



UNIVERSIDADE DA BEIRA INTERIOR  
Ciências Sociais e Humanas

# On the gender gap in labour market: Evidence of European Union countries

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## Resumo

O crescimento económico pode ser influenciado por várias externalidades positivas e negativas. Neste estudo é analisada a relação entre a desigualdade de género no mercado de trabalho e crescimento económico, utilizando um conjunto de países da União Europeia, recorrendo ao uso de dados anuais para o período de 2000 a 2012. Esta pesquisa enriquece a literatura atual pela análise econométrica aplicada, o modelo ARDL (*Autoregressive Distributed Lag*). Esta metodologia permite a avaliação das relações de curto e longo prazo entre as variáveis. Para medir a influência da força de trabalho de homens e mulheres no crescimento económico, realizaram-se duas regressões, um primeiro modelo que analisa o peso da Força de trabalho dos homens na economia, o segundo por sua vez analisa as mulheres. Por último, é realizado um terceiro modelo que estuda a desigualdade de género no mercado de trabalho e na educação. Usando a diferença da força de trabalho entre homens e mulheres e os índices de paridade para as taxas de matricular escolar dos três níveis de educação, confrontando esses diferenciais com o crescimento económico. Em suma, com esta investigação concluímos que a disparidade de género restringe o crescimento económico.

## Palavras-chave

Desigualdade de Género, Mercado de trabalho, Crescimento económico, Painel ARDL



# Resumo Alargado

Ao longo dos últimos anos a relação da desigualdade de género com o crescimento económico está cada vez mais presente no cerne do debate político em todo o mundo. Os estudos nesta temática têm sido crescentes, principalmente na última década, no entanto a maioria das abordagens ainda são teóricas, sendo a abordagem econométrica escassa, os resultados são bastante heterogéneos, pelo conjunto de dados, variáveis e horizonte temporal usado. A maioria da literatura existente diz-nos que a desigualdade entre homens e mulheres tanto no mercado de trabalho como na educação tem uma relação negativa com o crescimento económico, isto é, a desigualdade prejudica o crescimento, mas por outro lado existem alguns estudos que indicam o contrário, a desigualdade de género promove o crescimento económico dos países.

Nesta dissertação analisa-se a relação dinâmica entre o crescimento económico e a desigualdade de género no mercado de trabalho e na educação, e ainda é feita uma análise individual do sexo, de forma a perceber o peso da Força de Trabalho do Homem e da Mulher no crescimento económico, aplicado num painel de 20 países que integram a União Europeia para o período de 2000-2012. Este estudo diferencia-se dos demais pela metodologia aplicada, modelo autorregressivo com desfasamento distribuído (*Autoregressive Distributed Lag*). Este tipo de modelo suporta variáveis estacionárias em nível, e variáveis estacionárias nas primeiras diferenças, suporta também a inclusão de variáveis dummies. A metodologia ARDL também tem a capacidade de transmitir resultados viáveis mesmo com amostras pequenas, permite também a distinção entre efeitos de curto e de longo prazo entre as variáveis.

Para medir o crescimento económico foi utilizada a variável do Produto Interno Bruto, em moeda local constante. O índice de paridade para a taxa bruta de matrícula para os três níveis de educação, é usado para o estudo da desigualdade de género na educação, para a análise da desigualdade entre sexos no mercado de trabalho é calculada a diferença entre a Força de trabalho masculina e feminina, dividindo essa diferença pela Força de trabalho total, de forma a capturar o efeito do diferencial entre homens e mulheres no peso da Força de trabalho. Na análise individual por género foram usadas as Forças de trabalho por nível de educação (primário, secundário, terciário), bem como as horas de trabalho remunerado dos homens e das mulheres respetivamente. De forma a dar mais robustez ao estudo, foi aplicada a variável da idade média em que as mulheres têm os seus filhos, o Investimento Direto Estrangeiro, e ainda as seguintes variáveis de controlo de crescimento económico, a Taxa de Fertilidade, População em idade ativa e a Formação Bruta de Capital. Todas as variáveis foram convertidas em logaritmos naturais.

Nesta análise, foram realizados três modelos, modelo 1 que analisa o impacto da Força de trabalho dos homens, por sua vez temos o modelo 2, estuda as mulheres, e por último o modelo 3 que estuda a relação da desigualdade entre homens e mulheres no mercado de trabalho e na educação.

Foram realizados, o teste de dependência seccional (*cross-section dependence*) para todas as variáveis em estudo, a matriz das correlações e o VIF, fator de inflação da variância (*variance inflation factor*) para os três modelos, posteriormente os testes de primeira e segunda geração de raízes unitárias, devido à presença de dependência seccional na maioria das variáveis, mas não em todas. Foi realizado o teste Hausman para os três modelos, para estudar a presença de efeitos fixos ou aleatórios, resultando na existência de efeitos fixos para todos os modelos. De seguida ainda foram elaborados os testes de Especificação (Modified Wald test; Pesaran test; Wooldridge test), observando-se a existência de heterocedasticidade, correlação contemporânea e autocorrelação de primeira ordem, aplicando-se deste modo o estimador Driscoll e Kraay.

Os resultados obtidos neste estudo vão de encontro à maioria da literatura existente, no modelo 3 comprovou-se que a desigualdade de género no mercado de trabalho, bem como a desigualdade de género na educação ao nível secundário de educação tem um impacto negativo no crescimento económico. Com a análise do modelo 1 e do modelo 2 concluiu-se essencialmente, que a Força de trabalho do homem tem mais peso no crescimento económico do que a da mulher.

# Abstract

Economic growth can be influenced by positive and negative externalities. In this study is analysed the relationship between gender inequality in the labour market and economic growth, using the European Union countries with annual data for the time span from 2000 to 2012. This research enriches the current literature by using. In the econometric approach, the Autoregressive Distributed Lag model. Such methodology allows the appraising of short and long-run relationships separately. To measure the influence of the labour force of men and women in the economic growth, two regressions are performed, the first model analyses the height of Labour Force of men in the economy, the second model analyses the women. To analyse the gender inequality a third model is estimated, using the difference of the labour force and education of both genders confronted with economic growth. In short, the main findings indicate that gender gap constricts the economic growth.

# Keywords

Gender gap, Labour market, Economic growth, Panel ARDL



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## Acronyms list

UBI	Universidade da Beira Interior
EU	European Union
LF	Labour Force
GDP	Gross domestic product
ARDL	Autoregressive lag model
VIF	Variance inflation factor
ECM	Error correction mechanism.
ADF	Augmented Dickey-Fuller test
CIPS	Cross- sectionally augmented IPS
LLC	Levin-Lin-Chu
FE	Fixed effects
RE	Random effects
CD	Cross section dependence



# 1. INTRODUCTION

Gender inequality is more and more present at the core of political debate on economic development around the world. In the past few years, there has been an increase of studies in this area, but, nevertheless, the gender relevance as a macroeconomic variable has not been widely accepted by the economy. Gender inequality exists in several important dimensions related to well-being, such as education, health, employment or even salary, and this gender disparities are problematic since they reduce significantly the well-being (Klasen and Lamanna, 2009).

Throughout the last decades, gaps in health and education have declined substantially and in most cases, have completely closed down, however these improvements have not been accompanied by the economic and political parity. This verification suggests that different policies are needed to promote the economic and political parity, to guarantee equality, fully using women and men's power, which is essential to a sustainable economic development. The importance of this study is to broaden the discussion on this thematic in several specific areas, like education and labor market.

A basic premise for this research is that the gender effects on the economic growth will rely on the economy's structure, and this way the research focus will be a joint of developed countries, in the European Union. As time goes by women are more active in the labor market and the disparity in education is practically nonexistent between genders, therefore is important to realize if the disparity that still exists among men and women affects in any way the economic growth of this group of countries. The main goals of this paperwork are to comprehend the weight of men and women workforce in economics, and also to study the gender inequality of education and of workforce on economic growth.

In this research, was studied a panel of 20 countries of the European Union, for the period from 2000 to 2012. The main variables in study are the Gross Domestic Product (as a proxy for economic growth), the workforce by sex and by level of education, hours of paid work, in order to realize the time spent, by gender, in unpaid activities, the Education Parity Index, and finally, the differential between men and women in the workforce. The used model (ARDL) allows the short and long-term distinction between the variables, which enables to obtain robust results and to have perception of the variables behavior throughout time.

This study is organized as follows: Section 2 presents a literature review on the gender gap in labour market, education and economic growth relationships; Section 3 specifically studies the European case of gender inequality and the policies implemented to reduce it; Section 4 describes data, methodology and a preliminary analysis of the data, in Section results Section 5 discussion are presented Section 6 concludes.

## 2. LITERATURE REVIEW

Most of the existing literature focuses on the relationship between gender inequality in education and economic growth. This article follows the existence of this literature, but more specifically related to the labour market and its stakeholders. However, gender gaps in education and employment are not measuring the same thing, but at the same time they are interconnected which is important to put them in the research together. There is a considerable theoretical support about the notion of the gender disparities in education and in employment will decrease the economic performance.

The 90's, opened new ways for the integration of gender has a category of economic analysis, this allowed including gender in macroeconomic studies. This work was based in the articles of (Bakker, 1994), which made sure that economic policies developed perspectives in relation to gender in multiple countries. As a result of his work, the ground was prepared for introducing gender in macroeconomic models.

Throughout the literature, it is stated that gender differences in education reduce economic growth (King & Hill, 1993). Knowles (2002) use the model of growth of Solow and they found out that the gender differences on education has a negative effect and it is statistical significant at the level of gross domestic product. Dólar and Gatti (1999), Forbes (2000), Yamarik and Ghosh (2003), Appiah and McMahon (2002) and Klasen(2002), have also investigated the impact of gender disparity in education and its impact on economic growth, concluding that they have a negative impact on the subsequent economic growth.

Although, earlier studies suggested that income inequality in education could increase economic growth (Barro and Lee, 1994). According to Esteve-Volart (2004), gender disparities in education distort the economy by reducing the amount of talent that employers can employ in the labour market, reducing the average capacity of the workforce.

Regarding the labour market Elson, (1999) concluded that discrimination against women in the labour market is still persistent due to the absence of structural institutional changes, and this could be fixed regulating the labour market to establish equity and efficiency goals. The segregation of work by gender is a generalized characteristic in the majority of the economies, women tend to be overrepresented in jobs with lower remuneration, which explains a part of the wage difference between genders widely observable, (Jacobsen, 1997).

In the context of income inequality between man and women (Seguino, 2000) empirically investigates the determinants of economic growth for a set of semi-industrialized economies directed to exports, in which women provide most of the work in the exporter sector, showing that GDP growth is positively correlated with income inequality.

Kingdon (1998), examined the two forms of gender discrimination, the first form of gender discrimination is related to inequalities in the labour market with specific reference to job opportunities, the second form is related to the investment of the countries in education, and the author found that both forms of inequalities caused mainly by the disenchanting policies of the labour market is an important discriminating factor for the girls in relation to the boys.

Leading to what was mentioned before, for the gender inequality in education (Klasen ,2002) indicate that the exclusion of women in the labour market reduces the productivity of the workforce, superseding the more productive women by the less productive men. The women's employment growth, increases their bargaining power in families, which smooth the erosion of traditional norms that legitimize men's dominance over work and sexuality, Goldin (1990) and Seguino (2007). There is evidence that this renegotiation of bargaining power in favour of women, it is more like to say that reduce fertility, higher household savings, a larger fraction of income being diverted to investments in health and education, and reducing the girl's exclusion from family investment (Duflo, 2012).

Regarding to the externalities associated to the increase of female education, it is reducing fertility rates, reducing child mortality levels and it's promoting next-generation education, for each factor has a positive impact on economic growth (Galor and Weil, 1993) (Lagerlöf, 2003) and (King et al, 2007). Thus, it's presented a phenomenon, the reduction of the fertility levels of the last decades will drive to a favourable demographic constellation that (Bloom & Williamson, 1998), call "demographic present," the working-age population will grow much faster than the general population, thereby reducing dependency rates with positive repercussions on per capita economic growth.

Using a panel of countries and linear regressions (OLS), it was studied how far gender disparities in education and employment reduce economic growth, concluding that these disparities considerably reduce economic growth (Klasen and Lamanna, 2009).

Ferrant and Kolev, (2016), examined the impact of gender discrimination on economic *growth* in the context of cross-country analysis and found that gender inequality tends to reduce per capita income, its impact is more visible in low-income countries, reducing female capital stock, this crucial fact needs strong political reforms to reduce gender discrimination in all countries.

Kabeer,( 2016) argued for a different causal framework in order to assess the relationship between economic growth and gender equality, as it is evident in earlier literature that gender equality promotes economic growth in many countries, while reverse causality may promote gender equality while increasing economic growth, this inverse cause-effect relationship has some favourable policy implications for reducing gender disparity and promoting gender equality in all countries.

Most of the studies conducted in this thematic, are either theoretical or when data is studied, this data is collected through surveys and when studied econometrically in the large majority is performed a linear regression. This study consists of a short and long-term analysis between variables, as such an ARDL model was applied (Marques et al, 2016).

### 3. THE EUROPEAN CASE

Europe suffered a rapid transformation in the role of the women in the economic activity. The accommodation of women in the labour market occurs in a fast rhythm, forcing the family concept to accommodate such changes. The incorporation of women in the labour market disclosed their contribution to the wellbeing of the family, both in the monetary and materialistic way. These changes reveal the emancipation of women. This emancipation leads to change in the family context, in the natality rate and in consumption. To understand such “silent revolution” is necessary to unbrace all the different externalities.

In many societies, women are referred as fragile and require the protection of men, both financially and physically. This thinking emerged because, women after given birth are physically fragile and cannot work, becoming financial dependent. In this context, men emerged as the family guardian and with a strong nature. The development of society leads men to higher charges of administration in society, considering women as inferior being. Such thinking force women to become subdue to men, firstly to her father, secondly to her husband and if become a widow, to the oldest male son.

In the 1920's feminism emerged, influenced by the First World War and by the industrial revolution. Women from middle and upper class (with higher levels of education) began to occupy vacancies left by men. Women enroll in all economic sectors, since factories to management positions. This change raised emancipation of women that achieve their financial independence.

The EU emerged after World War II, with the proposed to ensure peace and stability and prosperity in Europe. Gender equality has been an objective of EU since 1957, with the implementation of Rome treaty. This treaty forces countries members to implement the same remuneration for a job performed by male or female. The gender equality has become one of the principal principles of the EU.

The EU strategies to promote the gender equality focuses on five principal points (Jurídica, 2017) :

- Raise the women participation the labour market and increase the economic independence;
- Reduce remuneration disparities among salaries and pensions, reduce the poverty among women's;
- Promote gender equality among men and women in decision-making positions;
- Fight against violence based on gender and victim caring and
- Promote gender equality and women rights worldwide.

The establishment of gender equality is positively correlated with the development of society. Through the ages, men and women fight for their role to become valorized, in a fair and equal way (European Commission, 2017).

In the few decades, the development of the EU members has been unequal, yet the applied policies and financial support of the EU as contributed to minimise the gender inequality. The European Union has promoted the employment of women and the balance between work and family life, setting targets, issuing recommendations, co-financing and mutual learning activities. Still in some countries is still possible to find many gender inequalities. As an example of such inequalities the unemployment rate for women, in the Southern Europe, the unemployment rate of women reached 27.2% against the 18.9% for men in Greece. In Spain 20.7% for women and 17.4% for men. In all countries, women are prone to jobs with partial time than men and with lower salaries.

The nature of the jobs that women are active in is important to understand the general level of employment. In one hand, about 32% of women work in jobs with partial time, in other hand, men with 9%. This leads to a decrease of career opportunities, and underutilization of human capital, leading to a decrease in economic growth. The EU with higher rates of female part-time jobs is the Netherlands, Germany, Austria, Belgium, United Kingdom, Sweden, Luxembourg, Denmark and Ireland. In positions of decision-making occupied by women only four countries, France, Italy, Finland and Sweden, with at least 30%.

The European Institute for Gender Equality (EIGE), has developed a study which indicates that a higher gender equality leads to higher employment benefiting women and men. There would be up to 10.5 million additional jobs by 2050, due to improvements in gender equality. If gender equality is substantially improved by 2050, EU employment rate will reach almost 80% compared to 76% in the absence of substantial improvements. The study also shows that improving gender equality has strong and positive impacts on GDP per capita. Improving gender equality would contribute to an increase in per capita GDP of up to 10% by 2050.

Inequalities in the labour market are also reflected in the pay gap between men and women. For every hour of work, women earn on average 16.3% less than men in 2015. This value is 20% in the Czech Republic, Austria, Estonia, Germany and the United Kingdom. Although the range of the difference is dissimilar, several underlying causes are quite comparable across countries. Recent research confirms that women work primarily in relatively low-wage sectors.

This explains a significant proportion of the gender pay gap in all EU countries. The same survey confirms that part-time and temporary contracts are associated with lower wages. The unequal distribution of care responsibilities between women and men is one of the main drivers of gender differences in employment, working hours and remuneration.

The principle of gender equality is included throughout the various treaties imposed by the European Union and the Directive (Jornal Oficial da União Europeia, 2006), on gender equality in the field of employment and occupation. That prohibits direct and indirect discrimination based on sex, but equal pay remains a challenge for all EU member states. Data for October 2016 show that women still account for less than one in four (23.9%) board members of the largest listed companies registered in the EU Member States. At the top executive level, women were even less well represented, representing only 5.7% of CEOs.

## 4. DATA AND METHODOLOGY

### 4.1 DATA

The main focus of this work is to analyse the relationship between gender inequality and economic growth. The study implements an individual base analyses for each gender and its effect in economic growth. To perform such analyses 20 European countries are used: Austria, Cyprus, Slovak, Slovenia, Spain, Estonia, Finland, France, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Portugal, United Kingdom, Czech Republic, Romania, Sweden and Bulgaria, with the time spam of 2000 till 2012. The panel technique reveals to be the most adequate, with allows to control the individual heterogeneity and individual characteristics which cannot be observed in time series analyses. All the available time spam is, used the used variables can be appraised in table 1. For the econometric analyses, it was used STATA 13 and Eviews 9.5.

**Table.1 Variables description**

Variables	Description	Source
GDP (constant LCU)	Gross Domestic Product	World Bank
GPI_p	School enrollment, primary, gender parity index	World Bank
GPI_s	School enrollment, secondary, gender parity index	World Bank
GPI_t	School enrollment, tertiary, gender parity index	World Bank
FDI	Foreign direct investment	UNCTADstat
LF_m	Labor force participation, men	World Bank
LF_w	Labor force participation, women	World Bank
LF_t	Labor force participation, total	World Bank
Pop_tot	Population, total	World Bank
Hours_m	Hours worked per week, men,	Eurostat
Hours_w	Hours worked per week, women	Eurostat
LF_p_m	Labor force with basic education, men	World Bank
LF_s_m	Labor force with intermediate education,men	World Bank
LF_t_m	Labor force with tertiary education, men	World Bank
LF_p_w	Labor force with basic education, women	World Bank
LF_s_w	Labor force with intermediate education, women	World Bank
LF_t_w	Labor force with tertiary education, women	World Bank
Age_chil	Mean age of women at childbirth	Eurostat
Fert_rate	Fertility rate, total (births per woman)	World Bank
Pop	Population ages 15-64 (% of total)	World Bank
Cap	Gross capital formation (% of GDP)	World Bank

The dependent variable, Gross Domestic Product (GDP) is measured in constant LCU to expunge the effects of inflation. Following (Flora et a, 2014), the GDP was converted in per capita values (GDP\_PC).

Gender labor force gap (LF\_D), is computed throw the difference between man labor force and female labor force then divided by the total of the labor force.

This procedure allows to absorb the gender inequality in the labor market. The variable HOURS\_M and HOURS\_W are used to capture the unpaid work i.e more unpaid hours indicate more hours worked in domestic labor. The parity ratios between genders for enrolling in the primary, secondary and superior education, measures the inequality among the education sector (Khan et al, 2016).

The foreign direct investment (FDI), is used to capture the gender inequality between education and work, since the gender disparity reduces the FDI flux (Busse and Nunnenkamp, 2009). The variable mean age of women at childbirth (AGE\_CHILD) is used as proxy of responsibility and maturity for the female. To ensure the quality of results three control variables are incorporated, fertility rate, population and gross capital formation.

## 4.2 METHODOLOGY

To perform such analyses the autoregressive distributed lag model (ARDL) is used, with allows the decomposition of short and long-run effects.

The model allows the use of variables stationary both on levels and first differences. It also produces quality estimations with a low number of observations. The “l” and “d” prefix indicates the natural logarithm and the first differences respectively. The ARDL specifications for our three models are the following:

(1)

$$lGDPpc_{it} = \alpha_i + b_{1i1}lGDPpc_{it-1} + b_{1i2}lLF\_p\_m_{it} + b_{1i3}lLF\_p\_m_{it-1} + b_{1i4}lLF\_s\_m_{it} + b_{1i5}lLF\_s\_m_{it-1} + b_{1i6}lLF\_t\_m_{it} + b_{1i7}lLF\_t\_m_{it-1} + b_{1i8}lhours\_m_{it} + b_{1i9}lhours\_m_{it-1} + b_{1i10}lFert\_rate_{it} + b_{1i11}lFert\_rate_{it-1} + b_{1i12}lPop_{it} + b_{1i13}lPop_{it-1} + b_{1i14}lCap_{it} + b_{1i15}lCap_{it-1} + \epsilon_{it}$$

(2)

$$lGDPpc_{it} = \alpha_i + b_{2i1}lGDPpc_{it-1} + b_{2i2}lLF\_p\_w_{it} + b_{2i3}lLF\_p\_w_{it-1} + b_{2i4}lLF\_s\_w_{it} + b_{2i5}lLF\_s\_w_{it-1} + b_{2i6}lLF\_t\_w_{it} + b_{2i7}lLF\_t\_w_{it-1} + b_{2i8}lhours\_w_{it} + b_{2i9}lhours\_w_{it-1} + b_{2i10}lage\_child_{it} + b_{2i11}lage\_child_{it-1} + b_{2i12}lFert\_rate_{it} + b_{2i13}lFert\_rate_{it-1} + b_{2i14}lPop_{it} + b_{2i15}lPop_{it-1} + b_{2i16}lCap_{it} + b_{2i17}lCap_{it-1} + \epsilon_{it}$$

(3)

$$lGDPpc_{it} = \alpha_i + b_{3i1}lGDPpc_{it-1} + b_{3i2}lLF\_d_{it} + b_{3i3}lLF\_d_{it-1} + b_{3i4}lGPI\_p_{it} + b_{3i5}lGPI\_p_{it-1} + b_{3i6}lGPI\_s_{it} + b_{3i7}lGPI\_s_{it-1} + b_{3i8}lGPI\_t_{it} + b_{3i9}lGPI\_t_{it-1} + b_{3i10}lFDI_{it} + b_{3i11}lFDI_{it-1} + b_{3i12}lage\_child_{it} + b_{3i13}lage\_child_{it-1} + b_{3i14}lFert\_rate_{it} + b_{3i15}lFert\_rate_{it-1} + b_{3i16}lPop_{it} + b_{3i17}lPop_{it-1} + b_{3i18}lCap_{it} + b_{3i19}lCap_{it-1} + \epsilon_{it}$$

The equations are re-parameterized to capture the dynamic relationship among variables, as follows:

(4)

$$lGDPpc_{it} = \alpha_i + \beta_{4i1}dlLF\_p\_m_{it} + \beta_{4i2}dlLF\_s\_m_{it} + \beta_{4i3}dlLF\_t\_m_{it} + \beta_{4i4}dlhours\_m_{it} + \beta_{4i5}dlFert\_rate_{it} + \beta_{4i6}dlPop_{it} + \beta_{4i7}dlCap_{it} + \gamma_{4i1}lGDPpc_{it-1} + \gamma_{4i2}lLF\_p\_m_{it-1} + \gamma_{4i3}lLF\_s\_m_{it-1} + \gamma_{4i4}lLF\_t\_m_{it-1} + \gamma_{4i5}lhours\_m_{it-1} + \gamma_{4i6}lFert\_rate_{it-1} + \gamma_{4i7}lPop_{it-1} + \gamma_{4i8}lCap_{it-1} + \epsilon_{it}$$

(5)

$$lGDPpc_{it} = \alpha_i + \beta_{5i1}dlLF\_p\_w_{it} + \beta_{5i2}dlLF\_s\_w_{it} + \beta_{5i3}dlLF\_t\_w_{it} + \beta_{5i4}dlhours\_w_{it} + \beta_{5i5}dlage\_child_{it} + \beta_{5i6}dlFert\_rate_{it} + \beta_{5i7}dlPop_{it} + \beta_{5i8}dlCap_{it} + \gamma_{5i1}lGDPpc_{it-1} + \gamma_{5i2}lLF\_p\_w_{it-1} + \gamma_{5i3}lLF\_s\_w_{it-1} + \gamma_{5i4}lLF\_t\_w_{it-1} + \gamma_{5i5}lhours\_w_{it-1} + \gamma_{5i6}lage\_child_{it-1} + \gamma_{5i7}lFert\_rate_{it-1} + \gamma_{5i8}lPop_{it-1} + \gamma_{5i9}lCap_{it-1} + \epsilon_{it}$$

(6)

$$lGDPpc_{it} = \alpha_i + \beta_{6i1}dlLF\_d_{it} + \beta_{6i2}dlGPI\_p_{it} + \beta_{6i3}dlGPI\_s_{it} + \beta_{6i4}dlGPI\_t_{it} + \beta_{6i5}dFDI_{it} + \beta_{6i6}dlage\_child_{it} + \beta_{6i7}dlFert\_rate_{it} + \beta_{6i8}dlPop_{it} + \beta_{6i9}dlCap_{it} + \gamma_{6i1}lGDPpc_{it-1} + \gamma_{6i2}lLF\_d_{it-1} + \gamma_{6i3}lGPI\_p_{it-1} + \gamma_{6i4}lGPI\_s_{it-1} + \gamma_{6i5}lGPI\_t_{it-1} + \gamma_{6i6}lFDI_{it-1} + \gamma_{6i7}lage\_child_{it-1} + \gamma_{6i8}lFert\_rate_{it-1} + \gamma_{6i9}lPop_{it-1} + \gamma_{6i10}lCap_{it-1} + \epsilon_{it}$$

A preliminary data analysis is crucial to understand the characteristics of both series and crosses, in order to conclude about the appropriateness of the estimators. Hence, an analysis of the statistics and integration order shall be done. It is worth noting that this paper studies a set of countries that have some common guidance, as it was previously stated. Indeed, this fact may lead to cross section dependence (Pesaran, 2004). Therefore, Table 1 discloses the descriptive statistics of the variables, as well as, the cross-section dependence tests.

**Table.2** Variables statistics and cross section dependence

Variables	Descriptive statistics					Cross section dependence (CD)		
	Obs	Mean	Std. Dev	Min	Max	CD-test	Corr	Abs(corr)
IGDP_pc	260	10.35136	1.44582	8.561844	14.86927	39.59***	0.797	0.804
lhours_m	260	3.711343	0.0425098	3.566712	3.815512	23.44***	0.472	0.602
llf_p_m	260	2.960006	0.6392153	1.458615	4.400603	42.74***	0.860	0.860
llf_s_m	260	3.917198	0.4204639	2.406945	4.411585	0.870	0.018	0.485
llf_t_m	260	3.007685	0.3665614	1.931521	3.597312	41.09***	0.827	0.827
lhours_w	260	3.581408	0.1189456	3.178054	3.725693	6.37***	0.128	0.511
llf_p_w	260	2.815858	0.5925944	1.360977	4.31348	46.06***	0.927	0.927
llf_s_w	260	3.866877	0.357809	2.572612	4.35799	4.72***	0.095	0.542
llf_t_w	260	3.269024	0.4054305	2.066863	3.885679	43.77***	0.881	0.881
lage_child	260	3.369694	0.0523258	3.218876	3.453157	47.63***	0.958	0.958
lFert_rate	260	0.4112987	0.1551028	0.1397619	0.722706	21.16***	0.426	0.700
lCap	260	3.180986	0.1860048	2.534476	3.729316	24.21***	0.487	0.521
lPop	260	4.216606	0.0259672	4.155522	4.282372	19.00***	0.382	0.616
llf_d	260	-1.835278	0.5179453	-3.154338	-0.7804627	15.22***	0.306	0.739
lGPI_p	260	-0.0113105	0.0118409	-0.0564328	0.0268269	4.21***	0.085	0.354
lGPI_s	260	0.012782	0.042027	-0.0568349	0.2390248	11.36***	0.229	0.483
lGPI_t	260	0.2772988	0.1407515	-0.1370691	0.6356505	9.72***	0.196	0.532
FDI	260	4.987728	11.92226	-78.8232	156.4145	9.86***	0.198	0.300
dIGDP_pc	240	0.0209683	0.0429846	-0.1573534	0.1215134	37.42***	0.784	0.784
dhours_m	240	-0.0029789	0.0105637	-0.0496716	0.0845573	2.55**	0.053	0.274
dllf_p_m	240	-0.0329164	0.0518674	-0.2411621	0.305074	-1.66*	-0.035	0.282
dllf_s_m	240	3.917198	0.4204639	2.406945	4.411585	1.20	0.025	0.243
dllf_t_m	240	0.0264548	0.0622557	-0.5883393	0.2137976	2.40**	0.050	0.283
dhours_w	240	-0.0024046	0.0078212	-0.0420332	0.0265894	2.10**	0.044	0.258
dllf_p_w	240	-0.0460645	0.0604883	-0.3493755	0.3493755	0.46	0.010	0.252
dllf_s_w	240	0.0003099	0.0364764	-0.081295	0.3849812	2.37**	0.050	0.270
dllf_t_w	240	0.0372657	0.0537215	-0.487820	0.2649541	0.62	0.013	0.271
dlage_child	240	0.0047346	0.0035415	-0.0069444	0.0141344	4.63***	0.097	0.262
dFert_rate	240	0.0070288	0.0320919	-0.0800427	0.1031842	13.47***	0.282	0.328
dCap	240	-0.0117387	0.1120884	-0.8017378	0.3675015	26.4***	0.553	0.559
dPop	240	-0.0004751	0.0033999	-0.0096846	0.0083375	37.39***	0.783	0.784
dllf_d	240	-0.0321585	0.0930919	-0.3670173	0.3074045	0.04	0.001	0.255
dIGPI_p	240	0.0001884	0.0055523	-0.0299245	0.0270158	1.90*	0.040	0.231
dIGPI_s	240	-0.0031761	0.0125574	-0.1365798	0.0388032	1.06	0.022	0.287
dIGPI_t	240	0.0032681	0.0366525	-0.1969013	0.1442339	9.27***	0.194	0.320
dFDI	240	-0.1774561	19.6297	-235.2377	142.0535	4.69***	0.098	0.295

Notes: All variables converted to natural logarithms with the exception FDI due to negative values; the PC indicates Per Capita values. CD test has N(0,1) distribution, under the H0: cross-section independence. \*\*\* denotes statistically significant at 1% level. The *stata* command *xtcd* was used to achieve the results for cross section dependence.

The cross-section dependence is present among all variables as indicated in table 2. Collinearity is also a concern, therefore the correlation matrix and the variance inflation factor (VIF) are calculated. The obtained results can be appraised in table 3 and indicate that collinearity is not a concern. The higher value of VIF is 4.07 and with the mean of 2,44, far from the borderline value of 10.

**Table.3** Matrices of correlations and VIF statistics

**Model (1)**

	dIGDPpc	dlhours_m	dILF_p_m	dILF_s_m	dILF_t_m	dIFert_rate	dIPop	dICap
dIGDPpc	1.0000							
dlhours_m	0.1571	1.0000						
dILF_p_m	0.0756	0.1101	1.0000					
dILF_s_m	-0.0578	-0.0457	-0.2744	1.0000				
dILF_t_m	-0.0482	0.0424	-0.1688	-0.5416	1.0000			
dIFert_rate	0.2350	0.1112	-0.0276	-0.1351	0.0960	1.0000		
dIPop	0.3493	-0.0042	-0.0627	0.0334	-0.0497	0.1109	1.0000	
dICap	0.7477	0.1906	0.1107	-0.0616	0.0003	0.0759	0.1266	1.0000
VIF		1.06	1.07	1.08	1.06	1.07	1.06	1.07
Mean VIF				1.07				

	IGDPpc	lhours_m	ILF_p_m	ILF_s_m	ILF_t_m	IFert_rate	IPop	ICap
IGDPpc	1.0000							
lhours_m	-0.0753	1.0000						
ILF_p_m	-0.1889	-0.1900	1.0000					
ILF_s_m	0.1582	0.1512	-0.8385	1.0000				
ILF_t_m	0.0176	-0.3947	-0.1067	0.0227	1.0000			
IFert_rate	0.0687	-0.4650	0.0851	-0.1145	0.6230	1.0000		
IPop	-0.0365	0.4125	-0.3431	0.2345	-0.2864	-0.5075	1.0000	
ICap	-0.0217	0.3730	-0.1174	0.1532	-0.2688	-0.2890	0.4387	1.0000
VIF		1.48	4.07	3.62	1.81	2.12	1.83	1.36
Mean VIF				2.33				

**Model (2)**

	IGDPpc	lhours_w	ILF_p_w	ILF_s_w	ILF_t_w	lage_child	IFert_rate	IPop	ICap
IGDPpc	1.0000								
lhours_w	-0.0875	1.0000							
ILF_p_w	-0.0117	-0.1914	1.0000						
ILF_s_w	0.1812	0.1885	-0.6859	1.0000					
ILF_t_w	-0.1162	-0.2485	-0.3200	-0.2176	1.0000				
lage_child	0.2788	-0.6013	0.2445	-0.4059	0.3716	1.0000			
IFert_rate	0.0687	-0.5814	-0.1189	-0.1511	0.5517	0.4868	1.0000		
IPop	-0.0365	0.4222	-0.0933	0.2343	-0.3198	-0.2501	-0.5075	1.0000	
ICap	-0.0217	0.4228	-0.0785	0.1562	-0.2030	-0.3046	-0.2890	0.4387	1.0000
VIF		2.33	3.83	3.38	2.51	2.04	2.37	1.65	1.38
Mean VIF				2.44					

	dIGDPpc	dlhours_w	dILF_p_w	dILF_s_w	dILF_t_w	dlage_child	dlFert_rate	dIPop	dICap
IGDPpc	1.0000								
dlhours_w	0.1509	1.0000							
dILF_p_w	-0.0478	0.0242	1.0000						
dILF_s_w	0.0183	-0.1029	-0.1772	1.0000					
dILF_t_w	-0.0124	0.0298	-0.1988	-0.5583	1.0000				
dlage_child	0.1687	-0.1249	-0.0562	0.0227	0.0377	1.0000			
dlFert_rate	0.2350	0.0435	-0.0439	-0.1362	0.1368	-0.0122	1.0000		
dIPop	0.3493	-0.0120	-0.0521	0.0304	0.0327	0.3394	0.1109	1.0000	
dICap	0.7477	0.1989	-0.0121	-0.0375	0.0276	-0.0708	0.0759	0.1266	1.0000
VIF		1.07	1.20	1.69	1.69	1.17	1.05	1.18	1.07
Mean VIF					1.26				

### Model (3)

	dIGDPpc	dILFd	dIGPI_p	dIGPI_s	dIGPI_t	dFDI	dlage_child	dlFert_rate	dIPop	dICap
dIGDPpc	1.0000									
dILFd	0.2746	1.0000								
dIGPI_p	-0.1349	-0.1026	1.0000							
dIGPI_s	0.0150	0.0210	0.1301	1.0000						
dIGPI_t	0.1255	0.1215	-0.0346	0.0700	1.0000					
dFDI	0.0058	-0.0452	0.1531	-0.0200	-0.0815	1.0000				
dlage_child	0.1687	-0.0368	-0.0003	-0.0434	0.1072	-0.0092	1.0000			
dlFert_rate	0.2350	0.1016	-0.1011	0.0492	0.1268	0.0010	-0.0122	1.0000		
dIPop	0.3493	0.0340	-0.1419	0.0087	0.1680	0.0133	0.3394	0.1109	1.0000	
dICap	0.7477	0.2729	-0.0486	0.0143	0.0339	0.0991	-0.0708	0.0759	0.1266	1.0000
VIF		1.12	1.09	1.03	1.07	1.05	1.23	1.04	1.28	1.12
Mean VIF					1.11					

	IGDPpc	ILFd	IGPI_p	IGPI_s	IGPI_t	FDI	lage_child	lFert_rate	IPop	ICap
IGDPpc	1.0000									
ILFd	0.0492	1.0000								
IGPI_p	0.1923	-0.0736	1.0000							
IGPI_s	0.0761	-0.1155	0.1081	1.0000						
IGPI_t	-0.0791	-0.3429	-0.0931	0.0307	1.0000					
FDI	-0.0473	0.0346	0.0620	0.0112	-0.1543	1.0000				
lage_child	0.2788	0.0644	0.2251	0.2151	-0.2083	0.0793	1.0000			
lFert_rate	0.0687	-0.2820	0.2802	0.1753	-0.0662	0.0143	0.4868	1.0000		
IPop	-0.0365	0.3833	-0.0820	-0.0716	-0.1349	0.1337	-0.2501	-0.5075	1.0000	
ICap	-0.0217	0.0943	-0.2295	0.1255	0.2059	0.0947	-0.3046	-0.2890	0.4387	1.0000
VIF		1.42	1.16	1.14	1.33	1.07	1.56	1.84	1.81	1.54
Mean VIF					1.43					

Following the defined path, the commonly unit root test of first generation where calculated, (Levin, Lin, & James Chu, 2002), ADF-Fisher (Maddala & Wu, 1999) and ADF-Choi (Choi, 2001). The ADF is conclusive indicate that all variables are stationary in first differences. Due to the presence of cross-section dependence is necessary to calculate the second-generation unit root tests (Pesaran, 2007). These tests are more robust in the presence of heterogeneity with the null hypothesis of non-stationarity. The CIPS test indicate a more inconclusive results indicating variables stationary in levels, still is confirmed that none of the variables is I(2). The obtained results justifies the use the ARDL model, since it allows both variables I(0) and I(1)

Tabel.4 Unit Roots Tests

	LLC			ADF-Fisher			ADF-Choi			CIPS lag=0		CIPS lag=1	
	a)	b)	c)	a)	b)	c)	a)	b)	c)	b)	a)	b)	a)
LGDP_PC	-5.01239***	-0.7748	2.09268	35.88	11.3188	9.63126	-0.7593	4.34943	4.42953	0.761	4.125	2.500	6.459
LHOURS_M	-2.20517**	-9.13278***	-6.49955***	26.5961	79.3714***	82.5385***	1.30185	-2.55542***	-4.11619***	-0.999	-2.844***	0.286	-1.653**
LHOURS_W	-1.85247**	-6.25294***	-3.15924***	28.747	53.5262*	74.1574***	1.01965	-0.31149	-2.59476***	-2.398***	-0.742	-0.079	1.278
LAGE_CHILD	-5.06952***	-0.35085	11.0471	29.8749	36.3125	1.07208	1.69785	2.13339	11.0398	-0.268	-0.281	2.238	1.411
LLF_P_M	-0.87593	-2.42334***	-10.1278***	30.6021	54.4829*	172.181***	4.19072	-0.94533	-9.3778***	-3.652***	-2.063**	-1.74**	0.503
LLF_S_M	-1.94244**	-1.92055**	-0.20601	62.4773**	65.492***	23.1806	-0.80826	-2.40541***	2.47284	-2.504***	-1.765**	-2.329***	-2.500***
LLF_T_M	0.09844	-0.36814	10.772	22.2408	47.7342	0.99433	4.19171	-1.47433*	10.4048	-5.000***	-4.385***	-2.766**	-2.568***
LLF_P_W	-2.87297***	-1.97926**	-8.28868***	25.4453	52.9035*	174.415***	4.33057	-1.27882	-9.49641***	-4.525***	-2.190**	-0.559	1.579
LLF_S_W	-1.33313*	-1.5226*	-3.55709***	39.8455	61.8634**	73.6928***	2.14355	-2.16162**	-1.80062**	-0.624	-5.343***	2.144	-1.836**
LLF_T_W	-1.87173**	-2.47133***	12.6827	26.2254	63.7526***	0.79034	2.85776	-2.74367***	10.8578	-4.938***	-3.678***	-2.620***	-0.355
LGPI_P	-2.78497***	-4.87044***	-3.2147***	58.6003**	47.866	51.6094	-1.05954	0.31538	-2.1546**	-2.106**	-1.447*	-2.376***	0.156
LGPI_S	-1.44604*	-3.60474***	-4.29074***	44.0597	41.9221	75.6236***	0.24102	-0.18832	-3.5141***	-0.339	2.254	-1.706**	1.475
LGPI_T	-3.17188***	0.23962	-0.71891	50.6829	18.4749	37.6348	-0.90046	3.75291	0.40416	0.183	1.537	1.109	3.501
LLF_D	-0.91478	-1.33251*	5.97115	26.349	40.7345	13.7294	1.98019	-0.00016	7.00064	-1.368*	-1.223	1.257	2.703
LFERT_RATE	-1.86586**	0.07951	0.23106	44.9594	35.2535	15.9895	-0.8043	1.83827	3.86296	-3.739***	-2.260**	-1.928**	-0.220
LCAP	-3.25452***	-4.5902***	-2.68294***	47.9921	43.32	39.3401	-0.34053	0.59761	-0.77014	1.699	1.467	1.426	2.295
FDI	-2.56926***	-2.44374***	-4.85552***	57.8784**	46.3076	65.3474***	-2.72958***	-1.05017	-3.49879***	-2.984***	-1.170	0.016	-0.057
LPOP	-0.10723	-7.01533***	-8.77306***	39.2748	31.9335	126.428***	3.92338	7.75175	-6.5422***	5.414	6.692	4.426	4.908
DLGDP_PC	-6.10604***	-9.09443***	-7.51205***	50.7423	52.2623*	104.205***	-1.99533**	-2.34552***	-6.26295***	-0.094	1.349	3.679	5.771
DLHOURS_M	-10.254***	-11.4969***	-10.0125***	126.253***	100.675***	137.504***	-6.99963***	-5.02001***	-8.01495***	-7.847***	-5.658***	-3.743***	-2.364***
DLHOURS_W	-6.43006***	-8.23074***	-9.73578***	105.812***	89.2078***	133.186***	-5.52792***	-4.16403***	-7.45953***	-7.615***	-6.024***	-3.417***	-4.906***
DLAGE_CHILD	-3.26402***	-3.24038***	-4.45186***	66.4722***	50.185	52.1622*	-2.64575***	-1.709**	-2.38857***	-6.771***	-4.255***	-1.670**	1.690
DLLF_P_M	-3.70808***	-4.4918***	-4.88474***	90.7868***	69.9566***	78.2366***	-4.68238***	-3.01284***	-3.74834***	-8.290***	-5.971***	-2.328***	-1.113
DLLF_S_M	-5.12691***	-5.52662***	-10.777***	115.883***	97.2231***	165.951***	-6.38793***	-4.98267***	-8.83937***	-1.285*	-0.612	-1.157	-1.695**
DLLF_T_M	-4.96218***	-6.69837***	-5.98968***	109.036***	83.6307***	84.8735***	-6.53486***	-4.64467***	-4.62904***	-9.294***	-7.857***	-4.772***	-3.328***
DLLF_P_W	-4.38561***	-5.62369***	-4.59171***	103.87***	80.4252***	71.3391***	-5.68995***	-4.01572***	-3.66388***	-7.967***	-6.550***	-0.995	-0.373
DLLF_S_W	-2.67999***	-0.71971	-8.79851***	99.1845***	73.6571***	125.89***	-5.21176***	-3.60797***	-6.95957***	-9.531***	-8.335***	-3.673***	-1.756**
DLLF_T_W	-7.54463***	-10.0624***	-5.14639***	129.233***	118.039***	84.0135***	-7.13522***	-6.26567***	-4.24568***	-8.699***	-5.977***	-4.620***	-4.173***
DLGPI_P	-9.73287***	-8.79928***	-13.6581***	86.9016***	67.8237***	150.635***	-3.96378***	-2.57287***	-8.32065***	-5.923***	-3.107***	-2.010**	0.638
DLGPI_S	-4.43082***	-6.45135***	-8.94249***	62.9992**	57.6681**	116.197***	-3.21766***	-2.22947**	-6.88373***	-3.324***	-2.498***	0.091	-1.749**
DLGPI_T	-1.37751*	-1.67355**	-7.46115***	47.1878	46.827	106.514***	-0.89522	-0.51194	-6.05099***	-3.416***	-2.662***	1.354	1.263
DLLF_D	-3.43864***	-6.13612***	-5.16663***	94.9874***	78.8355***	111.888***	-5.35091***	-3.54294***	-6.09964***	-8.549***	-7.209***	-0.883	0.488
DLFERT_RATE	-1.02941	-1.18128	-4.55579***	54.2884*	36.1987	94.8484***	-1.71725**	0.38632	-5.46752***	-7.256***	-4.892***	-3.371***	-3.361***
DLCAP	-7.10729***	-8.43215***	-10.8707***	93.1057***	72.6025**	170.453***	-4.74279***	-3.44196***	-8.97779***	-3.485***	-2.548***	-0.328	1.922
DLPPOP	-1.18445	-3.20484***	-4.37354***	23.4095	43.1725	47.5245	5.27387	0.95128	-0.40769	2.574	2.567	2.49	3.137
DFDI	-5.79445***	-5.62375***	-13.5263***	108.950***	85.3503***	199.643***	-6.0493***	-4.1685***	-10.7351***	-9.424***	-6.670***	-3.551***	-0.876

Notes: a) Trend and intercept; b) Intercept; c) None; \*, \*\*, \*\*\*, represents 10%,5%,1% respectively the null hypotheses are as follows. Levin-Lin-Chu: panels contain unit roots; Levin-Lin-Chu panels contain unit roots; Im-Pesaran-Shin: all panels contain unit roots, these unit-root tests have cross-section means removed and 1lags; ADF-Fisher and ADF-Choi: Unit root (individual unit root process); first generation tests follow the option “no constant”, which was decided after a visual inspection of the series; Pesaran (2007) Panel Unit Root test (CIPS): series are I(1); the presented results include 1 lag; n.a. denotes not available; and the stata commands *xtunitroot* and *multipurt* were used.

## 5. RESULTS

This work analyses the effects of gender inequality and economic growth and the labor force by gender. It is worth highlight the countries of study are all European countries, which allows the free circulation of goods, people and services, and follows standardized policies to all members.

In the panel approach, is necessary to verify witch is the proper estimator to use. Using the Hausman test with allows to confront fixed effects (FE) and random effects (RE), with the null hypothesis that random effects best fits the used data, the alternative indicate that fixed effects are the proper estimator. The options in the Hausman test of Sigmamore and Sigmaless were used, as in previous studies (Levie & Autio, 2008) and (Fuinhas et al, 2015). The obtained results are comprised in table 5, and indicate the presence of fixed effects. There is evidence of correlation among individual effects of the countries and the dependent variable. The effects of each cross are relevant for the estimations.

**Table.5** Hausman test

Chi2			
	Model 1	Model 2	Model 3
Hausman	42.07***	39.47***	63.74***
Hausman, sigmamore	45.84***	39.18***	55.48***
Hausman, sigmaless	53.78***	43.93***	68.23***

Notes: \*\*\* denotes statistical significance level of 1%.

To identify the proper estimator more diagnostics tests are computed. Heteroscedasticity, contemporary correlation and serial correlation are analysed. Firstly, using the modified Wald test the presence of heteroscedasticity is appraised, under the null hypothesis of homoscedasticity. Secondly the contemporary correlation is evaluated, with the null hypothesis of the residual are not correlated and follow a normal distribution. In third the Pesaran test to evaluate if the individual variances are correlated. Finalizing with the Wooldridge test of first order of serial correlation, with the null hypothesis of no serial correlation. The obtained results can be appraised in table 6, indicating the presence of heteroscedasticity and first order serial correlation

Table.6 Specification tests

	Statistics		
	Model 1	Model 2	Model 3
Modified Wald test	chi2 (20)=1668.25***	chi2 (20)=4378.75***	chi2 (20)=3039.05***
Pesaran test	11.438***	11.370***	10.170***
Wooldridge test	F(1,19) =40.042***	F(1,19) =91.528***	F(1,19) =62.166

Notes: \*\*\* denote significant at 1%; results for H<sub>0</sub> of Modified Wald test:  $\sigma(i)^2 = \sigma^2$  for all i; results for H<sub>0</sub> of Pesaran test: residuals are not correlated; results for H<sub>0</sub> of Wooldridge test: no first-order autocorrelation.

To overcome the presence of heteroscedasticity, cross-section dependence and first order serial correlation, the Driscoll & Kraay, (1998) estimator is used. This estimator generates robust standard errors that allows to obtain robust results.

As the main methodology, the ARDL model is used, which allows the analyses of short and long run relationships simultaneously and produces quality estimations with small samples analyses, also allows the use of variables with different order of integration, and supports also “zero one” dummies. (Jouini, 2015), indicates the possible causal relationships. The obtained results are exposed in table 7.

To correct the existing outliers the stability dummy (sd\_2008) is used witch referends to the European financial crisis. The visual inspection of the series indicates an outlier in Estonia for the year of 2009, in Ireland and Lithuania for the year of 2010.

The obtained models are specified as follows:

(7)

$$lGDPpc_{it} = \alpha_i + \beta_{7i2}dlLF\_s\_m_{it} + \beta_{7i3}dlLF\_t\_m_{it} + \beta_{7i5}dlFert\_rate_{it} + \beta_{7i7}dlCap_{it} + \gamma_{7i1}lGDPpc_{it-1} + \gamma_{7i4}lLF\_t\_m_{it-1} + \gamma_{7i5}lhours\_m_{it-1} + \gamma_{7i7}lPop_{it-1} + \gamma_{7i8}lCap_{it-1} + \epsilon_{it}$$

(8)

$$lGDPpc_{it} = \alpha_i + \beta_{8i3}dlLF\_t\_w_{it} + \beta_{8i6}dlFert\_rate_{it} + \beta_{8i8}dlCap_{it} + \gamma_{8i1}lGDPpc_{it-1} + \gamma_{8i3}lLF\_s\_w_{it-1} + \gamma_{8i4}lLF\_t\_w_{it-1} + \gamma_{8i6}lage\_child_{it-1} + \gamma_{8i8}lPop_{it-1} + \gamma_{8i9}lCap_{it-1} + \epsilon_{it}$$

(9)

$$lGDPpc_{it} = \alpha_i + \beta_{9i3}dlGPI\_s_{it} + \beta_{9i7}dlFert\_rate_{it} + \beta_{9i9}dlCap_{it} + \gamma_{9i1}lGDPpc_{it-1} + \gamma_{9i2}lLF\_d_{it-1} + \gamma_{9i4}lGPI\_s_{it-1} + \gamma_{9i5}lGPI\_t_{it-1} + \gamma_{9i6}lFDI_{it-1} + \gamma_{9i7}lage\_child_{it-1} + \gamma_{9i10}lCap_{it-1} + \epsilon_{it}$$

**Table.7** Estimation Results

	Models (dependent variable DLGDPpc)		
	Men (1)	Women (2)	Gender Gap (3)
Constant	-1.29191**	-2.119782***	-1.205876***
DLLF_S_M	-0.0618429**	-	-
DLLF_T_M	0.0192588*	-	-
DLLF_T_W	-	-0.0372986*	-
DLGPI_S	-	-	-0.1750586***
DLCAP	0.2433812***	0.2588672***	0.2342027***
DLFERT_RATE	0.1469945**	0.1581753**	0.1351534*
LGDPpc(-1)	-0.0564102***	-0.1206157***	-0.1594583***
LLF_T_M (-1)	0.0447353**	-	-
LLF_S_W (-1)	-	0.0385632**	-
LLF_T_W (-1)	-	-0.0277609**	-
LHOURS_M (-1)	0.1986972***	-	-
LAGE_CHILD (-1)	-	0.390271*	0.7609522***
LLF_D(-1)	-	-	-0.0168828***
LGPI_S(-1)	-	-	-0.0864385**
LGPI_T(-1)	-	-	0.0485256***
FDI(-1)	-	-	0.0001804***
LCAP (-1)	0.0210258*	0.0515306**	0.0885417***
LPOP(-1)	0.2295791**	0.4397951**	-
SD_2008	-0.0199733***	-	-0.0269512***
IDestonia2009	-0.0850533***	-0.0826098***	-0.0825317***
IDireland2010	0.0589117***	-	0.0584847***
IDLithuania2010	-0.0927114**	-0.0858915***	-
Statistics			
N	240	240	240
R <sup>2</sup>	0.8373	0.8102	0.8401
F	F( 13,11) =3356.88***	F( 11,11) =2183.05***	F( 13,11) =1631.42***

Notes: \*\*\*, \*\*, \* denote statistically significant at 1, 5 and 10 % level, respectively; and the Stata commands *xtreg*, and *xtscc* were used.

The error correction mechanism (ECM) is significant and negative and comprised between [-1, 0], indicating the correct specification of the obtained model and the presence of a long-run relationships. The results obtained are in agreement with the literature and the results obtained by other investigations.

The error correction mechanism (ECM) is between [-1, 0] (Marques et al., 2016) and statistically significant, as shown in table 8.

**Table.8** Elasticities, semi-elasticities, and adjustment speed

	Models		
	Men (1)	Women (2)	Gender Gap (3)
Semi-elasticities (short-run)			
DLLF_S_M	-0.0618429**	-	-
DLLF_T_M	0.0192588*	-	-
DLLF_T_W	-	-0.0372986*	-
DLGPI_S	-	-	-0.1750586***
DLCAP	0.2433812***	0.2588672***	0.2342027***
DLFERT_RATE	0.1469945**	0.1581753**	0.1351534*
Computed elasticities/ (long-run)			
LLF_T_M	0.7930353***	-	-
LLF_S_W	-	0.3197194**	-
LLF_T_W	-	-0.2301597**	-
LHOURS_M	3.522363***	-	-
LAGE_CHILD	-	3.235656***	4.772106***
LLF_D	-	-	-0.1058757***
LGPI_S	-	-	-0.5420756***
LGPI_T	-	-	0.3043155***
FDI	-	-	0.0011313***
LCAP	0.3727305***	0.4272293***	0.5552655***
LPOP	4.069816	3.646251**	-
Speed of adjustment			
ECM	-0.0564102***	-0.1206157***	-0.1594583***

Notes: \*\*\*, \*\*, \* denote statistically significant at 1, 5 and 10 % level, respectively. ECM denotes the coefficient of the variable LGDPpc lagged once.

## 6. DISCUSSION

The relationship between the weight of each gender in the labor market, education and gender inequality and economic growth have been merged in this study. The used approach focus on a panel approach using an econometric method, which in the current literature is underdeveloped. In latest decades, the gender inequality has become a major and important topic among the scientific community, this subject is being merged with the human rights and with sustainable development themes. Many processes to achieve gender equality have been implemented, still our evidences indicate a negative relationship between gender inequality and economic growth, this obtained results are in line with (Ferrant and Kolev, 2016).

Focusing in the education, the gender inequality has decreased, still in a slow and unstable form. In the parity index for the secondary (GPIs), indicate a negative effect in the long-run, in the tertiary (GPIt) reveals a positive sign in the long-run. The obtained results are justified to the fact that in the secondary level the index is composed by values under 1, indicating that the men have vantage facing the women. In the tertiary, the opposite effects are verified, having women a vantage facing the men. This results shows also that the gender inequality in favoring the women promote economic growth, indicating a more homogenous use of the capacities of both genders, increasing the total of the human capital increasing simultaneously the economic growth.

The foreign direct investment (FDI) reveals a positive and significant sign in the long-run, the same result is in line with Busse and Nunnenkamp,( 2009) which conclude the presence of a relationship between the gender inequality in education and FDI. This result indicate that the investors are discouraged to invest by the lack of qualified labor force. The presence of gender inequality in the education leads to a reduction of qualified labor force. In a country with no gender inequality in the education sector is more attractive to investors, leading to economic growth.

In the current times, several programs to decrease gender inequality have been promoted by the European Union. Still the gender inequality is still present and constraining the economic growth. The major inequality between men and women is in decision making posts, both in politics our economic. Therefor the use of gender inequality by education and gender, contributing to a development of the literature and confirming that both men and women reflect different weight on economic growth.

It's considered that employers hire workers with better qualifications and lower costs, this implies that men have higher possibilities of being chosen for jobs with better remunerations and that, in average, are better qualified (with more years of experience and their area of

education is more relevant for the job market, most women still pursue areas connected with humanities and languages). Equally employers hope that women create more costs to the employer, due to a generalized perception of increased family responsibilities, women present less assiduity. This enabled the development of a vicious bond between generations in which an occupational segregation and differentiated labor force are, at the same time, the principal determinants and consequences of inequality in the job market.

Focusing in the obtained results, in men estimations the labor force for the secondary level of education reveals to be only significant in the short-run and with a negative sign, indeed is a unexpected result. Still justified by the fact the employers have an initial training and formation, which leads to contains in the short-run. The *LF* in the long-run influences positively the economic growth. Indicating that men with higher formation requires less formation and can perform the designed task with minimal or no supervision. Those findings indicate that the higher rate of educations leads to higher economic growth.

In the women case the obtained results are distinct from the men, in one hand the secondary level the labor force reveals to be positive in the long-run, since many the women exercise functions attributed to the secondary level. On other hand the *LF* in the tertiary level is negatively both in short and long-run. This output is in line with the results obtained from the secondary level, this is because a small number of women enrolls in senior's positions in companies. Women are in majority attributed to inferior working posts in comparison to men.

In the social level, women still are stereotyped that the family caring and domestic work ate the women responsibility, forcing to leave a professional career. In the case of men, they can exercise their free right of paid work. This conclusion is retrieved from the variable Hours worked per week, reveling to be statistical significant in the men estimations, in the women case no statistical significance is found. This result indicates that women have less paid work, focusing their working hours to unpaid work Because of this multiplicity of tasks on the part of women, they are more likely than men to enter and exit the labor market The composition and structure of the household as well as the life cycle of women have shown some direct influence on the labor market. (Mercedes González de la Rocha, 1988) and Elson, (1995)find that while children are young, women tend to spend More hours in domestic work

Other contribution in this investigation is the analyses of the behavior of the Mean age of women at childbirth (*Age\_child*) it is verified an incrementing of the age, indicating that women are delaying to give birth. This allows women to begin a professional career and after achieving a stable point, use the birth license and keep the professional career, keeping their productivity in the labor market and salary. This variable is used as proxy of responsibility, personal and

professional maturity. The variable reflects also the fertility rate, contributing positively to economic growth in the long-run.

In this study, other variables were tested, still many of them do not reveal to be statistically significant, such as the labor force of the primary sector, the enroll rate of the primary level. This occurs due to the fact of the group of countries of study, and the majority of the population belongs to the secondary and tertiary level of education. To ensure the goodness of fit, three control variables are used, fertility rate, active population and gross capital formation.

Focusing in the gross capital formation the obtained results in such variables reveals to be consistent with the ones existing in the current literature (Ahmed et al, 2016). Revealing to be positive and statistically significant. The active population, reveals a positive signal, still justified in the current literature (Bloom and Williamson, 1998). The fertility rate, is positive and statistically significant in the long-run, proved also by the author Adserà, (2004).

Policymakers are developing policies to reduce or minimize the gap between men and women, still this inequality exists and is constraining the economic growth. There is a need to develop new and more efficient policies that can allow the minimization of such gap and revert the negative effect in the economic growth. Indeed, both men and women labor force is important to economic growth, but focusing the economic growth in one gender leads to inefficiencies.

The main recommendation to political holders is the understanding and permission for people to combine paid and unpaid work, with equal sharing of men and women in order to “design” protection and regulation systems in order to recognize the positive contribution of domestic work, because domestic production is time-consuming and is very important for the contribution of household welfare and consequently the social well-being of society. With this measure, the insertion of women and their performance in the labor market would be facilitated.

Summarizing, the obtained results are in concordance with the current literature, and the ARDL models reveal to be suitable revealing robust results. Contributing to the current literature using an econometric approach which was underdeveloped in the current literature.

## 7. CONCLUSION

This work analyses the dynamic of both short and long-run of labor force by gender, economic growth and gender inequality in the labor market and education. Using the ARDL model with the sample of 20 European countries for the year of 2000 till 2012. The obtained results indicate that the gender inequality is constraining the economic growth, same result is obtained by the gender inequality in the education at the secondary level. The labor force by gender allows to understand that the men's labor force is predominant and influences positively the economic growth on the tertiary level of education. Opposing those findings, the women labor force in the secondary level of education. This result exposes the stereotype that women have less chances of reaching higher job positions. This barrier that women face in the labor market are also constraining the economic growth.

Policymakers face the challenge of promoting gender equality and simultaneously reduce or remove the current barriers existing in the labor market. The economic activity can not only be focused in one gender. The maximization of resources leads to higher rates of growth, policymakers must force the society to run towards the maximization of the labor force. Leading to more employment and more economic growth.

## REFERENCES

- Adserà, A. (2004). Changing fertility rates in developed countries. The impact of labor market institutions. *Journal of Population Economics*, 17(1), 17-43.  
<http://doi.org/10.1007/s00148-003-0166-x>
- Ahmed, K., Mahalik, M. K., & Shahbaz, M. (2016). Dynamics between economic growth, labor, capital and natural resource abundance in Iran: An application of the combined cointegration approach. *Resources Policy*, 49, 213-221.  
<http://doi.org/10.1016/j.resourpol.2016.06.005>
- Appiah, E. N., & McMahon, W. W. (2002). The Social Outcomes of Education and Feedbacks on Growth in Africa. *Journal of Development Studies*, 38(4), 27-68.  
<http://doi.org/10.1080/00220380412331322411>
- Bakker, I. (1994). *The strategic silence : gender and economic policy*. Zed Books in association with the North-South Institute/l'Institut Nord-Sud.
- Barro, R. J., & Lee, J. W. (1994). Sources of economic growth. *Carnegie-Rochester Confer. Series on Public Policy*. [http://doi.org/10.1016/0167-2231\(94\)90002-7](http://doi.org/10.1016/0167-2231(94)90002-7)
- Bloom, D. E., & Williamson, J. G. David Bloom and jeffrey 1998.pdf, The World Bank Economic Review (1998). <http://doi.org/10.1093/wber/12.3.419>
- Busse, M., & Nunnenkamp, P. (2009). *Gender Disparity in Education and the International Competition for Foreign Direct Investment*. *Feminist Economics* (Vol. 15).  
<http://doi.org/10.1080/13545700802528315>
- Choi, I. (2001). Unit root tests for panel data. *Journal of International Money and Finance*, 20(2), 249-272. [http://doi.org/10.1016/S0261-5606\(00\)00048-6](http://doi.org/10.1016/S0261-5606(00)00048-6)
- Driscoll, J. C., & Kraay, A. C. (1998). Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data. *Economic Systems Research*, 10(4), 307-324.  
[http://doi.org/10.1016/S0099-1767\(98\)90076-9](http://doi.org/10.1016/S0099-1767(98)90076-9)
- Duflo, E. (2012). Women Empowerment and Economic Development. *Journal of Economic Literature*, 50(4), 1051-1079. <http://doi.org/10.1257/jel.50.4.1051>

- Elson, D. (1995). *Male bias in the development process*. Manchester University Press.  
Retrieved from <http://trove.nla.gov.au/work/5822644?selectedversion=NBD10380951>
- Elson, D. (1999). Labor Markets as Gendered Institutions: Equality, Efficiency and Empowerment Issues. *World Development*, 27(3), 611-627.  
[http://doi.org/10.1016/S0305-750X\(98\)00147-8](http://doi.org/10.1016/S0305-750X(98)00147-8)
- Esteve-Volart, B. (2004). Gender Discrimination and Growth: Theory and Evidence from India. *LSE STICERD Research Paper*, (DEDPS 42), 1-53.
- European Commission. (2017). *2017 Report on between women and men in the EU*.  
<http://doi.org/10.2838/52591>
- Ferrant, G., & Kolev, A. (2016). *Does gender discrimination in social institutions matter for long-term growth? Cross-country evidence*.
- Flora, R., Marques, A. C., & Fuinhas, J. A. (2014). Wind power idle capacity in a panel of European countries. *Energy*, 66, 823-830.  
<http://doi.org/10.1016/j.energy.2013.12.061>
- Forbes, K. J. (2000). A reassessment of the relationship between inequality and growth. *American Economic Review*, 90(4), 869-887. <http://doi.org/10.1257/aer.90.4.869>
- Fuinhas, J. A., Marques, A. C., & Couto, A. P. (2015). Oil rents and economic growth in oil producing countries: evidence from a macro panel. *Economic Change and Restructuring*, 48(3-4), 257-279. <http://doi.org/10.1007/s10644-015-9170-x>
- Galor, O., & Weil, D. (1993). *The Gender Gap, Fertility, and Growth*. *American Economic Review* (Vol. 86). Cambridge, MA. Retrieved from <http://www.nber.org/papers/w4550.pdf>
- Goldin, C. D. (1990). *Understanding the gender gap : an economic history of American women*. Oxford University Press. Retrieved from <https://global.oup.com/ushe/product/understanding-the-gender-gap-9780195072709?cc=pt&lang=en&>

- Jacobsen, J. P. (1997). Workforce sex segregation in developing countries : general patterns and statistical relationships for developing countries in the Western hemisphere. *Economic Dimensions of Gender Inequality : A Global Perspective* ; Retrieved from <https://www.econbiz.de/Record/workforce-sex-segregation-developing-countries-general-patterns-statistical-relationships-developing-countries-western-hemisphere-jacobsen-joyce/10001888532>
- Jornal Oficial da União Europeia. (2006). DIRECTIVA 2006/54/CE DO PARLAMENTO EUROPEU E DO CONSELHO de 5 de Julho de 2006 relativa à aplicação do princípio da igualdade de oportunidades e igualdade de tratamento entre homens e mulheres em domínios ligados ao emprego e à actividade profissional (r. *Jornal Oficial Da União Europeia*, 1(8).
- Jouini, J. (2015). Economic growth and remittances in Tunisia: Bi-directional causal links. *Journal of Policy Modeling*, 37(2), 355-373. <http://doi.org/10.1016/j.jpolmod.2015.01.015>
- Jurídica, B. (2017). Igualdade entre homens e mulheres - 2010, 1-6. Retrieved from [file:///C:/Users/Marcia/Dropbox/Tese/Enquadramento teorico\\_Bibliografia/JOUE\\_igualdade de genero\\_CELEX-52011IP0085-PT-TXT.pdf](file:///C:/Users/Marcia/Dropbox/Tese/Enquadramento%20teorico_Bibliografia/JOUE_igualdade%20de%20genero_CELEX-52011IP0085-PT-TXT.pdf)
- Kabeer, N. (2016). Gender Equality, Economic Growth, and Women’s Agency: the “Endless Variety” and “Monotonous Similarity” of Patriarchal Constraints. *Feminist Economics*, 22(1), 295-321. <http://doi.org/10.1080/13545701.2015.1090009>
- Khan, H. U. R., Khan, A., Zaman, K., Nabi, A. A., Hishan, S. S., & Islam, T. (2016). Gender discrimination in education, health, and labour market: a voice for equality. *Quality and Quantity*, 1-22. <http://doi.org/10.1007/s11135-016-0384-4>
- King, E. M., & Hill, M. A. (1993). *Women’s education in developing countries : barriers, benefits, and policies*. Published for the World Bank [by] the Johns Hopkins University Press. Retrieved from <http://documents.worldbank.org/curated/en/849491468740172523/Womens-education-in-developing-countries-barriers-benefits-and-policies>

- King, E. M., Klasen, S., & Porter, M. (2007). Copenhagen Consensus 2008 Challenge Paper Women and Development. *Copenhagen Consensus Center*, (November 2007).
- Kingdon, G. G. (1998). Does the labour market explain lower female schooling in India? *Journal of Development Studies*, 35(1), 39-65.  
<http://doi.org/10.1080/00220389808422554>
- Klasen, S. (2002). Low Schooling for Girls, Slower Growth for All? Cross-Country Evidence on the Effect of Gender Inequality in Education on Economic Development. *The World Bank Economic Review*, 16(3), 345-373. <http://doi.org/10.1093/wber/lhf004>
- Klasen, S., & Lamanna, F. (2009). The Impact of Gender Inequality in Education and Employment on Economic Growth: New Evidence for a Panel of Countries. *Feminist Economics*, 15(3), 91-132. <http://doi.org/10.1080/13545700902893106>
- Knowles, S. (2002). Are educational gender gaps a brake on economic development? Some cross-country empirical evidence. *Oxford Economic Papers*, 54(1), 118-149.  
<http://doi.org/10.1093/oep/54.1.118>
- Lagerlöf, N.-P. (2003). Gender Equality and Long-Run Growth. *Journal of Economic Growth*, 8, 403-426. <http://doi.org/10.1023/A:1026256917489>
- Levie, J., & Autio, E. (2008). A theoretical grounding and test of the GEM model. *Small Business Economics*, 31(3), 235-263. <http://doi.org/10.1007/s11187-008-9136-8>
- Levin, A., Lin, C.-F., & James Chu, C.-S. (2002). Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of Econometrics*, 108(1), 1-24.  
[http://doi.org/10.1016/S0304-4076\(01\)00098-7](http://doi.org/10.1016/S0304-4076(01)00098-7)
- Maddala, G. S., & Wu, S. (1999). A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test. *Oxford Bulletin of Economics and Statistics*, 61(s1), 631-652.  
<http://doi.org/10.1111/1468-0084.61.s1.13>
- Marques, A. C., Fuinhas, J. A., & Menegaki, A. N. (2016). Renewable vs non-renewable electricity and the industrial production nexus: Evidence from an ARDL bounds test approach for Greece. *Renewable Energy*, 96, 645-655.  
<http://doi.org/10.1016/j.renene.2016.05.033>

- Mercedes González de la Rocha. (1988). Economic Crisis, Domestic Reorganisation and Women's Work in Guadalajara, Mexico. *Bulletin of Latin American Research*, 7(2), 207. <http://doi.org/10.2307/3338289>
- Pesaran, M. H. (2004). *General Diagnostic Tests for Cross Section Dependence in Panels*. Retrieved from <https://www.repository.cam.ac.uk/handle/1810/446>
- Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, 22(2), 265-312. <http://doi.org/10.1002/jae.951>
- Seguino, S. (2000). Gender inequality and economic growth: A cross-country analysis. *World Development*, 28(7), 1211-1230. [http://doi.org/10.1016/S0305-750X\(00\)00018-8](http://doi.org/10.1016/S0305-750X(00)00018-8)
- Seguino, S. (2007). PlusÇa Change?1 evidence on global trends in gender norms and stereotypes. *Feminist Economics*, 13(2), 1-28. <http://doi.org/10.1080/13545700601184880>
- Yamarik, S., & Ghosh, S. (2003). Is Female Education Productive ? A Reassessment. *Mimeo*, (August).