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RESEARCH ARTICLE

Impact of unemployment by sex and marriage rate on fertility decline: Estimates for Turkey and Greece using CCR model

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Abstract

The article analyses the effect of unemployment by sex and marriage rate on fertility changes in Greece and Turkey. The empirical part of the study is based on annual time series data retrieved from the World Bank and National Statistical Offices of Turkey and Greece for 1991–2019. Canonical Cointegrating Regression model is applied for the two countries separately, allowing to quantify the effects of the determinants (crude marriage rate and unemployment rate by sex) on the variation of fertility rate. CCR models show these determinants to be the most significant factors of fertility dynamics in both countries. The results from Engle-Granger and the Phillips-Ouliaris tau (*t*-statistics) tests confirm the cointegration, i.e., long-term relationship between the variables only for Turkey's CCR model. However, it was found that in Greece, female unemployment impacts fertility rate negatively and male unemployment has a positive effect on fertility rate; for Turkey modelling shows the opposite relationship. The results of the study suggest that economic uncertainties might be one of the factors contributing to fertility decline in these countries, long-term or in the coming years.

Keywords

TFR; CMR; unemployment rate by sex; Canonical Cointegrating Regression; Turkey; Greece

JEL codes: J11, J12, J13, J16, C51, C87, E24

Introduction

The political and socioeconomic environment in a country is shaped by important national and international forces, such as the development of market economy or globalizati-

on, which have different effects in different ways across countries and societies (Leridon 2015). Declining fertility in populations observed from historical and recent perspective is a generality in the empirical studies (Burger and DeLong 2016). In a modern society, it has been shown that modernization did not generate an instant shift from high fertility to low fertility. Furthermore, Leridon (2015) indicates that high fertility remained favourable for certain members of some societies who are capable to adapt to the new modes of social organization and economic production (for instance, by sending children to work in the city, and demanding to send the part of their wages back to the family of origin). However, Leridon considers that in most cases, the parents must spend money to raise and educate their children with no expectation of any later monetary revert by them. Using the term «gender equity», Leridon (2015: 334) claims that greater equity within the family, where the woman is free to define her fertility plans, is a prerequisite for the transition from high to low fertility. Economic uncertainty about future employment and decreasing earnings may also be among factors explaining changes in demographic behavior (Klärner 2015). The fast economic change happening in a short time, new labour markets and the decreasing power of states to provide social security have led to an increase in individual feelings or perceptions of economic uncertainty (Klärner 2015; Matysiak, Sobotka and Vignoli 2021; Clark and Lepinteur 2020).

The aim of this study is to carry out an independent country analysis for two Mediterranean countries (Turkey and Greece) in terms of fertility changes and unemployment and marriage context within the last three decades. These two countries represent different fertility transition patterns. Turkey and Greece differ in more than one respect: the beginning of fertility transition in these countries started at different times, it followed different ways and paces, and at this very moment these countries display different rates of fertility decline. Turkey experienced the earliest drop in fertility in the 1950s, and by the end of the twentieth century the fertility was already approaching the replacement level (D'Addato et al. 2007). In Turkey, the trend in fertility decline was rapid and almost stable from the 1950s to 1980s. Therefore, Turkey is an interesting case for research because fertility in this country stays below replacement level even nowadays, besides the socio-economic development and modernization that have occurred since the 1950s. Starting in 1980, Greek fertility rates declined rapidly across all age groups. Within just a decade, the total fertility rate (TFR) had fallen from 2.22 to 1.42 (Tragakis and Bagavos 2019). According to Tragakis and Bagavos (2019), the insignificant recovery of fertility at the beginning of the 21st century in Greece lasted less than 8 years, and ended with the economic crisis of 2009[1]. There is no doubt that both countries, Turkey and Greece, represent a specific family model in which the family still plays a key role for marriage and reproduction. In addition, it is found that there is no strong convergence process regarding civil marriages but rather a durable homogeneity for both countries. To be specific, Turkey has the lowest rate of births outside of marriage in Europe (3%) and in Greece this indicator comes to 10.3% against over 50% in most of the EU countries in 2017 (Eurostat 2020). Additionally, within the societies of Southern Europe the model of a nuclear family is based on the understanding that the couple is not likely to decompose due to separations and divorces; the fertility rates adjusts to the generational change; a husband

1 The Greek economic crisis arised in 2009 following the global financial crisis. In 2010–2016, Greece went through a series of fiscal and structural adjustment programmes leaded by the labour market reforms influenced by neoliberal economic models (Tourtouri, Papatheodorou and Pavlopoulos 2018). From the conclusions of these authors, it is evident that the reforms were principally in collective labour legislation, which in most part involved the dismantling in the centralization and the labour law shifting the power considerably in favor of the employers.

is considered to be responsible for family income, i.e., he is «the breadwinner», while a wife should preferably not be so busy in order to be fully available for family care (Bertani 2013). According to Moreno (2006), such circumstances have deep historical roots within Mediterranean region and are not diminishing at present in any fundamental way.

To be precise, the goal of this article is to study whether the decline in fertility observed in Turkey and Greece (the countries are considered separately, without comparison) could be related to the interplay between the labour market uncertainty and fertility dynamics. Implications of this study might gain more importance after the institution of marriage transforms along with the global structural development process in the economic and demographic domains (for instance, urbanization, industrialization, and modernization in a wider perspective). This analysis covers several key research questions about the fertility, economic uncertainties, and labour market, namely: Have economic uncertainties been a less important fertility factor decades ago than they are now? Have gender inequalities on a labour market lessened? Is marriage status still important factor of fertility?

The article is organized as follows: section 2 contains the theoretical background of the research; section 3 presents data and methodology of the study; section 4 reviews the empirical results of the study; section 5 provides discussion and summarizes the key concluding remarks of the research.

Theoretical background

Most of the demographic theories appear to be explaining fertility processes, such as the questions why fertility declines over time, what leads women to give birth, and why there is a negative relationship between fertility and family income (Andreev 2019). The economic theory of fertility, in its *New Home Economics* version, states that 1990s trends in fertility may be fully understood only if seen as a unified part of the changes in family structure that have been taking place since the 1960s (Paci 1999). Furthermore, Paci (1999) explains the *economic theory of the family* and its main implications, pointing out that the key factor influecing women's decisions about childbearing and employment was the comparative advantage of men and women in salaried work. There is disagreement on whether modernization theory or reproduction theory better explain national trends or cross-country differences in regard to reproduction and social inequalities (Marks 2009). *Reproduction theory* has many diverse explanations basing on the assumption that the intergenerational reproduction in regard to socioeconomic inequalities is strong and still existing. According to Marks (2009), processes such as urbanization and educational expansion are still ongoing, and hypothetically, are likely to further reduce the socioeconomic inequalities. It is believed that *modernization theory* is a more appropriate concept because its primary interest is the labour market. The socioeconomic success of males has been positively associated with reproductive success across a variety of «traditional» pre-industrial societies. In modern societies, the anticipated positive associations between socioeconomic and reproductive success of the population have been weakened or even reversed (Goodman et al. 2015). This change is still underexplained, but Goodman et al. (2015) mention that there is a concept explaining that the process of modernization contributes to reducing fertility by increasing the costs of rearing children. In line with this view, many studies indicate that children's education and wealth in modern societies considerably contribute to low fertility. In addition, Huber et al. (2010) point out that women

are expected to adapt their reproductive behavior according to their available resources and to prefer partners who can offer access to more resources. Consequently, the statistics indicators from the rural or agricultural societies and also modern societies show that for male population, the association between socioeconomic status and reproduction is positive. At the same time, for modern women, the relationship between socioeconomic status and number of children is negative. This probably results from incompatibility of education, work, and rearing of children.

Citing the Giddens' *theory of structuration*, from 2013, Klärner and Knabe (2017) point out that the reproduction of a society takes place mainly through the certain repeating of traditional behavioral patterns, and modification processes may occur when there are contrasts between conventional and alternative behaviors. These scholars note that such conflicts may cause individuals to reflect upon traditional models. The financial resources accessible to a person in general are seen as an indicator of someone's material standard of living. From a gender perspective, Neyer and Rieck (2009) consider them as an indicator of the scope of alternatives available to someone, of his/her capabilities to choose, and of his/her potential to achieve welfare. Thus, financial resources are not simply an indication of possessions or of wealth, but are also an indication of the power to act, of the ability to take part in the active life of society, and of the potential to decide one's own life course (Neyer and Rieck 2009:143). Following the discussion of Fieder and Huber (2007) for the *life history theory* and evolutionary explanations of human behavior in modern societies, these scholars reported a positive relationship between income and number of children observed for modern men. A similar positive association for men was also found analyzing General Social Survey data. By analyzing a part of a larger group of society, Fieder and Huber (2007) illustrated a positive association between formal status and reproduction in men as well as a negative association in women. These findings support the importance of some particular cohorts of society when investigating human behavior.

Data, variables and methodology

The empirical part of this study bases on annual time series data retrieved from World Bank indicators database (World Bank 2020) for the period 1991–2019. Additionally, the data for Turkish and Greek TFR for 2019 and data for the Turkish marriage rate for the whole period of study were obtained from National Statistical offices of the countries, Turkish Statistical Institute (2020, 2014) and Hellenic Statistical Authority (2020), respectively — due to the lack of these data within UN and World Bank databases. In order to have methodologically standardized data for both countries, the estimations of the World Bank about Total Fertility Rate (TFR) for these countries have been used as well. These estimations of the World Bank are based mainly on the following sources: United Nations database; census reports and other statistical publications from national statistical offices; Eurostat database and international database of the U.S. Census Bureau.

We should make some remarks on the methodological comparability of the data covering the two countries under review. Thus, the TFR series for Turkey is the average of expert estimates and simulations based on a variety of approaches, i.e., estimates based on indirect methods. The TFR series for Greece is a direct calculation based on official birth registration statistics and annual estimates of the number of women by one-year age group. Hence, in spite of the fact that the data are taken from the same database (the World Bank), this does

not ensure their methodological comparability. For this reason, the country analysis in this study is carried out independently, the author avoids comparing countries.

The variable of interest is *total fertility rate*, measured as the number of live births per woman.

One of the independent variables is *crude marriage rate (CMR)*, which is measured as a number of marriages per 1,000 persons. In the family demography, analysis of marriages, i.e. measure of the trend of marriage rate is simply used as an indicator of family formation and/or behavior. Marital status is an important source of information on the family (Bartolini, Bilancini and Pugno 2013) and marriage is considered an important institution (Potančoková et al. 2008). The opinion that marriage is an important proxy determinant of fertility lies partly on the presumption that marital fertility is steady over time (Fukuda 2020). Marriage rates and fertility are closely related, thus the periods of high marriage rates positively impacted the fertility trend, and on the contrary, lower fertility may be a result of a decrease in marriage rates (Potančoková et al. 2008). Accordingly, the development of marriage rates has been considered as an important determinant affecting the fertility trend.

Another independent variable is *unemployment rate by sex*. The perception of financial security is seen as a significant prerequisite for having children (Potančoková et al. 2008). The uncertainty related to the stability of the household is only one of the many potential factors that have an effect on fertility (Paci 1999). One of the most common indicators of an economic downturn is unemployment. Comolli (2017) indicates a negative average effect of −0.5 conceptions per 1,000 women for each percentage point increase in unemployment for the cohorts of American women between 2007–2011.Other studies that have explored the nexus between unemployment and fertility in Europe found that unemployment rates have depressed fertility during the Great Recession, and a particularly prominent relationship was revealed between the long-term male unemployment rates and first birth rates (Comolli 2017). Additionally, this author points to a strong negative effect of unemployment on the chances of first births among men and women below 30 years old, especially for those with higher education. Hence, given these explanations, the hypothesis of this study could be defined as follows: «Is there a cointegration, i.e., a long-term relationship between of unemployment and marriage rates and the variations in the total fertility rate in Greece and Turkey»?

In order to understand the impact of the economic and demographic indicators on the total fertility rate and to explain the variation of the fertility rate in Turkey and Greece, the author applies cointegrating regression. Figures 1–3 visually present the TFR, CMR, and unemployment trends in Turkey and Greece for the period 1991–2019.

Regarding the cointegrating relationships, Engle and Granger have noted that a linear combination of two or more I(1) series can be stationary, or I(0), in which case it could be said that the series are cointegrated (IHS 2017). This kind of a linear combination defines a cointegrating equation with cointegrating vectors of weights indicating the long-run relationship between the variables. This study applies a Canonical Cointegrating Regression (CCR), which represents the same cointegrating relationships as the original models. Anyhow, CCR models are constructed in such a way that the regular least squares procedure generates asymptotically efficient estimators and chi-square tests (Park 1992). The reason why Canonical Cointegrating Regression (CCR) was applied even though CCR is strongly related with FMOLS (full modified OLS), is the well-known fact that CCR uses stationary transformations of the (y_{1t}, X_t') data to get least squares estimates in order to remove the long run dependence between the cointegrating equation and stochastic regressors changes, i.e., innovations (IHS 2017). Therefore, the CCR transformations asymptotically remove the

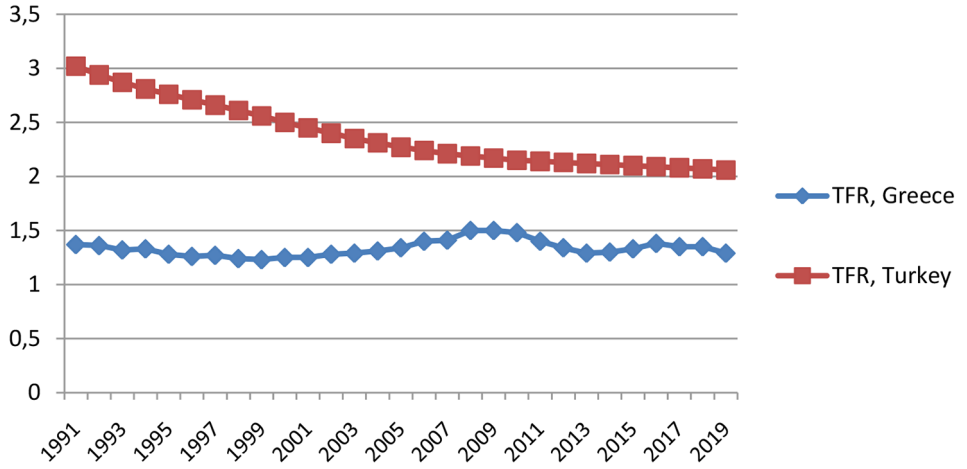

Fig. 1. Total fertility rate, Greece and Turkey, 1991–2019. *Source:* Author's estimates based on various sources

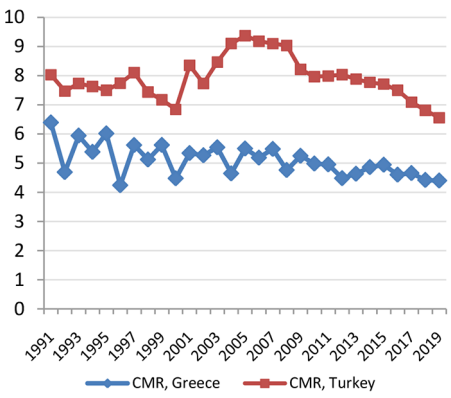

Fig. 2. Crude marriage rate per 1,000, Greece and Turkey, 1991–2019. *Source:* Author's esctimates based on various sources

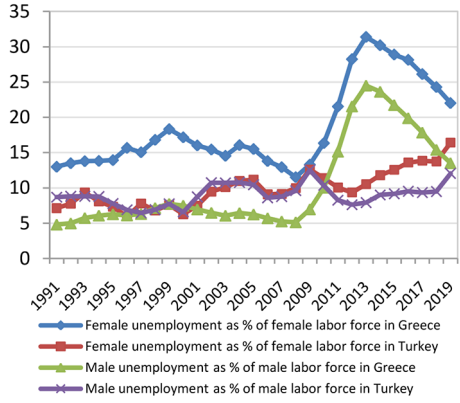

Fig. 3. Unemployment rate in Greece and Turkey, 1991–2019. *Source:* Author's estimates based on various sources

endogeneity generated by the long run correlation of the cointegrating equation errors and the stochastic regressor's innovations. The needed transformations include simple adjustments of the integrated processes using stationary components in cointegrating models (Park 1992). Thus, Canonical Cointegrating Regression is an efficient estimation method of testing the cointegrating relationship and hence of the long-run relationship between the variables (IHS 2017).

If one of our explanatory variables is correlated with the error term, then the assumption of $E = (\varepsilon_i x_i) = 0$ is not valid (Thomsen et al. 2013). The problem of endogeneity might cause our estimator to be inconsistent and biased. The best way to solve this problem is to find an estimator which is consistent and unbiased even if there is endogeneity. One of the common ways to avoid endogeneity in the model is by using instrumental variables. In case of this study, a CCR estimator has been applied. In addition, the usefulness of the application of the CCR method is seen for the reason that at the same time, CCR

transformations correct the asymptotic bias occurring from the existing correlation between the regression and stochastic regressor errors. Accordingly, estimates based on the CCR are fully efficient and have the same unbiased, mixture normal distribution, which is free of non-scalar interference parameters and allows asymptotic Chi-square testing as FMOLS does. Thus, this method eliminates the long-term correlation; the long-term covariance is computed with a procedure of pre-whitening with lags and kernel functions and the standard errors are consistent with heteroskedasticity and autocorrelation. Hence, the empirical results of this model with Canonical Cointegration Regression (CCR) are in line in regard to statistical significance and signal orientation. In addition, the negative consequences that the model might present specification bias or not be homoscedastic or that it might not have a standard normal distribution as well as the issue of stationarity have been avoided (Hdom and Fuinhas 2020).

Following IHS guidelines (2017: 276), first thing to do when using the CCR model is to get the estimations of the innovations $\hat{u}_t = (\hat{u}_{1t}, \hat{u}'_{2t})'$ and appropriate constant estimations of the long-run covariance matrices $\hat{\Omega}$ and Λ. Differently from FMOLS, CCR needs additionally a consistent estimator of the contemporaneous covariance matrix $\hat{\Sigma}$. The columns of $\hat{\Lambda}$ that are consistent with the one-sided long-run covariance matrix of $\hat{u}_t$ and (the levels and lags of) $\hat{u}_{2t}$ are removed.

$$\hat{\Lambda}_2 = \begin{bmatrix} \hat{\lambda}_{12} \\ \hat{\Lambda}_{22} \end{bmatrix} \tag{1}$$

The transformation of (y_{1t}, X'_t) have been performed by using the formulas as in (2) and (3), respectively:

$$X^*_t = X_t - \left(\hat{\Sigma}^{-1}\hat{\Lambda}_2\right)' \hat{u}_t \tag{2}$$

$$y^*_t = y_t - \left(\hat{\Sigma}^{-1}\hat{\Lambda}_2\hat{\beta} + \begin{bmatrix} 0 \\ \hat{\Omega}^{-1}_{22}\hat{\omega}_{21} \end{bmatrix} \right)' \hat{u}_t \tag{3}$$

where the $\hat{\beta}$ are estimates of the cointegrating equation coefficients, thus, these are usually the standard OLS estimates employed to get the residuals $\hat{u}_{1t}$ (IHS 2017). Therefore, CCR estimators could be defined as ordinary least squares applied on the transformed data.

$$\begin{bmatrix} \hat{\beta} \\ \hat{\gamma}_1 \end{bmatrix} = \left(\sum\nolimits_{t=1}^{T} Z^*_t Z^{*\prime}_t \right)^{-1} \sum\nolimits_{t=1}^{T} Z^*_t y^*_t \tag{4}$$

where $Z^*_t = (Z^{*\prime}_t, D^{*\prime}_{1t})'$.

When estimating the specification by CCR for Turkey, a prewhitened Quadratic-spectral kernel estimators of the long-run covariance matrices was applied. Thus, the calculation method was changed and a (fixed lag) VAR(1) was specified for the prewhitening method, so the kernel shape was changed to quadratic spectral. The first thing that was noted was that the VAR prewhitening within Turkish CCR model had a stronger effect on the kernel part of the calculation of the long-run covariances. Furthermore, as a result of prewhitening, the estimate of the conditional long-run variance has changed quite a bit. Differences aside, this contributed to smaller standard errors of the estimated coefficients for CCR. All of this was not possible to do when estimating the specification by CCR for Greece. Instead, for the Greek CCR model the Bartlett kernel estimator of the long-run covariance matrices was used and a lag was not specified within the calculation method. The estimates of the regressors equations are in differenced form.

Emirical results of the study

A Canonical Cointegrating Regression (CCR) model was estimated that includes additional deterministics in the cointegrating regression equations, i.e. intercept and @TREND. Our empirical results are acquired by using aggregate annual data for total fertility rate (TFR) and crude marriage rate (CMR), as well as female unemployment rate and male unemployment rate as percentage of the female and male labour force, respectively, for Greece and Turkey from 1991 to 2019. The estimated coefficients, the standard errors, *t*-statistic, and *p*-value for the estimated coefficients, the constant and trend values as well as summary statistics are presented in Tables 1 and 2. The descriptive and fit statistics are also calculated using the CCR transformed data.

Crude marriage rate has no significant effect on total fertility rate for Greek CCR model, but other variables do have a significant effect on fertility rate at 5% and 1% level of significance. For Greece, the female unemployment rate has the most significant (negative) impact on fertility rate. The impact of male unemployment is also significant but with positive signs. All included variables in the CCR model for Turkey are significant at 5% and 1%. The most significant (positive) effect on fertility rate is the female unemployment rate. In the Turkish CCR model, both male unemployment rate and the crude marriage rate have a statistically significant (negative) effect on fertility rate.

Table 1. Specification of CCR model for Greece

Variable	Coefficient	Std. Error	t-Statistics	Prob.
Crude marriage rate	-0.0090	0.0390	-0.2301	0.8201
Female unemployment rate	-0.0560	0.0080	-6.9909	0.0000
Male unemployment rate	0.0468	0.0079	5.9335	0.0000
C	1.8544	0.2534	7.3165	0.0000
@TREND	0.0053	0.0018	2.9493	0.0072
Summary statistics				
R-squared	0.7739			
Adjusted R-squared	0.7346			
S.E. of Regression	0.0386			
Long-run variance	0.0014			
Mean dependent var	1.3332			
S.D. dependent var	0.0748			
Sum squared resid	0.0342			
Cointegration Tests				
Engle-Granger tau statistics Value	-3.5130			
Prob.	0.4091			
Engle-Granger z-statistics Value	-17.8216			
Prob.	0.3801			
Philips-Ouliaris tau statistics Value	-3.4653			
Prob.	0.4298			
Philips-Ouliaris z-statistics Value	15.7760			
Prob.	0.5166			

Notes: **Long-run covariance estimate for Greece (Bartlett kernel, Newey-West fixed bandwidth=4.0000). Dependent variable: Total fertility rate (TFR). Method: Canonical Cointegrating regression (CCR). Sample (adjusted): 1992–2019. Included observations: 28 after adjustments. Cointegrating equation deterministics: C @TREND. *Source:* Author's calculations

Table 2. Specification of CCR model for Turkey

Variable	Coefficient	Std. Error	t-Statistics	Prob.
Crude marriage rate	-0.0580	0.0100	-5.7918	0.0000
Female unemployment rate	0.0637	0.0080	8.0077	0.0000
Male unemployment rate	-0.0469	0.0080	-5.8920	0.0000
C	3.2741	0.0738	44.377	0.0000
@TREND	-0.0464	0.0016	-28.378	0.0000
Summary statistics				
R-squared	0.9837			
Adjusted R-squared	0.9808			
S.E. of Regression	0.0384			
Long-run variance	0.0008			
Mean dependent var	2.3593			
S.D. dependent var	0.2772			
Sum squared resid	0.0339			
Cointegration Tests				
Engle-Granger tau statistics Value	-5.2844			
Prob.	0.0286			
Engle-Granger z-statistics Value	-20.2056			
Prob.	0.2447			
Philips-Ouliaris tau statistics Value	-5.3259			
Prob.	0.0265			
Philips-Ouliaris z-statistics Value	-20.7365			
Prob.	0.2191			

Notes: ** Long-run covariance estimate for Turkey (Prewhitening with lags=1, Quadratic Spectral-kernel, Newey-West automatic bandwidth = 4.6742, NW automatic lag length =3). Dependent variable: Total fertility rate (TFR). Method: Canonical Cointegrating regression (CCR). Sample (adjusted): 1992-2019. Included observations: 28 after adjustments. Cointegrating equation deterministics: C @TREND. *Source:* Author's calculations.

Consequently, our test of the null hypothesis of no cointegration against the alternative of cointegration is consistent with a unit root test of the null of non stationarity against the alternative of stationarity. Resuming with our CCR model of TFR and CMR as well as unemployment by sex, Engle-Granger and Phillips-Ouliaris tests were constructed from an estimated equation where the deterministic regressors include a constant and linear trend. It is confirmed that Engle-Granger and Phillips-Ouliaris tests are computed using C and @TREND as deterministic regressors, and it is also noted that the option to include a lagged difference in the ADF regression was determined using automatic lag selection with a Schwarz criterion (IHS 2017). For that reason, the asymptotic distributions of the Engle-Granger and Phillips-Ouliaris τ and z statistics are non-standard and depend on the deterministic regressors specification, thus the critical values for the statistics are obtained

from simulation results. These two tests contradict the method of interpreting for serial correlation in the residual series. Therefore, the Engle-Granger test uses a parametric, augmented Dickey-Fuller (ADF) approach, while the Phillips-Ouliaris test uses the non-parametric Phillips-Perron (PP) method. Our test results showed that the Engle-Granger tau-statistic (*t*-statistic) did reject the null hypothesis of no cointegration (unit root in the residuals) at the 5% level only for Turkey. Accordingly, the tau-statistic did not reject the null hypothesis of no cointegration for Greece. The normalized autocorrelation coefficient (which is termed the *z*-statistic) did not reject the null hypothesis of no cointegration (unit root in the residuals) at the 5% level for any of the countries. Hence, the evidence from these tests clearly suggests that TFR and CMR as well as unemployment rate by sex are cointegrated for Turkey, but not for Greece (Tables 1 and 2). The Phillips-Ouliaris tests reject the null hypothesis of no cointegration at the 5% significance level for Turkey, but not for Greece. Also the Phillips-Ouliaris test results obtained with tau-statistic (*t*-statistic) did reject the null hypothesis of no cointegration but the test results with *z* statistics did not reject the null hypothesis of no cointegration.

Discussion of the results and conclusion

This paper highlights the great importance of fertility decline analysis in relation with unemployment rate by sex and marriage rate. The distinctions are noticed separately for two countries, Turkey and Greece, suggesting in general that the economic surroundings and inequalities play a significant role in the process of fertility decline.

In our case, Engle-Granger tau-statistic (*t*-statistic) for Turkey has shown that the null hypothesis of cointegration is rejected. For Greece, none of the performed tests rejected the null hypothesis. These results indicate that there is no cointegration relationship between model variables for Greece. Therefore, the hypothesis of the study is partially accepted, i.e., the long-term cointegration between model variables was found only for Turkey, but not for Greece.

The results obtained for Turkish case imply that there is some kind of mutual mechanism between these series in the long-run, since the process of convergence is perceived. This provided a determination of the long-term coefficient between the variables by the CCR method as a tool to examine the importance of the cointegration relationship between these time series. In other words, marriage status and the consequences of unemployment by sex and in consequence of TFR are captured by our cointegration model (CCR) which determines feasible interactions between each variable used by this model. Taken separately, these findings confirm suggestions that the CCR model is a powerful estimator of examining the fertility decline for Turkey.

Table 2 reports that in Turkey, for the crude marriage rate and male unemployment variables, the coefficients of direct effects are negative. Put it differently, in the long run, the coefficients are perfectly elastic to the TFR variation in Turkey. This means that in Turkey an increase of the marriage rate implies a reduction in the TFR. This result is quite unexpected. It seems that, in the period here observed, marriage still played a role in Turkish society but that its effect was negative on TFR. From this point, Windzio and Aybek (2015) clearly emphasize that the role of the family in regard to the autonomy and dependence of separate family members in the Turkish society is different from patterns instituted in northern or western European societies (e.g. in Turkish context, autonomous living before marriage was

found to be very rare). Anyhow, it is known that Turkey has undergone major socioeconomic changes over the past decades and as a result the family life transitions have been impacted as well. These changes have been caused by modernization processes, influence of the Western values, and socioeconomic changes (Caarls and de Valk 2018). Here it may be mentioned clearly the role of *modernization theory*, where the process of modernization contributes to reducing fertility by increasing the costs of rearing children. In other words, women in marriage are expected to adapt their reproductive behavior according to their available resources and to prefer partners who could offer them an access to more resources (Hubert 2010). Besides, in the opinion of Caarls and de Valk (2018), the enormous regional variation has also made Turkey a peculiar case: there are substantial differences between regions both in terms of economic development and in the spread of more modern values toward family life. Considering TFR, for example, in some regions, these rates approximate those of European countries, while in other regions TFR has remained high. Since the divorce growth in Turkey is recent, as stated by Caarls and de Valk (2018), it could be considered a new family demographic phenomenon in the Turkish context. According to the Eurostat data (2021), the crude divorce rate in Turkey has been slightly increasing since 2004, i.e., its value has been over 1.3 per 1,000 persons in comparison with previous years when its value was below 1 per 1,000 persons. Theories on the diffusion of innovations assume that new behaviors first emerge in the cities and large towns between those with a higher socioeconomic status. The study of Caarls and de Valk (2018) suggest that probably for Turkey, modernization and the diffusion of new family norms are connected with a divorce growth.

The results of the study have a few implications in economic and socio-demographic sense for Turkey. Firstly, the female unemployed status on the labour market in Turkey has exceptionally strong impact on the decision to have a child. In addition, the fact that Turkey is a very heterogeneous society may be one of the key challenges for policymakers to embrace a different strategy to improve the quality of life of the people. At the same time, it is important to mitigate the risk of labour market uncertainties for the long run since it is necessary for higher employment rates and in consequence it may induce the increase of TFR. In a society where there are contrasts between conventional and alternative behaviors, as was stated by Klärner and Knabe (2017), it is most likely that such conflicts may cause many individuals to repeat traditional patterns and reflect upon traditional models. These explicit implications could be also explained by the fact that demographic transition in Turkey is still incomplete. Namely, after the 2000s Turkey has entered the last phase of demographic transition (Yüksel 2015) and according to the recent demographic structure, the country is still there.

A CCR model estimated for Greece has not shown any cointegrating relationship between the variables (Table 1). Anyhow, a particular negative influence of female unemployment status on fertility decline could be noticed in this country. What was interesting is that female unemployment rate has a significant (negative) impact while male unemployment has a significant (positive) impact on fertility rate in Greece. In addition, it was found that the crude marriage rate has no relevant significant effect on fertility rate in Greece. However, the results have a few implications in economic and socio-demographic sense for Greece.

Our results for Greece however still reveal a relationship that we cannot neglect, even though the different effect of the unemployment by sex on fertility requires more operative and systematic methodologies that should be justified within future research. Maybe an announcement for more substantial and deeper reforms of public policies for structural economic investments and social protection are the endogenous factors that may explain these conflicting results for Greece.

To define further, our results point to the well-known difficulties of balancing between reproduction career and socioeconomic context in modern societies (Marks 2009; Goodman et al. 2015). From an evolutionary perspective, the negative association between women unemployment and fertility as was found in Greece may be attributed to a *life history strategy* (Fieder and Huber 2007). Also, the *modernization theory* (Goodman et al. 2015) may be applied for the Greek case: according to that theory, in modern societies, the anticipated positive associations between socioeconomic and reproductive outcomes of the population have been weakened. The empirical results have shown this situation for the Greek model. From a political and economic point of view, we can assess that the various paths to TFR increase or its stabilization for example for Greece are complicated and the connections that imply its recovery need to be improved. Therefore, a possible approach by the individuals would be to know how to manage financial resources (Neyer and Rieck 2009) and by the policymakers to demonstrate a more productive direction of the movement of financial resources.

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