COMUNICACIÓN

Participación de la mujer en el mercado laboral y crecimiento económico en los países de la Unión Europea / Economic growth and female labor force participation in the European Union countries

Amaia Altuzarra Artola amaia.altuzarra@ehu.eus

Catalina Gálvez Gálvez catalina.galvez@ehu.eus

Ana González Flores ana.gonzalezflores@ehu.eus

Departamento de Economía Aplicada V

Universidad del País Vasco (UPV/EHU)

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El objetivo de este trabajo es estudiar la relación entre la participación de la participación de la mujer en el mercado laboral y el crecimiento económico en los países de la Unión Europea 28 durante el período 1990- 2017. El análisis se realiza desde dos perspectivas distintas: en la primera se estudia el conjunto de los países y, en la segunda se presenta evidencia desagregada por grupos de países. Los datos utilizados provienen del Banco Mundial y de Eurostat. La metodología utilizada consiste en la estimación de modelos de efectos fijos y modelos dinámicos (Modelo de Momentos Generalizados- GEMM). Los resultados para el conjunto de países son consistentes con la hipótesis que sugiere la existencia de una relación en forma de U entre la participación de la mujer en la fuerza laboral y el crecimiento económico. No obstante, este resultado presenta diferencias cuando el análisis se realiza por grupos de países.

Palabras Clave: Desarrollo Económico, Fuerza Laboral Femenina, Modelos Estáticos Y Dinámicos, Unión Europea

Clasificación JEL: J16, O10,

Abstract:

In this paper, we study the relationship between female labor force participation and economic development in the 28 countries of the European Union during the period 1990-2016. The analysis is carried out from two different views: first, we study all the countries of the EU-28 and, second, the evidence is disaggregated into two groups of countries: old (EU-15) and new (EU-13) member estates. The data used comes from the World Bank open data repository and Eurostat. The methodology used consists in the estimation of static (OLS and fixed effects) and dynamic (Generalized Moments Model - GMM) models. Results for all European countries (EU-28) are consistent with the hypothesis that suggests the existence of a U-shaped relationship between women´ labor force participation and economic development. When the sample is broken down into groups, we find evidence that confirms the feminization hypothesis for the new countries of the EU, but not for the old ones.

Keywords: Economic Development, European Union, Female Labor Force, Static and Dynamic Models.

JEL Clasification: J16, O10

1. INTRODUCTION

The study of the relationship between female labor force participation (FLFP) and economic development have recently attracted renewed attention. The pioneering works including Sinha (1967), Boserup (1970) and Durand (1975) proposed the hypothesis that the long-term relationship between economic development and FLFP follow a U shape. The U-hypothesis states that during the early stages of economic development FLFP tends to decline due to the structural changes of the economy from an agricultural to an industrialized economy, in later stages of development, FLFP increases as countries transition into modern economies, fertility rates decline and female education level increases.

Most empirical research regarding the U-hypothesis has involved large international comparisons of countries (cross-country as well as panel data) and has revealed that FLFP is high in low-income countries and highly-income countries and, relatively low in middle-income ones. Thus, creating the so-called U-shaped relationship between FLFP and economic development (Tampel and Tanaka, 1986; Goldin, 1994; Goldin, 1995; Cagatay and Ozler, 1995; Luci, 2009; Tam, 2011; Lechman and Kaur, 2015). Only Gaddis and Klasen (2013) has questioned the U-shaped hypothesis using cross-country data for the period 1980-2005. They showed that results are very dependent on the data used.

Some other studies have tested the feminization hypothesis for one country and have also found support the U-shaped relationship (Mammen and Paxon, 2000 for India and Tahiland; Lahoti and Swaminathan, 2016 for India; Fatima and Sultana, 2009 for Pakistan; Olivetti, 2013, Goldin, 1995 for United States; Tansel, 2002 for Turkey and Tilly and Scott (1987) for England and France). Time-series evidence for world regional areas are still scarce but most of it found similar results (Tsani, 2013 for South Mediterranean countries; Verme, 2014 and Chapman, 2015 for Middle East and North Africa).

This paper explores the relationship between economic development and women's labor force participation testing the U-shaped hypothesis in the context of the European

Union (EU) over the period 1990-2016. We also study how a set of variables the relationship between development and FLFP. We include fertility rate, life expectancy, education levels and unemployment rate. The analysis is carried out from two different views: first, we study all the countries of the EU-28 and, second, the evidence is disaggregated into two groups of countries: old (EU-15) and new (EU-13) member estates.To the best of our knowledge, this hypothesis has not been tested in this geographical area so far.

The EU, since the foundation in 1957, has gradually increased the number of countries in several waves. With no doubt, the most ambitious enlargement was the so-called big Eastern enlargement (Estonia, Lithuania, Latvia, Poland, Czech Republic, Slovakia, Slovenia and Hungary) along with Cyprus and Malta occurred in 2004. Three years later, in 2007 Romania and Bulgaria entered the EU and, Croatia in 2013. Many Easter countries entered the UE after the fall of the Iron Curtain in 1989, though not before having initiated dramatic structural transformations of their economies to transit from a communist society to the global economy. The far-reaching reforms implemented included liberalization of trade and prices, changes in the labor market, enterprise restructuring, building new institutions, among others reforms. During the first years of transition, there was gains in female education, falls in fertility rates and in labor participation and sharp increases in unemployment.

The most recent enlargements of the EU have also induced changes in the economic structure of the “old” countries (EU-15). In general, the integration process has brought benefits for all members. For example, “new” member states (EU-13) benefited from faster growth that enabled them to move from GDP per capita that was 40% of the EU-15 average prior to enlargement to 60% in 2016 (International Monetary Fund, 2016). “Old” member states gained from enlargement as well. On the one hand, they benefited from a larger export market and from a trade surplus with the new member states. On the other hand, the private sector restructured production by locating plants to maximize efficiency, which helped maintain global competitiveness and safeguard jobs in the old member states (European Commission, 2009).

These developments makes the EU a compelling case study for exploring the relationship between FLFP and economic development and for better understanding the underling factors of this relation in the region.

The rest of the paper is organized as follows. Section 2 explains the methodological framework and data used. In section 3, we present and interpret the main results and the last section presents the conclusions.

2. DATA AND METHODOLOGICAL FRAMEWORK

Our data comes from different data sources. First, FLFP is defined as the women´s (15 years old and above) share in the country`s total labor force (LFP). LFP is defined as employed (paid and unpaid family workers) plus unemployed (actively seeking work). Second, to approximate level of economic development, we use gross domestic product per capita based on purchasing power parity (PPP) in constant 2011 international $ (GDPpcPPP). GDP per capita is the gross domestic product divided by the midyear population of the country. All these data come from World Bank open data repository. Third, we also study how some variables affect the FLFP, including fertility rate, life expectancy, female unemployment rate and female education.

Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year. Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Unemployment rate refers to the share of the labor force that is without work but available for and seeking employment. These variables are also taken from the World Bank open data repository. Education-related variables includes secondary and tertiary education. These are measured as the percentage of female (from 15 to 64 years) who have upper secondary and post-secondary non-tertiary education and tertiary education, respectively. These data are taken from Eurostat[1].

[1] Finally, some authors have referred to additional factors affecting the FLF, such as the sectoral structure (Verme, 2014), wages, social and cultural norms (Goldin, 1995; 2006; Akerlof y Kranton, 2000) or the

The basic data are annual observations for a cross-country panel covering the 28 European member estates over the period 1990-2016. The dataset is an unbalanced panel, with several observations missing over different variables, countries and years. Table 1 shows some basic statistics of the whole sample.

Table 1. Basic statistics of the whole sample. 1990-2016.

	Mean	S.D	Min	Max
FLFP	50,0	7,2	27,9	64,6
GDPpc	30236,6	14379,0	8001,7	97864,2
Life expectancy	80,0	2,9	72,6	86,3
Fertility rate	1,6	0,2	1,1	2,4
Tertiary education	22,3	9,4	3,9	43,2
Secondary Education	43,8	13,0	11,6	70,4
Female unemployment rate	9,6	4,9	1,5	31,4

2.2. MODEL SPECIFICATIONS AND ESTIMATION TECHNIQUES

We estimate different models to test the U-hypothesis. First, we follow the initial studies that were made about the feminization hypothesis and use OLS estimations, pooling the data in a unique cross-section (Pampel and Tanka, 1986; Goldin; 1994) as in equation (1).

$$FLFP_{it} = \alpha + \beta lnGDPpc_{it} + Y(lnGDPpc_{it})^2 + \varepsilon_{it} \qquad (1)$$

where $lnGDPpc_{it}$ is natural log of the national GDP per capita PPP (constant 2011 international $), FLF_{it} is the female labor force participation rate, *i* denotes countries and *t* denotes time. The U-shape hypothesis holds if $\hat{\beta} < 0$ and $\hat{Y} > 0$.

However, although there is some value in using OLS estimator as it is a transparent way to describe the data, it is well known that can be biased in the presence of time-invariant unobserved heterogeneity. When this is the case, it is more appropriate to exploit the

urbanization level (Fatima and Sultana, 2009; Tsani, 2013). Nevertheless, these factors are not examined in this study.

panel structure of the data and use the fixed effects estimator. Therefore, we also estimate equation (2) which includes country-specific intercepts α_i and time-specific fixed effects δ_t to capture common trends.

$$FLFP_{it} = \alpha_i + \beta lnGDPpc_{it} + Y(lnGDPpc_{it})^2 + \delta_t + \varepsilon_{it} \quad (2)$$

The use of the fixed- effects model controls for the potential endogeneity problems emerging from the correlation between the set of independent variables and the time-invariant country-specific unobserved heterogeneity. However, they do not account for other sources of endogeneity. For example, first, if FLFP varies little, lagged FLP is correlated with the error term and the repressors become endogenous (Verme, 2014). Second, there could be a potential reversed causality between the dependent and independent variable. To overcome these potential endogeneity problems, we propose a dynamic model using equation (3):

$$FLFP_{it} = \alpha_i + \varphi FLF_{it-1} + \beta lnGDPpc_{it} + Y(lnGDPpc_{it})^2 + \delta_t + \varepsilon_{it} \quad (3)$$

This model, however, if estimated with fixed effects accounts for endogeneity but does not correct for autocorrelation. Arellano and Bover (1995) and Blundell and Bond (1998) estimators can account for autocorrelation. Both estimators are well suited for panel data where the number of periods is relatively smaller than the number of countries. However, the Blundell and Bond (1998) types of estimators assume that the instruments (lagged dependent variable) are uncorrelated with the individual effects (country/year). As in Gaddis and Klasen (2013) and Verme (2014), we find this assumption too restrictive and opt to use the difference model for the panel equations. This is also the preferred choice in the recent literature.

Since we are not interested in short-term cyclical effects and want to follow in the tradition of the feminization U literature we use 5-year windows[e1].

Furthermore, the shape of the FLFP-GDP per capita relation may be different across group of countries (as well as across individual countries) in the European Unión. This is because different groups of countries may be transiting on different parts of the U curve during the period considered. Hence, we could expect if $\hat{\beta}$< 0 and $\hat{\gamma}$> 0 for U-shape transitions, $\hat{\beta}$> 0 and $\hat{\gamma}$> 0 for positive transitions and $\hat{\beta}$< 0 and $\hat{\gamma}$< 0 for negative transitions. It is also possible, of course, to find inverted U-shape transitions with $\hat{\beta}$> 0 and $\hat{\gamma}$< 0.

As control variables, we include fertility rate, education levels, unemployment rate and life expectancy. We expect a negative relationship between fertility rate and FLFP because when socio-cultural attitudes change and the productive activity of women is more valued than their reproductive role, more women enter the labor market (Goldin, 1995). The fertility rate controls for population growth and it also indicates the extent to which women are occupied with raising children and thus will have less time to work or attend school (Bussmann, 2008).

We also expect a positive effect of education on the PLF as education increases the potential earnings of women as well as the opportunity costs of not working (Goldin, 1995, Mammen and Paxson, 2000, Tansel, 2002, Klasen and Pieters, 2012; Tsani, 2013; Tasseven, 2017).

Unemployment rate is one of the variables that best describes the conditions of the labor market. However, the relationship between the unemployment rate and the FLFP is ambiguous. The former variable affects the likelihood that a woman will find a job. The higher the unemployment rate, the less likely it is for a woman to find a job. For this reason, women can be discouraged in the search for employment, becoming part of the "group of discouraged" (inactive). Therefore, unemployment would have a negative impact on the FLFP (Tansel, 2002, T sani, 2013, Fatima and Sultana, 2009, Ozerkek, 2013, Tasseven, 2017). However, when the unemployment rate of men increases, women can decide to enter the labor market in order to compensate for the loss of family income. In this case, the PLF is expected to rise with the increase in the male unemployment rate (Fatima and Sultana, 2009).

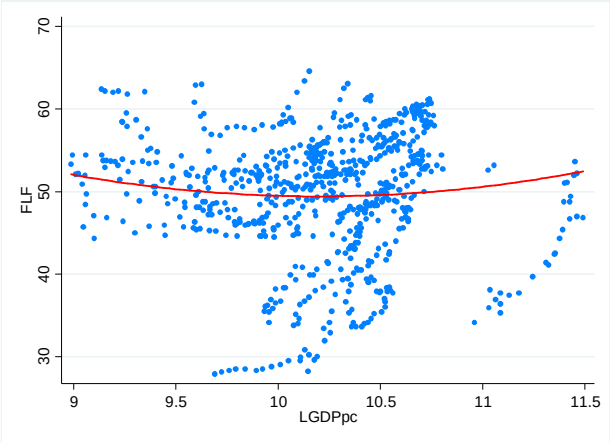
Finally, the impact of life expectancy at birth is uncertain (Mammen and Paxon, 2000). This variable may be seen as a proxy for sufficient health care, that is, captures aspects of the physical quality of life (Gray et al., 2006; Bussmann, 2008). However, if retirement age does not increase as life expectancy increases the effect would be the opposite.

3. RESULTS

Before presenting our estimation results, it is worth first focusing on the visual representation of the data. In Figures 1-3 we show the scatter plots of the association between $FLFP_{it}$ and $GDPpc_{it}$ for the EU-28, EU-15 and EU-13 countries, respectively.

Figure 1 confirms that the EU-28 countries follow a slight U pattern over the period 1990-2016. This is stable by individual survey time periods (not presented here). It is observed that both for relatively low and high levels of $GDPpc_{it}$ the $FLFP_{it}$ is around 50%, while for average per capita incomes, $FLFP_{it}$ is highly variable. In countries where $GDPpc_{it}$ (in logs) ranges from approximately 9.5-10.5 women´s participation in labor market is observed both at relatively high (over 60%) and low (below 30%) levels. Over the years under study, several countries have experienced significant increases in female labour force participation. However, despite positive changes there are still economies lagging behind, not reaching the UE average $FLFP_{it.}$ Countries situated below the curve turning point are those of the old countries of the EU (except Denmark, Finland, Sweden and UK) and some new member states (Malta, Cyprus, Bulgaria or Romania). However, most Eastern countries exhibit female labor participation rates above average. These economies of Eastern Europe represent cases of highly feminized labor forces because of the socialist commitment to and imperative for women's economic mobilization (Cagatay and Ozler, 1995).

Figure 1. Female Labor Force participation vs. GDPpc. 28 EU countries. 1990-2016



When we move to the distinction between the EU-15 countries (Figure 2) and the newest European countries (Figure 3), we find mixed results, indicating the relevance of contextual factors in determining the $FLFP_{it}$-$GDPpc_{it}$ relationship. In the former group of countries, an inverted U-shape is found whereas in the latter one, a slight U-shape relationship is identified.

Figure 2. Female Labor Force participation vs. GDPpc. EU-15 countries. 1990-2016

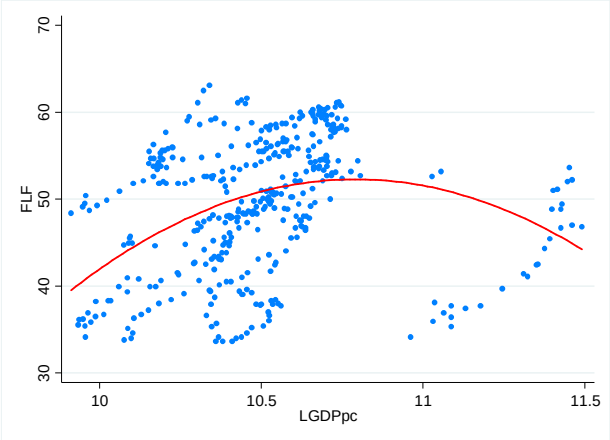
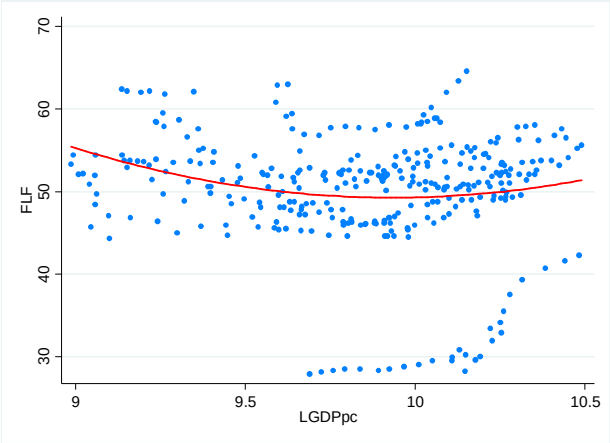


Figure 3. Female Labor Force participation vs. GDPpc. EU-13 countries. 1990-2016



Given this, an in order to understand better the relationship between $FLFP_{it}$ and $GDPpc_{it}$, we report the estimation results for our sample.

We first present the results for the static models (OLS and fixed effect) for all EU countries in Table 2. We report for each regression the coefficients for GDP per capita (in logs), GDP per capita squared (in logs), the control variables as well as the turning point (time fixed effects are included). It shows that there is a statistically significant U relationship in both OLS and fixed effect (FE) estimations when control variables are not included.

There is a variability in turning points between the estimations, being lower in the FE estimator than in the OLS one, similar to the findings in Gadis and Klasen (2013). The turning point occurs at 34,417 $ per capita (in 2011 constant prices) in OLS estimation without control variables and at 22,601$ per capita (in 2011 constant prices) in the FE estimation without control variables.

When we include control variables, the U-shaped relationship remains significant only in the fixed effect estimation.[2]. The coefficients of education variables are positive and statistically significant meaning that an increase in the education level leads to higher female labor participation. The tertiary education has greater value than the secondary

[2] We are aware that many studies have noted that female education and fertility rates are strongly inversely correlated, creating a collinearity problem in the equations. For this reason, we have run the models with and without the fertility rate variable, and results remain largely unchanged.

education. The unemployment rate holds a negative and significant coefficient. Unemployment rates has a statistically negative effect. This is an indication of the existence of a discouraged worker effect, which occurs during the recessions when workers do not search for work *because* they view their chances of finding a suitable job as too low. This result is also finding by Ozerker (2013). Finally, life expectancy and fertility rates are not statistically significant. In Appendix 1, we present a robust test for the U-shape relationship.

The static models for the whole EU countries suggest that, in general terms, FLFP and economic growth relationship follows a U-shaped pattern over the period analysed. The downward slope of the curve exhibit the de-feminization process of the labour force that is associated with economic growth. Countries in early stages of growth are exposed to structural changes that encourage women in low paid jobs join the education system (Lechman and Kaur, 2015). The upward slope suggest growth the empowerment process in women due to further economic growth[e2].

Table 2. Static models. EU-28

	Model 1 OLS		Model 2 OLS		Model 3 Fixed Effects		Model 4 Fixed Effects	
LGDP_pc	-52.148	*	51.258		-221.917	***	-124.02	***
	(30.49)		(29.79)		(26.39)		(29.78)	
LGDP_pc2	2.496	*	-2.477		11.067	***	6.187	***
	(1.49)		(1.40)		(1.36)		(1.52)	
Life expectancy			-.450				-.258	
			(.37)				(.49)	
Fertility rate			-1.548				-1.298	
			(2.20)				(2.27)	
Secondary education			.154	***			.212	***
			(.06)				(.06)	
Tertiary education			.455	***			.353	****
			(.07)				(.09)	
Unemployment rate			-.378	***			-.072	
			(.11)				(.08)	
Constant	318.991	**	-190.145		1158.14	***	676.20	****
	(318.99)		(114.23)		(128.16)		(148.56)	
N	163		148		163		148	
F(7,155); F(12,135) F(7,128); F(12,108)	1.71		13.37		20.70		16.30	
Prob>chi2	0.090		0.000		0.000		0.000	
Rho					0.886		0.848	
N. groups					28		28	
R-sq	0.074		0.499					
R-sq: within					0.530		0.644	
R-sq: between					0.006		0.294	
R-sq: overall					0.024		0.339	
Turning point	34417.3		31156.9		22608.2		22530.6	

Cluster standard errors (country-level) in brackets. Time dummies not reported. *** p<0.01; p<0.05; *p<0.1

Moving to the estimations of the two groups of EU countries included in the study (Table 3), we find that the U-shaped relationship between FLFP and GDPpc only holds for new member states. We observed that in both estimators (OLS and FE) the coefficient of GDPpc is much larger than the one of the squared GDPpc, which might suggest that the "negative" relationship between FLP and GDPpc is dominant.

For the EU-15 group of countries, there is no evidence of U relationship since the corresponding coefficients are not statistically significant (except in the OLS estimation without controls where inverse U-shaped relationships is found).

For the two groups of countries, the coefficients for education variables are positive and statistically significant. Unemployment rate is statistically non-significant (except for

UE-15 in OLS estimations with controls) although it has negative sing as in the estimations for the whole Europe. The remaining variables are not statistically significant (except for the life expectancy in EU-13 that is significant and negative in OLS estimations with controls). In Appendix 1, we present a robust test for the U-shape relationship.

Table 3. Static Models. EU-15 and EU-13

	EU-15				EU-13			
	Model 5 OLS	Model 6 OLS	Model 7 Fixed Effects	Model 8 Fixed Effects	Model 9 OLS	Model 10 OLS	Model 11 Fixed Effects	Model 12 Fixed Effects
lnGDPpc	283.26 ***	-45.42	-91.04	-35.87	-114.92	-159.12 *	-264.18 ***	-141.46 *
	(105.26)	(99.82)	(76.03)	(66.20)	(125.87)	(92.34)	(58.20)	(79.23)
lnGDPpc2	-13.17 ***	1.72	4.78	2.12	5.67	8.94 *	13.38 ***	7.51 *
	(4.91)	(4.58)	(3.58)	(3.10)	(6.40)	(4.73)	(3.05)	(4.13)
Life expectancy		-1.01		.71		-2.38 ***		-.314
		(.63)		(.90)		(.51)		(.83)
Fertility rate		-4.68		3.26		-6.97		-4.17
		(3.19)		(4.51)		(4.25)		(3.75)
Secondary educ.		.13 **		.19 **		.24 ***		.30 *
		(.06)		(.07)		(.051)		(.15)
Tertiary educ.		.59 ***		.31 **		.39 ***		.48 ***
		(.11)		(.12)		(.061)		(.19)
Unempl. rate		-.63 ***		.03		-.08		.04
		(.14)		(.10)		(.17)		(.21)
Constant	-1473.61 **	410.86	475.93	116.24	631.14	929.39 **	1353.04 ***	.722.76 *
	(562.31)	(522.84)	(403.66)	(363.50)	(615.82)	(459.28)	(278.06)	(407.84)
N	90	86	90	86	73	62	73	62
F(7,82);F(12,73) F(7,68) F(12,59)	3.37	17.31	17.91	15.53	.61	10.07	5.47	2.79
F(7,65) F(11,50); F(7,53) F(11,38)								
Prob>chi2	0.003	0.000	0.000	0.000	.7479	0.000	0.000	.009
Rho			.896	.906			.845	.709
N. groups			15	15			13	13
R-sq	.223	.638			.06	.689		
R-sq: within			.648	.7595			.419	.446
R-sq: between			.002	.1335			.017	.509
R-sq: overall			.068	.2376			.042	.523
Turning point	46663.7	542253.2	13732.50	4703.90	25185.90	7327.1	19298.3	12239.7

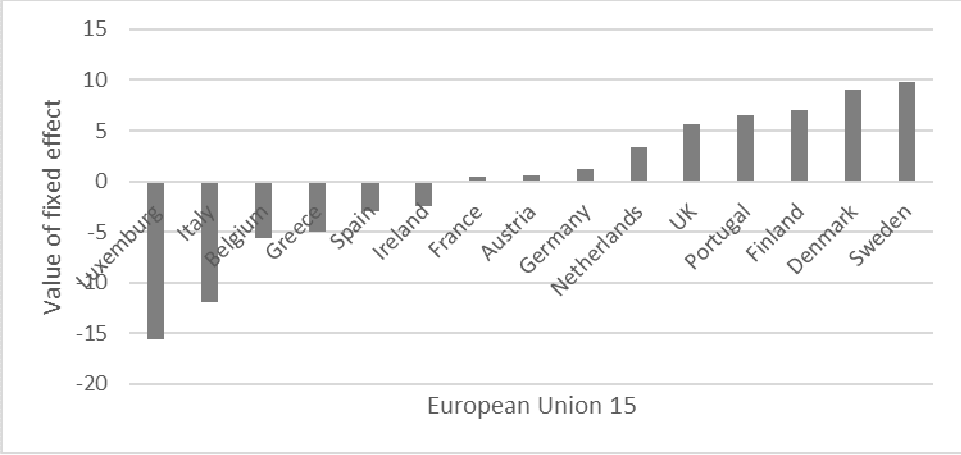
Cluster standard errors (country-level) in brackets. Time dummies not reported. *** p<0.01; p<0.05; *p<0.1

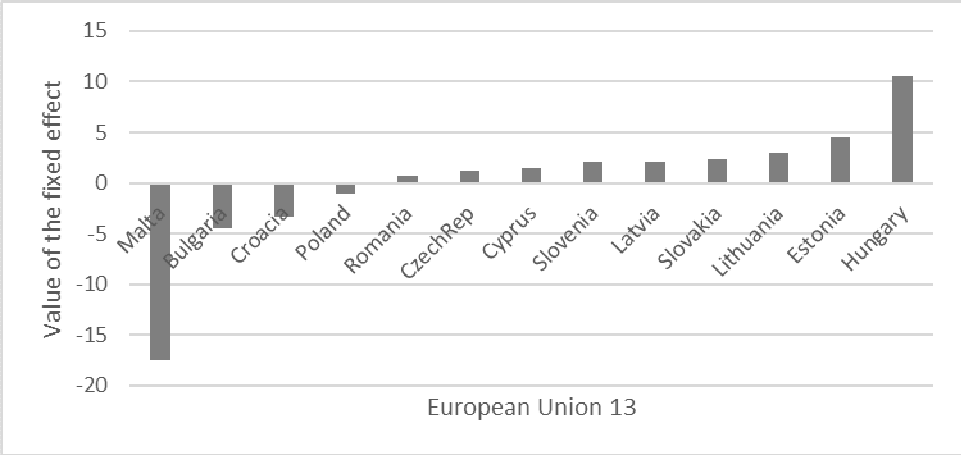
Besides the sings and significance levels of the GDP variables, the fixed effect regressions also provide useful information on country-specific differences in FLFP, which cannot be explained by the level of GDP or over time changes. Figure 4 shows the estimated fixed effects using the regression without controls revealing the countries with the largest positive and negative fixed effects. The Figures unveil striking regional patterns in female labour force participation, which are conditioned on the level of GDP.

Most eastern transition countries (Hungary, Estonia, Slovenia, Lithuania, Czech Republic and Latvia) have large positive effects confirming the idea that the region has above average rates of FLFP because of the legacy of socialism, which promoted female labour force participation (Kornai, 1992; Gadis and Klassen, 2013).

The Figure 4 also shows the pattern of FLFP for EU-15 countries, with negative fixed effects in south European countries (Italy, Spain and Greece) along with other countries such as Luxemburg or Belgium. The largest positive fixed effects are associated with norther countries (Finland, Denmark and Sweden). These results reveal, as stated by Gaddis and Klasen (2013) the strong influence of the history of the countries in determining the evolution of the labour force participation.

Figure 4. Country specific fixed effects by country group. Fixed effect regression based on the OLS without controls.





The use of dynamic models (GMM) allows us to capture, at least partially, the influence of past values of the FLFP, that is, the power of the history. Table 4 displays the results of the difference GMM estimator for the EU-28 and the two subgroups of European countries. We report the turning points, samples sizes and regression diagnostics.

We observe the persistent behaviour of the FLFP, as the coefficient of the first lag of the dependent variable is positive and highly significant in all cases. The FLFP and economic growth relationship follows a U-shaped pattern when all European countries. However, when the EU-28 is split into the two groups, we find that there is evidence for the feminization U hypothesis only in the newest European countries (EU-13). We do not find such evidence for the old countries (EU-15) since the coefficients for GDP per capita (lnGDPpc) and the squared GDP per capita (squared lnGDPpc) are statistically non-significant. The turning point for the former group of countries occurs at around 14,000 $ (in 2011 constant prices). Again, the negative relationship between female labour force engagement and level of per capita income is strong (lnGDPpc), compared to the positive one (squared lnGDPpc). In the dynamic models, control variables are not statistically significant due to the high persistence of the female labour participation variable. In Appendix 1, we present a robust test for the U-shape relationship.

Table 4. Dynamic Models. GMM estimator. EU-28; EU-15 and EU-13

	EU-28				EU-15				EU-13			
	Model 13		Model 14		Model 15		Model 16		Model 17		Model 18	
Female Labor Force Participation (t-1)	.77	***	.70	***	.76	***	.84	***	.61	***	.24	*
	(.14)		(.19)		(.08)		(.13)		(.22)		(.13)	
lnGDPpc	-98.38	**	-264.10	***	-104.54		-129.05		-211.04	**	-230.19	*
	(42.39)		(124.50)		(71.80)		(82.78)		(94.35)		(140.39)	
lnGDPpc2	5.51	**	14.23	**	5.03		6.21		11.049	**	11.98	*
	(2.25)		(6.48)		(3.31)		(3.95)		(4.86)		(7.26)	
Life expectancy			.92				.45				.415	
			(.97)				(.35)				(.66)	
Fertility rate			19.13				1.72				-.545	
			(15.62)				(2.48)				(3.77)	
Secondary educ.			.12				.01				.203	
			(12.56)				(.06)				(.15)	
Tertiary educ.			-.06				-.04				.162	
			(15.25)				(.12)				(.17)	
Unempl. rate			.07				-.06				-.057	
			(.24)				(.05)				(.13)	
N	112		119		60		60		52		49	
Wald Chi2(9)(14)(9)(14)(9)(14)	153.0		307.4		469.8		5167.7		57.43		1330.48	
Prob>chi2	0.000		.0000		0.000		0.000		0.000		0.000	
N. groups	28		28		15		15		13		13	
Number of IVs	13		18		13		14		10		11	
2nd order autocorrelation	.610		.675		.105		.174		.510		.324	
Hansen test of overid. retrictions	.177		.136		.408		.335		.244		.313	
Turning point	7472.9		10682.9		32328.1		32660.7		14047.3		14899.4	

Standard errors in brackets. Time dummies not reported. *** p<0.01; p<0.05; *p<0.1

CONCLUSIONS

This paper studies the relationship between female labour force participation and economic growth in the European Union countries over the period 1990-2016, distinguishing between the old countries (EU-15) and the new member states (EU-13) incorporated to the European Union in the enlargements occurred since 2004.

We have estimated static (OLS and fixed effect estimators) and dynamic models (GMM estimator) with and without control variables. We control for life expectancy, fertility rate, secondary and tertiary education and unemployment rate. Our results support the U-hypothesis for the EU-28, which suggests that in early stages of economic growth female labour force engagement tends to fall, as countries increases their development and become more serviced-based female labour force start to grow.

However, when the feminization hypothesis is tested in the two group of countries (old and new member states) separately, results change. For the EU-15 countries, the existence of the U-shaped relationship is not verified (it is only statistically significant in the OLS estimation without controls). Most of these countries were already high-income economies in the 90´s, and the female labour participation has spread out most of its potential. For the group of the new member stats, the U-shaped relationship is confirmed.

In all of the groups of countries and static estimations, the results also show that female education has a positive effect on female labor force participation. Although fertility rate has negative correlation with female labor force participation, it is not statistically significant.

These findings regarding the relationship between female labour force participation and economic growth in the European Union, however, should be taking with some cautions since the period of time analysed is not very long. In addition, beside the traditional control variables considered in our analysis, there could be other factors affecting the women's labour participation such as legal and tax regulation, level of competition and liberalization or the country openness as Lechman and Kaur (2015) states.

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Appendix 1

Given a model of the form $FLFP_i = LGDPpc_i\alpha + LGDPpc_i^2\beta + Z_i\gamma + u_i$, Lind and Mehlum (2010) show that a test for the presence of *U* relationship needs to be based on the following joint null hypotheses:

$$H0 : (\alpha + 2\beta lnGDPpc_{\min} \leq 0) \cup (\alpha + 2\beta lnGDPpc_{\max} \geq 0), \quad (1)$$

against the alternative:

$$H1 : (\alpha + 2\beta lnGDPpc_{\min} > 0) \cap (\alpha + 2\beta lnGDPpc_{\max} < 0), \quad (2)$$

where, $lnGDPpc_{\min}$ and $lnGDPpc_{\max}$ are the minimum and maximum values of *lnGDPpc*, respectively. Lind and Mehlum (2010) use Sasabuchi´s (1980) likelihood ratio approach to build a test for the joint hypothesis given by Eq (1) and (2). Tables A1-A4 report the results of the Sasabuchi-Lind-Mehlum (SLM) test based on the results of Tables 2-5, respectively.

The top panel of Table A1 shows that the marginal effect of *lnGDPpc* is negative and statistically significant al $\text{lnGDPpc}_{\min}$ and positive and statistically significant at $\text{lnGDPpc}_{\max}$., for models 1, 3 and 4. The bottom panel of the table shows that the SLM test rejects H_0 (presence of inverse U-shape) for the aforementioned models and indicates that these results are consistent with the presence of a U relationship between lnGDPpc and FLFP.

Table A1. Tests for a U-shape. EU-28

	Test for Model 1 OLS	Test for Model 2 OLS with controls	Test for Model 3 FE	Test for Model 4 FE with controls
Slope at GDPpc min	-50.65**	49.77**	-215.27***	-120.31***
Slope at GDPpc max	5.05*	-5.50**	31.67***	17.75***
SLM test for inverse U shape	1.25	1.72 (a)	5.97	3.22
P value	.10	.04	.00	.00
Fieller 90% confidence interval	[10.01;52.82]	[5.75;11.12]	[9.87;10.21]	[9.73;10.40]

This table reports the results of the Sasabuchi–Lind–Mehlum test for a U-shaped relationship. Robust standard errors *** p<0.01, ** p<0.05, * p<0.1. (a) SLM test for U-shape. The test rejects the H0 (presence of U-shape).

Table A2 shows results of the U-shape test for the EU-15 countries. Results for these regressions do not strongly support the presence of the U-shape. The marginal effect of *lnGDPpc* is positive and statistically significant at $\ln GDPpc_{min}$ (model 4). The SLM tests rejects the null of existence of inverse U-shape against the alternative of U-shape or monotonic. For estimations 5-7, the marginal effect of *lnGDPpc* is negative but statistically non-significant at $\ln GDPpc_{min}$.

Table A2. Tests for a U-shape. EU-15

	Test for Model 4 OLS	Test for Model 5 OLS with controls	Test for Model 6 FE	Test for Model 7 FE with controls
Slope at GDPpc min	275.35***	-44.39	-88.18	-34.59
Slope at GDPpc max	-18.6024***	-5.93	18.43***	12.73**
SLM test for U shape	3.19 (a)	(b)	1.19	0.54
P value	.0012	-	.118	.296
Fieller 90% confidence interval	[10.55-10.91]	[-inf; +inf] U [10.25;+Inf]	[-Inf; 14.67] U [10.30;+Inf]	[-Inf; 11.88] U [10.26;+Inf]
	Rechaza U	No rechaza	No rechaza inverted	No rechaza: inverted

This table reports the results of the Sasabuchi–Lind–Mehlum test for a U-shaped relationship. Robust standard errors *** p<0.01, ** p<0.05, * p<0.1
(a)SLM Test for inverse U-shape. The test reject the null of existence of U-shape
(b) Extremum outside interval - trivial failure to reject Ho (H0: monotone or U shape]

In Table A3, the top panel shows that the marginal effect of *lnGDPpc* is negative and statistically significant at $\ln GDPpc_{min}$ and, positive and statistically significant at $\ln GDPpc_{max}$. for all models. The bottom panel shows that the SLM test rejects H_0 (presence of U-shape) for model 9-11 suggesting that the results are consistent with the presence of a U relationship between lnGDPpc and FLFP.

Table A3. Tests for a U-shape. EU-13

	Test for Model 8 OLS	Test for Model 9 OLS with controls	Test for Model 10 FE	Test for Model 11 FE with controls
Slope at GDPpc min	-111.51	-153.75**	-256.14***	-136.96**
Slope at GDPpc max	15.062	45.73***	42.53***	30.74**
SLM test for U shape	.71	1.72	3.43	1.78
P value	.239	.046	.000	.0412
Fieller 90% confidence interval	[-inf; +inf]	[2.12;9.38]	[9.64; 10.22]	[6.57;10.43]

This table reports the results of the Sasabuchi–Lind–Mehlum test for a U-shaped relationship. Robust standard errors *** p<0.01, ** p<0.05, * p<0.1

Table A4 shows that the the marginal effect of lnGDPpc is negative and statistically significant at $\ln GDPpc_{min}$ and positive and statistically significant at $\ln GDPpc_{max}$., for both models. The SLM test rejects H_0 (presence of U-shape) for model 9-11 suggesting that the results are in line with the feminization hypothesis.

Table A4. Tests for a U-shape for dynamic panels. EU-28

	Test for Model 12 GMM	Test for Model 13 GMM with controls
Slope at GDPpc min	-95.06**	-255.55**
Slope at GDPpc max	27.98***	62.07***
SLM test for U shape	2.32	2.12
P value	.0112	.0182
Fieller 90%	[7.69;9.37]	[8.15;9.56]

confidence interval		

This table reports the results of the Sasabuchi–Lind–Mehlum test for a U-shaped relationship. Robust standard errors *** p<0.01, ** p<0.05, * p<0.1

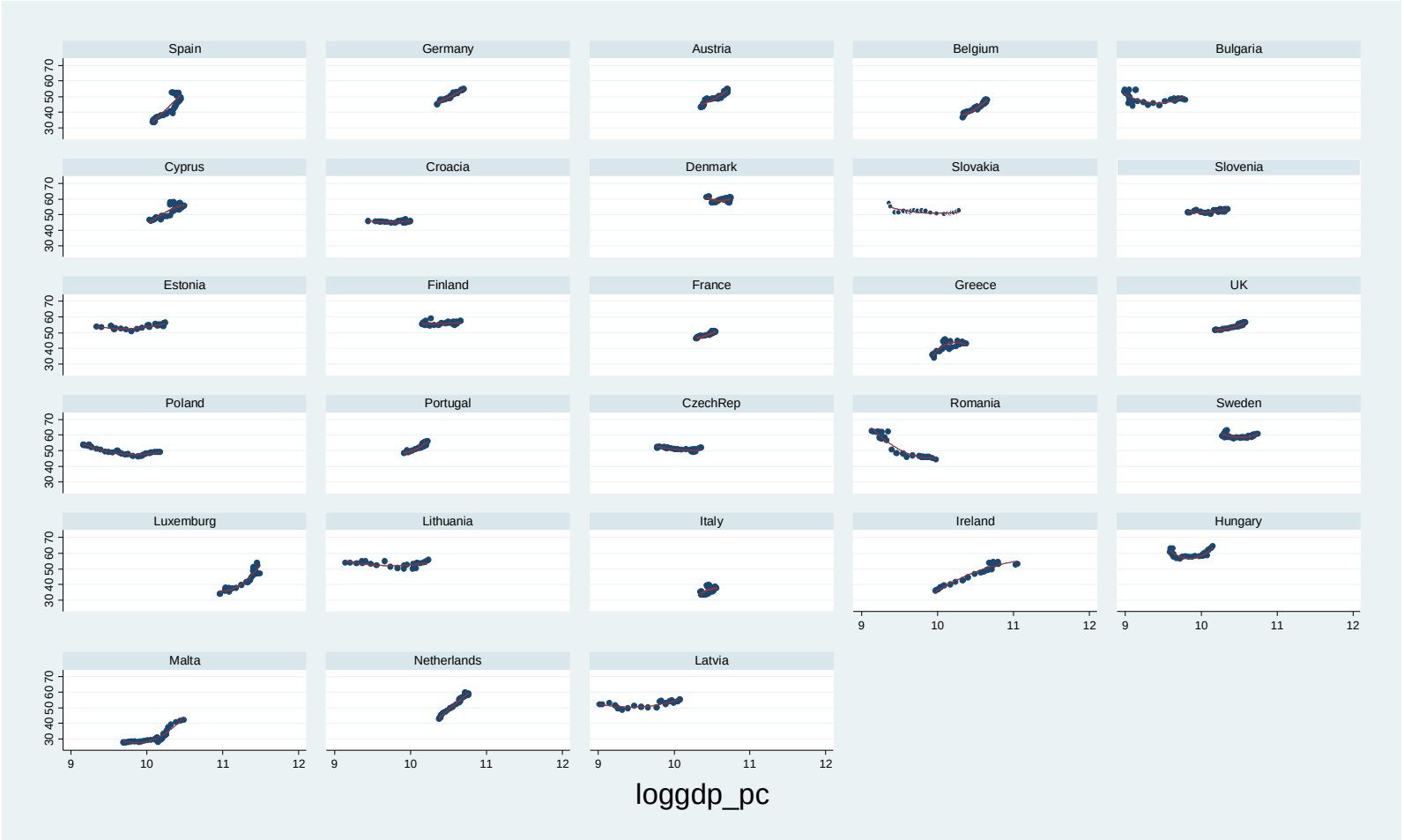
Finally Table A5 shows that the the marginal effect of *lnGDPpc* is negative and statistically significant at $\ln GDPpc_{min}$ and positive and statistically significant at $\ln GDPpc_{max}$., for all models. The SLM test rejects H_0 (presence of U-shape) suggesting that the results are consistent with the presence of the U relationship between lnGDPpc and FLFP for estimations 16-17. However, this hypothesis is not confirmed for estimations 14 and 15.

Table A5. Tests for a U-shape for dynamic panels. EU-15 and EU-13

	EU-15		EU-13	
	Test for Model 14 GMM	Test for Model 15 GMM with controls	Test for Model 16 GMM	Test for Model 17 GMM with controls
Slope at GDPpc min	-101.52*	-125.32*	-204.41**	-223.01*
Slope at GDPpc max	10.82**	13.20*	42.14**	44.26*
		SLM test for U shape	SLM test for U shape	SLM test for U shape
SLM test for U shape	1.45	1.41	2.24	1.64
P value	.0755	.0814	.0148	.0538
Fieller 90% confidence interval	[-Inf; 14.58] U [11.01; +Inf]	[-Inf;+Inf]	[8.95;9.82]	[6.57;10.43]

This table reports the results of the Sasabuchi–Lind–Mehlum test for a U-shaped relationship. Robust standard errors *** p<0.01, ** p<0.05, * p<0.

Appendix 2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Portugal
CzechRep
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Lithuania
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Netherlands
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30 40 50 60 70
9 10 11 12
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