2)	10.2	14.5	18.6	24.4	17.5	36.8
Clerical (3)	3.7	9.1	16.5	19	16.3	11.7
Managerial (4)	0.2	0.2	0.9	4.3	7	4.4
(1) + (2) + (3) + (4)	17.8	30.9	50.2	68.8	72.2	77.3
Other occupations						
Craft, operatives and non-farm workers (5)	13.6	15.5	17.5	14.9	12.9	16.3
Farm workers (6)	68.6	53.3	32.3	16.3	14.9	6.1
(5) + (6)	82.2	69.2	49.8	31.2	27.8	22.4
Source: ELSTAT, Population Census, 1961-2011						

Another important issue that has to be mentioned is that of fertility rates in Greece. As it can be presumed it is an important matter for women and it can affect their decision to enter the labor market. As Figure 3 shows, there is a declining trend in fertility rates in Greece from 1965 onwards. While in 1960 each woman had 2.23 births, the corresponding figure was 1.30 births in 2015. This is compatible with a situation in which women have decided to devote more of their time to other activities besides raising children. This could in fact be a factor behind increased labor participation rates. Women have put family to one side and they are focusing on their careers. It is also important to note at this point that the economic downturn that started in Greece in 2008 is likely to be a reason behind even lower fertility rates more recently. The big reduction in income makes it more difficult to care for children and women have to enter the labor market in order to support family income (added worker effect). While this is an important point that plays its role, from Figure 3 we can observe that the declining rate in fertility rate dominates the whole period post-1975.

Figure 3
Fertility rates (births per woman), Greece, 1960-2015



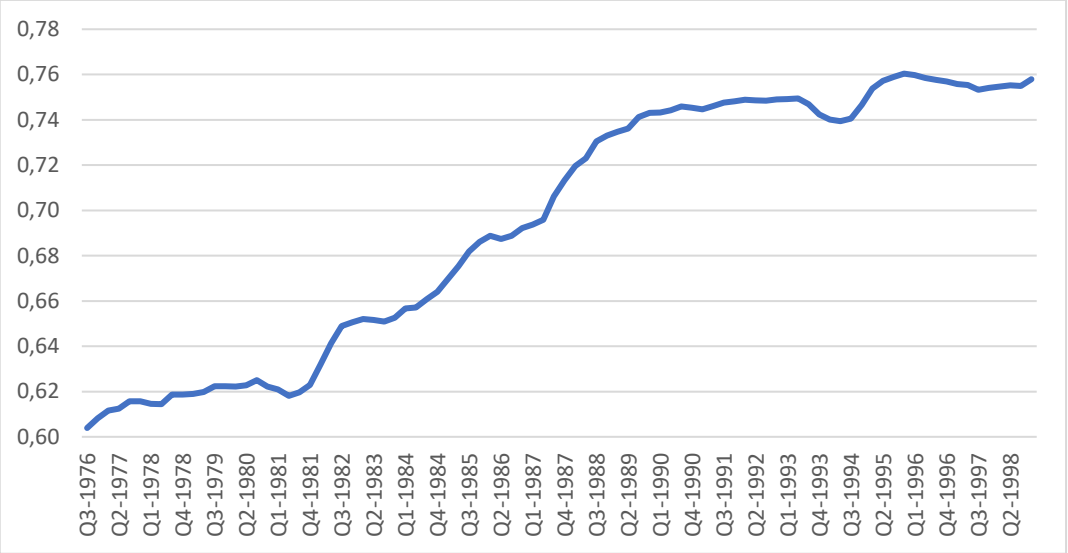
Source: World Bank, DataBank

The decline in fertility rates is also reflected in the ageing of the population as Table 7 demonstrates. The share of individuals between 0 and 34 years old has decreased over time while the share of individuals older than 34 has increased. The increase is more significant for individuals aged 75 and above. As labor supply differs by age group, given life-cycle decisions about marriage and education, we would expect a change in participation due to demographic developments.

Table 7 Distribution of the population by age group (%)												
	1961		1971		1981		1991		2001		2011	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
0-14	28.1	25.4	26.7	24.1	24.8	22.6	20.1	18.4	15.8	14.6	15.1	14.4
15-19	7.6	7.2	7.9	7.3	7.7	7.1	7.8	7.1	7.0	6.3	5.4	5.0
20-24	8.7	8.6	7.7	6.9	7.4	7.2	7.9	7.5	8.1	7.2	6.1	5.7
25-29	8.5	8.7	5.7	5.8	6.9	6.7	7.1	7.0	8.1	7.4	7.0	6.6
30-34	8.4	8.5	6.6	7.2	6.7	6.7	7.1	7.1	8.2	7.8	7.9	7.6
35-39	6.2	6.3	7.3	7.4	5.7	5.7	6.8	6.5	7.2	7.1	7.7	7.6
40-44	5.2	5.6	7.5	7.7	6.6	6.9	6.7	6.5	7.2	7.1	7.8	7.9
45-49	6.0	6.0	5.7	5.8	6.9	6.7	5.5	5.4	6.6	6.5	6.9	7.2
50-54	5.6	5.5	4.8	5.2	6.8	6.9	6.3	6.5	6.2	6.3	6.7	7.1
55-59	4.7	4.7	5.4	5.5	4.9	5.1	6.4	6.4	5.0	5.2	6.1	6.4
60-64	3.7	4.3	4.9	5.1	4.0	4.5	6.1	6.5	5.5	6.2	5.7	6.1
65-69	2.5	2.9	3.9	4.2	4.2	4.6	4.2	4.7	5.4	6.0	4.6	5.0
70-74	2.0	2.7	2.7	3.4	3.4	3.9	3.0	3.7	4.6	5.4	4.6	5.6
75+	2.7	3.4	3.1	4.4	4.0	5.3	5.1	6.7	5.1	6.9	8.3	11.6
Source: ELSTAT,Population Census, 1961-2011												

Besides the changes that have taken place in the last decades regarding the education level, the number of children and the other variables we referred to above, one of the most important factors impacting on the decision to enter the labor market, as presented in detail in Chapter 2, is the level of wages. As Figure 4 shows for the period 1976 to 1998 the ratio of women's to men's salaries has been trending upwards strongly and has most likely contributed to the increase in the female labor market participation (see Nicolitsas, 2006).

Figure 4: Ratio of female to male regular monthly payments in manufacturing firms with over 10 employees, Q3:1976-Q2:1998

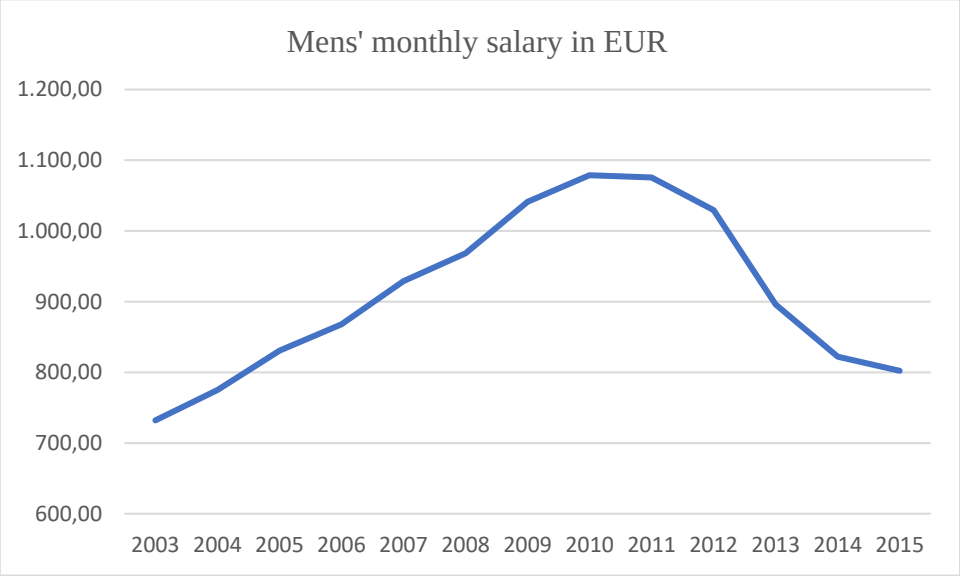


Source: ELSTAT, Labor Statistics

The period from 1976 to 1998 refers to the years before entrance to the EA. Figures 5 and 6 shows the trend of monthly wages for men and women for the period following EA entrance. As Figure 5 shows men's' salaries increased by almost 60% between 2003 and 2011 - from an average monthly salary of about 730 euro in 2003 men's' salaries reached their peak of about 1100 euro in 2010. From 2010 salaries started to decrease significantly. Between 2010 and 2015 men's' salaries decreased by about 35% (from 1078 euro to 801 euro in 2015).

Figure 5

Average monthly salaries of full-time men employed in firms with less than 10 employees

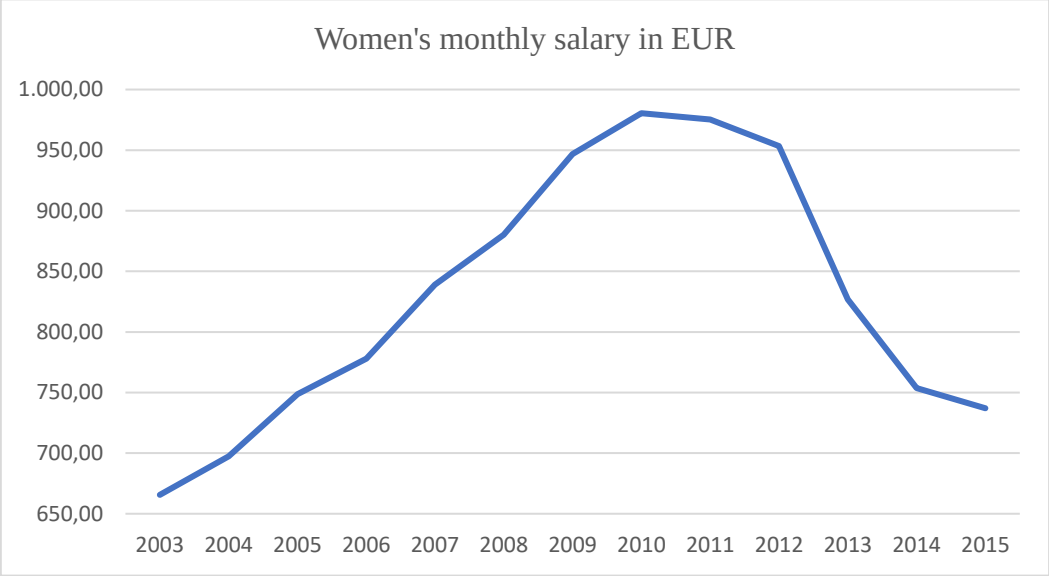


Source: IKA, Labor Statistics

Women's wages appear to follow the same trend over the same period. As Figure 6 shows women's wages increased by about 40% between 2003 to 2010 (from 665 euro in 2003 to 980 euro in 2010). In more recent years, women's salaries also declined, following the same path as men's' salaries, and in about the same percentage (from 980 euro in 2010 wages fell to 736 euro in 2015).

Figure 6

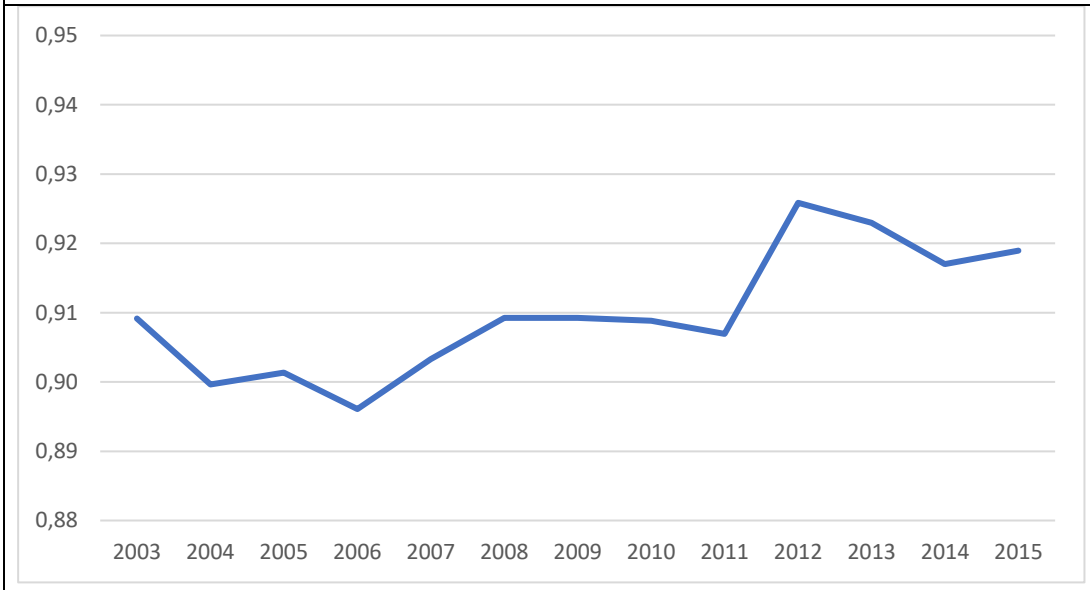
Average monthly salaries of full-time women employed in firms with less than 10 employees



Source: IKA, Labor Statistics

The most interesting point from the last two Figures is that the gender gap in salaries seems to have remained stable and might have declined somewhat post 2011. More specifically, the salaries ratio was 0.90 in 2003 and the fluctuations for the period 2003 to 2015 were minimal (0.91 in 2015).

Figure 7: Ratio of female to male monthly salaries in firms with less than 10 employees, 2003-2015



Source: IKA, Labor Statistics

The above descriptive analysis suggests that a number of factors could have contributed to the increase in the participation rate of women: their improved educational status (and thus the wage they could get in the labor market), the reduction in family size, the increase of wages and the demographic changes in the population (if we assume that very young individuals will participate less because they stay for longer in education). We next proceed to look at the impact of these factors on labor force participation in a more systematic way.

4. Econometric Research

The data used in this thesis are from the Greek Labor Force Survey (GLFS) for the period 1993 to 2016. The GLFS is a sample survey of individuals aged 15 and above conducted since 1981 from ELSTAT (Hellenic Statistical Authority). For the period from 1981 to 1997 statistics were collected only for the second quarter of each year. From 1998 data are collected quarterly. This thesis uses data from the second quarter of each year.

This thesis uses for the analysis a sample of 692.627 females aged 18-64 years old, which amount to about 29.000 observations per year. The oldest individuals in the sample used herein are born in 1929 and the youngest in 1998 (see Table 8).

Table 8 contains the Summary Statistics of the sample used. As shown, approximately one out of two women decide to participate in the labor market (52%). Around 70% of the women in our sample are married, 23% are single while another 8% are widowed or divorced. Around 58% of the women in our sample have no children while 42% have one or more children. About 21% of the women we observe have completed Tertiary education and this percentage is the same for the partners of married women.

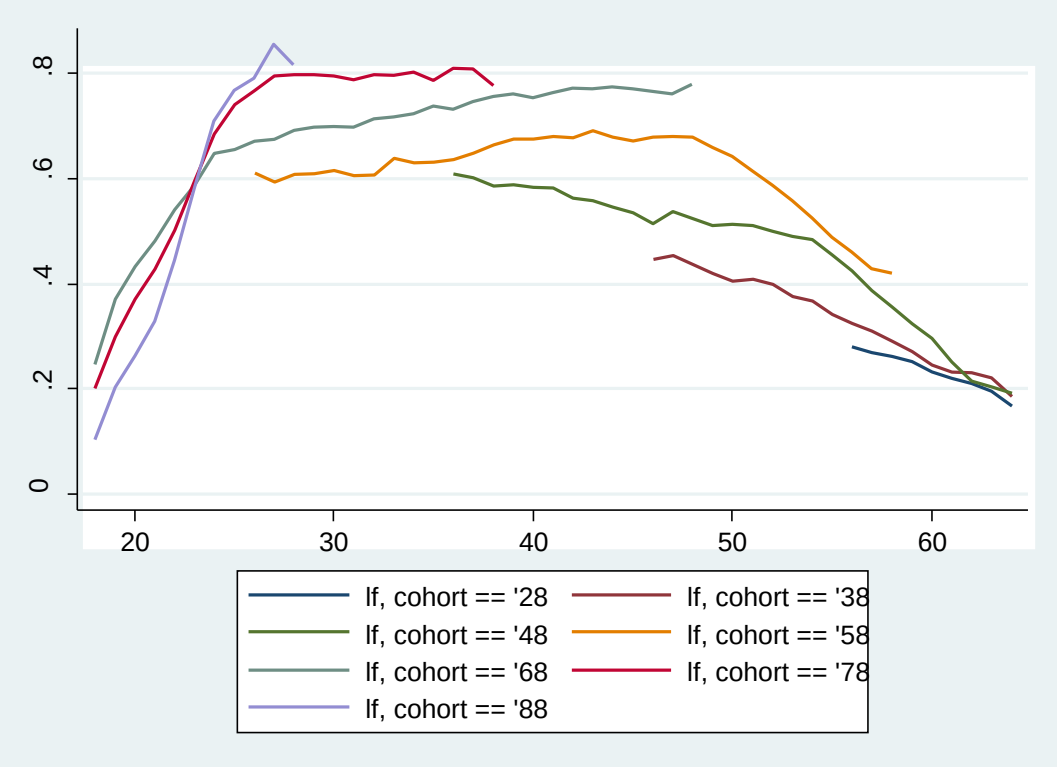
Table 8 Summary Statistics of the sample used				
	Mean	Min.	Max.	#Obs.
Participate	0.52	0	1	692,627
Position in household				
Single	0.23	0	1	692,627
Married	0.69	0	1	692,627
Widowed or Divorced	0.08	0	1	692,627
Children				
No children	0.58	0	1	692,627
One or more children	0.42	0	1	692,627
Education woman				
Primary	0.04	0	1	692,627
Lower secondary	0.43	0	1	692,627
Higher secondary	0.32	0	1	692,627
Tertiary	0.21	0	1	692,627
Education male partner				
Primary	0.04	0	1	446,459
Lower secondary	0.51	0	1	446,459
Higher secondary	0.24	0	1	446,459
Tertiary	0.21	0	1	446,459
Age	41	18	64	692,627
Period (year)	2001	1993	2016	692,627
Cohort (year of birth)	1960	1929	1998	692,627
Source: ELSTAT, GLFS 1993-2016				

We divide our sample according to year of birth into 7 cohorts. Each cohort contains individuals born within a decade starting in 1929. Figure 8 shows the participation rates of females by cohort and age. The first cohort contains individuals born between 1929 and 1937. By 1993, when our sample starts, the individuals born in 1929 are 64 years old and those born in 1937 are 56 years old. The participation rates of these individuals are presented with the dark blue line in Figure 8. As expected the participation rate is declining as individuals are approaching retirement. What is interesting, however, is that for subsequent cohorts the participation rate is higher. The most significant difference is observed for the individuals born in the fourth of the cohorts we examine (dark yellow line); those born in 1958 are the last individuals in our sample which we observe being in this interval having reached the age of 58 by 2016. On the other side

of the spectrum, we observe individuals that were born between 1988 and 1998 and their participation rate is depicted with the light purple line. For those individuals until about the age of 25 the participation rate is lower than for the previous two cohorts while after the age of 25 we observe that the participation rate has increased considerably. For the age groups between around 30 years old and 40 years old we observe that the more recent the cohorts, the higher the participation rates. Thus, while participation rates were declining after the age of 40 for older cohorts (those born until 1958), for the cohort represented by those born in the interval 1958 to 1967 we observe no such decline.

Figure 8

Female participation rates by birth cohort and age (%).



Source: GLFS 1993-2016

Moreover, we observe no obvious motherhood dip between the age of 25 to 35 although the labor force participation rate ceases to increase at least for the one before the last cohort. In other studies, see, for example Knoeff, van Vuuren and Euwals (2011) for the Netherlands, there is in fact a slight decrease in the participation rate between 25

and 35 years suggesting a possible motherhood dip. The absence of a clear motherhood dip for Greece may reflect that individuals choose not to have children but to work instead. This argument is in accord with the information presented in Chapter 3 where it was shown that fertility rates have been declining for Greece.

In our sample we observe individuals of the same age who belong to different cohorts and/or participated in the labor market under different economic circumstances. For example, we observe 40 year old women who were born in any year between 1956 and 1976. These individuals belong to different cohorts and made their decision about labor market participation when external economic conditions were different; these give us the cohort and period effects. At the same time we observe individuals of different ages between 18 and 64 years old; which gives us the age effect.

4.1. Model presentation

The statistical model used for the estimation of the determinants of female labor force participation is specified in this section. The analysis follows closely that presented in Euwals *et al.* (2011). A reduced form approach is followed in which we aim to disentangle the cohort, age and period effect on the labor market participation decision.

The model below specifies the decision of females to participate in the labor market where *i* indicates the individual and *t* stands for time.

$$lf^{*}_{it} = \beta_0 + \beta_1 x_{it} + m_a(a_{it}/\theta_a) + m_c(c_i/\theta_c) + m_y(y/\theta_y) + \varepsilon_{it} \quad (1)$$

where x_{it} is the vector that contains the control variables and α_{it}, c_i and y are the age, cohort and year effects, m denotes the transformation functions. The probability of participating in the labor market for individual i is specified as a binary Logit as follows:

$$\Pr\{lf_{it} = 1/x_{it}, \alpha_{it}, c_i, y\} = \Pr\{lf_{it}^{*} > 0/ x_{it}, \alpha_{it}, c_i, y\} = \exp(\beta_0 + \beta_1 x_{it} + m_a(a_{it}/\theta_a) + m_c(c_i/\theta_c) + m_y(y/\theta_y))/(1 + \exp(\beta_0 + \beta_1 x_{it} + m_a(a_{it}/\theta_a) + m_c(c_i/\theta_c) + m_y(y/\theta_y))) \quad (2)$$

where lf_{it} equals 1 if individual i participates in the labor market and 0 if not.

In case of a linear transformation function m we know that we cannot identify the cohort, age and year effect separately as the following identity holds:

$$y = c_i + \alpha_{it} \quad (3)$$

Following Euwals *et al*. (2011) we deal with the above problem in the following two ways: first, we proxy the period variable (y) using the unemployment rate of the individual by education level at the specific point in time and thus identity (3) no longer holds. This will be Model I in what follows. The second approach we follow is to assume that the cohort effects are not linear but are declining over time as the participation rates increase. This will be Model II in what follows.

4.2. Estimation

In this section estimation results are presented and discussed. The dependent variable is the labor force participation decision and is binary; it takes the value 1 when the individual participates in the labor market and 0 when the individual does not participate. We estimate two reduced form specifications using a logit model. As already mentioned the two specifications differ in the procedure used to identify the age, cohort and period effects. The independent variables in both models include demographic (age, family status) and productive characteristics of women and of their partners (education level). Model I proxies period effects with the unemployment rate by education level and Model II proxies cohort effects by a logarithmic transformation of the year of birth variable.

Starting with Model I, Table 9 presents in column (1) the coefficients of the relevant variable while column (3) presents the exponentiated coefficients. A coefficient with a positive sign in column (1) suggests that this variable is associated with a higher probability of labor market participation with a negative one showing the opposite. Column (3) has the following interpretation it shows the ratio of the odds of a woman with each characteristic examined (e.g. marital status, level of education etc) participating in the labor market to the odds of a woman in the reference group participating in the labor market holding all other variables in the model constant.

Compared to married women (the reference group) both single women and divorced or widowed women are more likely to enter the labor market. In fact, the ratio of the odds of a single woman participating in the market is double that than the corresponding odds

for a married woman (married women constitute the reference category for the *Position in the household* variable).

Children depress the probability of entering the labor market and this probability of abstaining from the labor market is higher the more children a woman has. This result could reflect the lack of childcare facilities and especially those provided by the state sector where it might be more difficult for families to get a place for more than one child. A related matter has to do with the recent economic downturn and the important change in the attitude of the employer towards female employees. In many cases employers are not willing to wait for the female employee to raise her children and they find it easier to give the job to a new employee with no children. This is an additional explanation also for the lower fertility rates of Greek women.

Higher education is associated with a higher probability of entering the labor market. In the context of the model being estimated here we could assume that the level of education proxies the wage rate. As far as the specific coefficients estimated on the education variable we find that, compared to individuals who have only completed Lower Secondary Education (Gymnasium), women who have completed Tertiary education are more likely to join the labor market. However, women who have only completed primary education are also more likely to participate in the labor market compared to Gymnasium graduates. This perhaps reflects the fact that some women, especially in the past, dropped out of school in order to work (mainly in agricultural or other unskilled occupations) to support their families.

Turning to the unemployment rate, the coefficient suggests that a woman is less likely to participate in the labor market when unemployment is at a high level, as the negative coefficient estimate for unemployment shows. This is linked with the *Discouraged Worker Effect*, according to which, as explained in Chapter 2, an individual is less likely to search for a job when the unemployment rate is high because he/she believes there are no jobs available (see Borjas, 2016).

Finally, regarding age compared to women of 45 years of age, women up to the age of 35 appear to have a lower probability of entering into the labor market. The probability of participating is less the younger the woman is until the age of 35. Post 35 years of age, the participation probability increases until the age of 44 and it decreases again

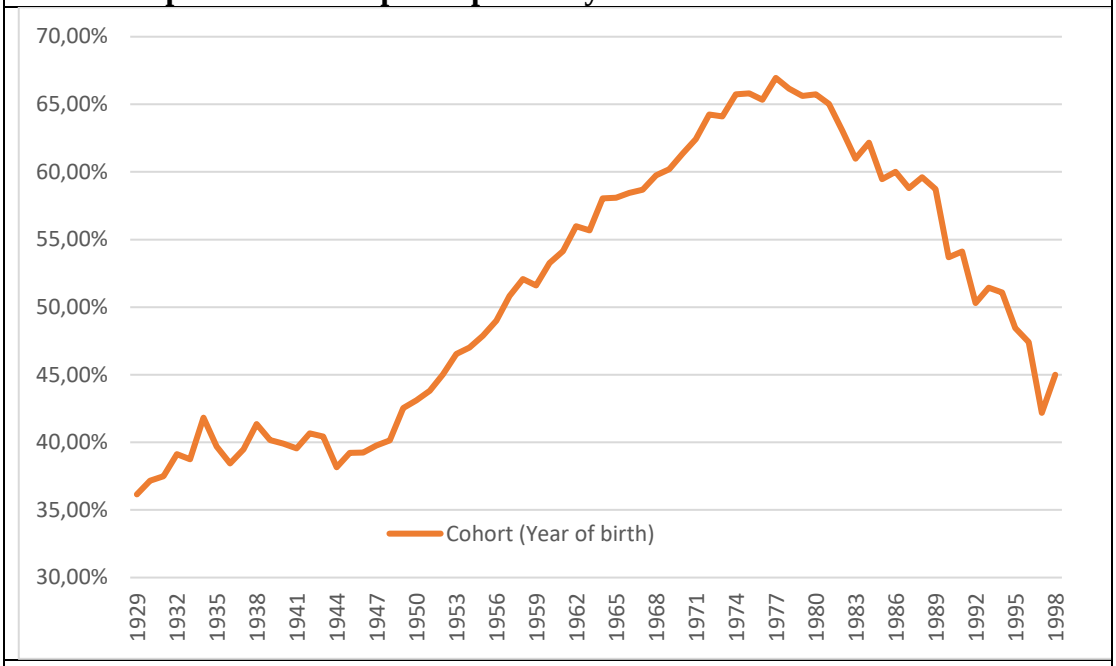
from 46 onwards. The marginal effects, i.e. the probability of participation at different ages, are presented in Figure 10.

Table 9 Logit estimates of equation (2) (Model I)				
Estimation results				
	Coefficient estimates (βs)	S.e.	Odds ratios (exp β)	S.e.
Position in household				
Married (Reference group)				
Single	0.716***	0.0100	2.047***	0.020
Divorced/Widowed	0.389***	0.00959	1.475***	0.014
Children				
No children (Reference group)				
One child	-0.0631***	0.00759	0.939***	0.0071
Two children	-0.229***	0.0086	0.795***	0.0069
Three children	-0.401***	0.0141	0.669***	0.0094
Four to six children	-0.426***	0.0256	0.653***	0.017
Seven children or more	-0.538***	0.184	0.584***	0.11
Education				
Lower Secondary (Reference group)				
Primary	0.0967***	0.0136	1.101***	0.015
Higher Secondary	-0.0308***	0.00812	0.969***	0.0079
Tertiary	1.166***	0.008	3.209***	0.026
Period effect				
Unemployment	-0.112*	0.065	0.894*	0.0584
Age	Yes		Yes	
Cohort (Year of birth)	Yes		Yes	
Log-likelihood	-443,201.23		-443,201.23	
Pseudo-R^2	0.143		0.143	
Number of observations	746,721		746,721	
***, **, * suggest significance at 1%, 5% and 10% level respectively				

Figures 9 and 10 show the estimated unobserved cohort and age effects based on Model I. Figure 9 suggests that Model I has difficulty in explaining the increase in the participation rate for women born between 1950 and early 1970s. Post the early 1970s the cohort effects are declining perhaps because variables such as the family status and the education level which differ by cohort, as indicated in Chapter 3, capture the cohort effects.

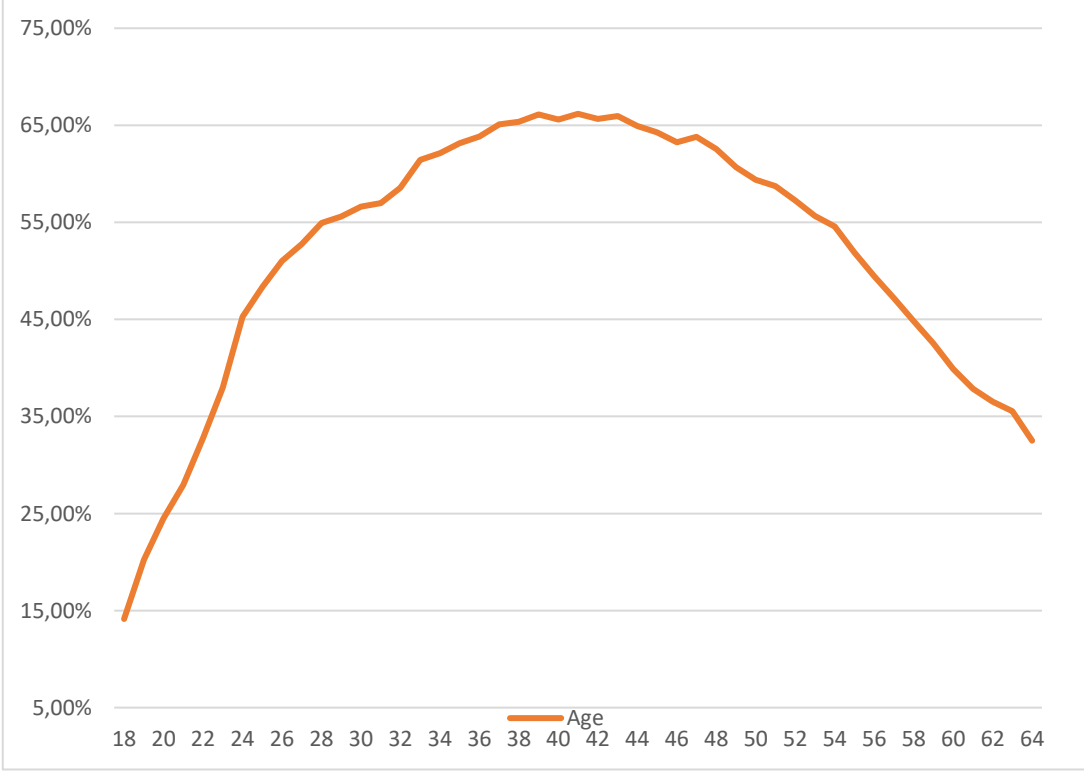
Figure 10 shows estimated probabilities of participation by age given the other control variables in the model. We note that the unobserved effects increase rapidly until the early 30s. This could reflect the fact that women complete their education mainly in their 20s and having completed their education, then enter into the labor market. This part is similar to that observed in Figure 8. Post the early 30s and until the early '40s, Figure 10 shows a slight increase in the participation rate while in Figure 8 we observe a stable participation rate for this age group. The difference could be the result of controlling for marital status and children in the regression. Post-early 40s Figure 10 shows a decline in participation suggesting an effect of early retirement.

Figure 9
Estimated probabilities of participation by cohort



Source: GLFS 1993-2016

Figure 10
Estimation probabilities of participation by age



Source: GLFS 1993-2016

Besides the education level of the woman, that of her male partner also plays a role in her decision. Results, not presented here in detail show that the higher the education level of the male partner the more likely the spouse to participate in the labor market.

The results from Model II are presented in Table 10 and don't show significant differences with the estimates from Model I. The cohort variable takes on a positive effect which is significant only at the 10% level however, suggesting that there is a cohort effect remaining after having included the control variables in the model.

Table 10 Logit estimates of equation (2) (Model II)

Estimation results				
	Coefficient estimates (βs)	S.e.	Odds ratios (exp β)	S.e.
Position in household				
Married (Reference group)				
Single	0.687***	0.0100	1.989***	0.020
Divorced/Widowed	0.391***	0.00959	1.479***	0.014
Children				
No children (Reference group)				
One child	-0.0598***	0.00759	0.942***	0.0071
Two children	-0.227***	0.0086	0.797***	0.0069
Three children	-0.398***	0.0141	0.671***	0.0094
Four to six children	-0.428***	0.0256	0.652***	0.0166
Seven children or more	-0.557***	0.184	0.573***	0.105
Education				
Lower Secondary (Reference group)				
Primary	0.132***	0.0136	1.141***	0.0151
Higher Secondary	-0.0135***	0.00812	0.987***	0.0061
Tertiary	1.188***	0.008	3.282***	0.026
Period effect				
Year dummies	Yes	*	Yes	*
Age	Yes	*	Yes	*
Ln (Cohort - 1928)	Yes		1.0287*	0.0153
Log-likelihood	-445,527.97		-445,527.97	
Pseudo-R^2	0.138		0.138	
Number of observations	746,721		746,721	
***, **, * suggest significance at 1%, 5% and 10% level respectively				

Based on Model I and the marginal effects from the model's estimates, which give us the change in probability of participation when an independent variable changes by one unit, and using the values of the independent variables in 1993 and in 2016 we decompose the change in female labor force participation between the two years. Between 1993 and 2016 in our sample the female labor force participation rate increased by over 17 percentage points. The decomposition presented in Table 11 suggests that this increase is mainly due to an unobserved cohort effect (8 percentage points out of the total change i.e. 46.8%) and to the improvement in the education of women (5.8 percentage points, i.e. 33.85% of the total change). The change in age composition was the third most important factor. Period effects appear to be going in the opposite direction since the unemployment rate in 2016 was much higher than in 1993 and the unemployment rate had a negative coefficient.

Table 11 Decomposition of female participation growth 1993-2016	
Cohort effects	46.8%
Education effects	33.85%
Age effects	11.93%
Marital status	5.51%
Number of children	4.04%
Unemployment	-2.08%

5. Conclusions

In Greece female participation in the labor market has increased considerably in the past four decades. The increased participation rates have emerged from different type of changes that took place in the Greek economy. An important fact is the entrance in the Euro Area, which changed not only the economic status of the country but also the attitude people reacted to variables such as education or having a child to take care of. In order to try to understand the trends on female participation but also to analyze how a woman gets her decision to enter or not the labor market we use a binary age-period-cohort Logit model with data from 1993 to 2016 attained from the Greek Labor Force Survey (GLFS).

The purpose of this thesis is to explore the interaction between the female decision of participation with important proxy variables for women, such as the education level, the existence of children and family status they have.

The estimation results indicate that married women are less likely to enter the labor market compared to single or widowed/divorced women. The existence of children is a negative factor for the participation decision and the more children a woman has to take care of the less likely she is to work in the market. A possible explanation for the negative effect of existence of children may be the lack of childcare facilities in Greece, especially when a household has more than one child to take care of. The higher educational level of a woman stimulates her participation in the labor market. The same outcome exists for the educational level of the male partner for the married women. Unemployment plays a negative role on the decision of a female to search for a job, as when the unemployment rate is high the participation rates are lower.

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