Unemployment and Fertility in Italy. A Regional Level Data Panel Analysis.

Gabriele Ruiu, Department of Economics and Business, University of Sassari

Marco Breschi, Department of Economics and Business, University of Sassari

Abstract

The effect of increasing unemployment on the decision to have children is not completely clear, from either the theoretical or empirical point of view. We focus our empirical analysis on a peculiar context: Italy. Indeed, the demographic behavior in this Country challenges the most influential theoretical predictions developed in social sciences.

Our results indicate that a negative long run relationship exists between the two variables, but some surprising results are obtained when the short-run is considered. In contrast to previous empirical findings, our results indicate a that fertility is pro-cyclical in Southern Italy, while the opposite is true in the North.

1. Introduction

The relationship between unemployment and fertility is widely debated in both economics and demography. In particular, the effect of increasing unemployment on the decision to have children is not completely clear, from either the theoretical or empirical point of view.

It would seem reasonable to hypothesize that during periods of economic crisis, the increase in economic uncertainty (usually captured through the rise in unemployment rates) with an associated sense of precariousness (in addition to possible reduction of incomes due to job losses) should cause a short-term contraction of births (Bongaarts and Feeney 1998). For instance, Sobotka et al. (2011) assert that macroeconomic uncertainty influences reproductive decisions as much as individual economic conditions. However, it must be said that, at least from a theoretical point of view, the effect of unemployment might be different between the sexes.

For men, unemployment implies not being able to reach previously accessible goods due to the reduction of income. Therefore, if we are willing to accept the idea that having a child may be modeled as an economic decision, the prediction is inevitably that a sharp reduction in the demand for "children" will be observed. For women, in addition to the income effect just described, another force pushes in the opposite direction. Indeed, unemployment implies that the opportunity cost of having a child (in other words, the wage that one has to give up net of the possible maternity allowance) suffers a drastic decline, thus favoring fertility choices (substitution effect). So, if - and only if - the latter force compensates the income effect, there will be an overall increase of fertility in times of crisis, while the opposite will happen when the substitution effect is overwhelmed by the income effect.

However, when the female labor market participation rate is low, income effects related to the loss of the partner's income should be relatively more important. In particular, regions with low female participation rates experience a higher incidence of households in a situation of zero earnings, with upsetting effects on fertility. Therefore, the positive substitution effects should be negligible in these regions.

Recently, in their cohort analysis of the total number of births in the U.S., Currie and Schwandt (2015) found that if the members of a cohort experience a one percentage point increase in unemployment during their twenties, this implies a short-time reduction of six births per 1,000 women and a cumulative long-term effect of 14 births per 1,000 women. Pro-cyclical relationships have been confirmed by other empirical studies that use macro-level data (see, among others, Örsal and Goldstein 2010; Ahn and Mira 2002; Matysiak et al. 2018).

However, there are also empirical works, especially those analyzing data before the late 1980s, which have found a counter-cyclical tendency in fertility (see, for instance, Heckman and Willis 1976; Butz and Ward 1979; Ermisch 1998; Comolli 2018). Interestingly, Comolli, analyzing fertility in Finland, finds that fertility behavior was countercyclical during the 1990s recession but pro-cyclical during the most recent one. Del Bono et al. (2015) similarly find that unemployment has no effect on fertility in Austria, but at the same losing a career-oriented job because of a firm closure implies negative effects on the fertility of female white-collar workers. Considering a country characterized by strong link between marriage and fertility as Japan, Raymo and Shibata (2017) find that unemployment depresses male propensity to marry but at the same increases marital fertility, with the second effect that outweighs the former.

As argued by Adsera (2004), labor market institutions play a crucial role in explaining these empirical mixed findings. The more generous the unemployment benefit, the less strong the income effect should be. In addition, if labor market flexibility allows the unemployment episode to be short, then the uncertainty tied to the possibility of finding another job after pregnancy should be reduced. This might make an episode of involuntary unemployment an ideal moment for having a child.

Considering the Italian case, Cazzola et al. (2016) have shown that signs of the relationship between unemployment and general fertility rates are different in Northern and Southern regions. Specifically, they found that in Northern and Central Italy, the effect of unemployment is negative, while the opposite is true for Southern Italy (although in the latter case the results were weakly statistically significant). They conclude that this difference may be due to regional heterogeneity in the pervasiveness of the underground economy. In particular, as Southern Italy is characterized by a higher level of underground economic activity, the level of official unemployment may not reflect the true economic situation of this part of the country. Even though this seems a reasonable conclusion, it should be noted that according to Ferreira-Tiryaki (2006),[1] the underground economy seems to be pro-cyclical. Accordingly, when the formal economy is affected by negative shocks, the informal one is affected too. Hence, at least in principle, one might expect stronger effects in Southern Italy, where both formal and informal economy are affected by the crisis. In addition, even though one may surmise that an individual who loses his/her job enters the unofficial labor market, the increased insecurity attached to this position should produce a negative effect on fertility.

1 It must be said that the causal relationship between unemployment and the shadow economy is debated in economics (for a discussion, see Lisi 2010). See also Bajada (2003), who finds that negative shocks to legitimate economic activity have a greater effect on the underground economy than positive shocks.

Finally, the empirical results of Cazzola et al. are obtained by pooling together all the regions belonging to the same macro-area and estimating a dynamic regression model for each. In other words, this approach does not allow regional heterogeneity to be taken into account. Figure 1 reports the evolution of both the quarterly general fertility rate (GFR) and unemployment rates (male + female) in Italian regions broken down by geographical macro-area, while Figure 2 reports male and female unemployment rates for the same period.

>>> Insert figure 1 here <<<

>>> Insert figure 2 here <<<

In Northern regions, during the worst phase of the 2008-2013 recession, unemployment rates peaked at around 12% (in Piedmont and Liguria), a level that would be considered low in Southern Italy. A similar situation (with slightly higher unemployment rates) characterizes Central Italy. In line with the pro-cyclical hypothesis, in Northern and Central Italy the periods of decreasing unemployment (1992-2007) seem to roughly correspond to periods of increasing fertility, while the opposite holds in periods of increasing unemployment. It should be recognized that previous studies have underlined that the recovery in fertility rate in Northern Italy was mainly driven by the behavior of immigrants (see, for instance, Goldstein et al. 2009) and the recent recession has especially affected traditional sectors, such as manufacturing or building and construction, in which immigrant workers are strongly concentrated (see Reyneri 2004).

In the South (where the presence of immigrants is relatively modest), on the other hand, a decreasing GFR in the last decade of the twentieth century was followed by a stabilization, and a new negative trend after 2009. This pattern could be observed in particular in Campania and Sicily (the two regions with the largest population). Given that unemployment was also decreasing at the turn of the nineties, this may explain the positive correlation found in Cazzola et al. (2016). In Sardinia, Abruzzo, and Molise (the regions with the lowest fertility in Italy) we see a decline in fertility during the nineties followed by a period of modest recovery interrupted by a new decline after the beginning of the great recession. The patterns in these Southern regions seem thus to be different from other Southern regions.

We believe that Italy represents a peculiar context for analysis for several reasons. First of all, the country is (together with Spain, Portugal, Greece, Cyprus, and Malta) characterized by the lowest total fertility rate (TFR) in the world, leading Livi Bacci (2015) to argue that fertility was already so low as to exclude any possible further negative effect produced by recession.

In addition, given that female participation in the labor market in Italy is among the lowest in Europe,[2] and this is particularly true in the South (see Table 1), the positive relationship between unemployment and fertility challenges the predictions made by neoclassical microeconomic models. Furthermore, Italy has often been depicted as the least secularized of the developed countries (see Breschi et al. 2018 for a discussion), hence the very low fertility is also difficult to explain by means of the Second Demographic Transition theory (see Lesthaeghe and Surkyn 1998).

Table 1. Inactivity rates in the population aged 15-64, Italy and macro-regions.

Territory	**Gender**	**2005**	**2010**	**2015**	**2016**	**2017**
Italy	males	25.63	26.90	25.92	25.22	24.98
	females	49.53	48.93	45.90	44.81	44.07
	total	37.63	37.99	35.96	35.06	34.57
Northern Italy	males	22.46	22.33	21.55	21.04	20.99
	females	41.30	39.58	37.26	36.19	35.45
	total	31.82	30.95	29.40	28.61	28.21
Central Italy	males	24.81	23.65	22.88	22.35	22.38
	females	44.33	43.07	39.04	38.62	37.72
	total	34.70	33.51	31.06	30.59	30.14
Southern Italy	males	30.14	34.53	33.26	32.22	31.61
	females	62.51	63.82	60.68	59.23	58.65
	total	46.51	49.35	47.10	45.83	45.23

Source: Italian National Institute of Statistics (ISTAT)

Finally, the focus on the Italian situation also allows us to eliminate the possible confounding effects played by different institutional contexts (for example different systems of law regulating

2 For a European comparison: https://ec.europa.eu/info/sites/info/files/european-semester_thematic-factsheet_labour-force-participation-women_en.pdf

the labor market, different laws regarding maternity or paternity leave, different systems of unemployment benefit) since the same institutions are in force throughout the country.

In the following section we will present data and methodology. In the third section, we will show the obtained results, while the last section is devoted to discussion.

2. Methods and data

We calculated the time series of quarterly GFR for each Italian region in the period 1992 (fourth quarter)-2017 (fourth quarter) using official data produced by ISTAT. The log of GFR is used as a dependent variable in an ARDL panel where both the log of the male unemployment rate (hereafter unem_male) and the log female unemployment rate (hereafter unem_female) are the main explicative variables.

Going into greater detail on ARDL panel techniques, we implement both the Mean Group (MG) and Pooled Mean Group (PMG) estimator, proposed respectively by Pesaran and Smith (1995) and Pesaran, Shin, and Smith (1999). In addition to distinguishing between short-run and long-run effects, these techniques make it possible to deal with time series that have different orders of integration; however, the series must not be second order stationary. Furthermore, alternative techniques, such as the GMM difference estimator or the GMM system estimator, are designed for the analysis of microlevel data where N tends to be large and T small; thus, as argued by Roodman (2006), in macro-analysis where instead N tends to be small and T large, they often give spurious results.

The PMG model allows the estimation of regional specific short-run coefficients and heterogeneous (region by region) speed of adjustment to the long-run equilibrium values, allowing also error variances to be heterogeneous across regions, while the long-run slope coefficients are restricted to be homogeneous across regions. With LGFR indicating the log of general fertility rate and with x the log of the unemployment rates, the PMG could be written as follows:

$$LGFR_{it} = \sum_{j=1}^{p} \lambda_{ij} LGFR_{i,t-j} + \sum_{j=3}^{q} \eta_{ij} x_{i,t-j} + m_i + \varepsilon_{it} \qquad (1)$$

For i=Apulia, Basilicata, … and t=1992q4,…2017q4

The subscripts i and t indicate respectively the cross-section unit (the region in our case) and time, while m_i is a unit-specific effect.

In equation 1, j=3 is exemplificative of a model in which we assume that the short-run effects on fertility produced by the increase in unemployment are exerted with a lag of three quarters. This has been done to take into account the fact that the effect of economic uncertainty should induce individuals to delay conception to better times. Thus, this should have a negative effect on fertility, at least nine months later. However, we estimated the model also allowing j=4, j=5, and j=6.[3] ε is a white noise error term. p and q are usually decided by adopting the AIC criteria.

We also added a dummy for each quarter in order not to confuse seasonal movements and short-run effects, and a dummy for the period 2008-2013 to control for the effect of the recession.

The model can be reparametrized as a VECM system:

$$\Delta LGFR_{it} = \theta_i \left(y_{i,t-1} - \beta' x_{i,t-6} \right) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta GFR_{i,t-j} + \sum_{j=3}^{q-1} \eta_{ij} \Delta x_{i,t-j} + m_i + \varepsilon_{it} \qquad (2)$$

Where the β is the long-run parameter and assumed to be equal across i. θ_i are the error correction parameters, which can be interpreted as the speed of adjustment when a shock perturbs the long-run equilibrium.

As usual, the operator Δ indicates that the variables are differenced.

The main difference between PGM and MG is that the latter does not impose long-run homogeneity. In particular, the MG estimator obtains the long-run parameters from autoregressive distribution lag models estimated separately for each unit I, while for the whole panel the long-run parameter is computed as the arithmetic mean of the individual β_i. MG is less efficient than PMG when the assumption of homogeneity holds. In the latter case we have also that the PMG is both consistent and efficient and thus

3The results of each model will be not reported to save space. They do not change a great deal from one specification to another and are available upon request to the corresponding author.

should be preferred to MG. We will implement both estimations and use the Hausman to decide between the MG and PMG estimators.

3. Empirical results

Table 2 reports the results of the different panel unit root tests. In particular, the null of the IM, Pesaran and Shin test (the autoregressive parameter is allowed to be different across panels in this test) is that all the panels contain a unit root, whereas the alternative is that the fraction of panels that are stationary is nonzero. As noted by Hadri (2000), classical hypothesis testing requires strong evidence to reject the null hypothesis. Thus, Hadri suggests running a test in which the null and alternative hypotheses are reversed, to help confirm or reject conclusions based on tests with the null hypothesis of non-stationarity. Neither of these tests takes into account the eventual occurrence of a structural break in the time series. The visual inspection of Figure 1 seems to confirm that structural changes, especially in unemployment rates, have occurred. For this reason, we also run the generalization of the Hadri LM test proposed by Carrion-i-Silvestre et al. (2005), which takes into account the possible presence of unknown breaks (which may also differ across each panel units) in the time series and that may involve only a shift in the mean, or both in the mean and in the trend. However, this test is also based on the very restrictive hypothesis of cross-sectional independence. For this reason, as suggested by Carrion-i-Silvestre et al., we report the critical values obtained from the bootstrap distribution as described in Maddala and Wu (1999). We run the test alternatively assuming homogeneous long-run variance across panel and heterogenous long-run variance. As regards selecting the number of breaks, we follow the suggestions of Bai and Perron (2006). In particular, their comparison shows that in the case of structural change involving a shift in the mean but not in the trend, the sequential computation and detection of structural breaks with the application of pseudo F-type test statistics overperforms the available alternatives (e.g., AIC, BIC, or the modified Schwarz Criterion). In contrast, when shifts involve both trend and mean, Bai and Perron report that the modified Schwarz Criterion proposed by Liu et al. (1997) performs better than the other criteria.

Hence, the sequential procedure is used when we assume only a shift in the mean, while the modified Schwarz criterion is used when we allow a shift in both trend and mean. Note that from Figures 1 and 2, the time series of male and female unemployment rates do not seem to be trending; however, clear shifts in the mean of the series emerge in the great recession period. At the same time, at least in the Northern Region, the economic downturn seems to have inverted an upward trend in the GFR. For this reason, for male and female unemployment rates we ran the Carrion-i-Silvestre test allowing for an unknown number of breaks in the mean, while for the GFR we ran both types of test (with and without trend shift).

The log GRF turns out to be I(0) in all the tests (at least considering the critical values obtained from the bootstrap distribution) with the exception of the IM, Pesaran and Shin's test. However, this is the most restrictive test in our battery.

In the case of unemployment, it is worthwhile noting that the unemployment hysteresis has provoked an animated debate in economics. In particular, we can distinguish three main hypotheses in relation to the dynamics of unemployment: the hysteresis hypothesis (hereafter HH), the natural rate of unemployment (hereafter NAIRU), and the structuralist view (hereafter STRUCT). The HH implies that shocks have permanent effects on unemployment because of labor market rigidities and, therefore, the rate of unemployment can be characterized as an I(1) process. The NAIRU hypothesis assumes that unemployment dynamics are a mean-reverting process, which means that after a shock the unemployment rate tends to revert to an equilibrium; thus, unemployment should be I(0). According to the STRUCT view, unemployment fluctuates around a natural rate with structural shifts. In other words, the unemployment rate should be a I(0) around a trend that may have breaks. From an empirical point of view, Camarero et al. (2006) find support for the NAIRU hypothesis in most of the OECD, with the exception of Italy, New Zealand, and Canada, for which HH could not be rejected.

Our battery of tests seems to confirm the latter findings for male unemployment even when the presence of structural breaks is allowed (also using bootstrapped critical values), while female unemployment turns out to be I(0) when breaks are allowed (considering bootstrapped critical values). Queneau and Sen (2008) argued that the dynamics of unemployment may differ by gender for several reasons, such as, for example, different levels of job search intensity, job market discrimination, different attitudes towards working parents, etc. Among the different explanations proposed, they argue that in countries where gender-prescribed roles exist (e.g., Italy), men are mostly employed in traditional sectors as manufacturing, construction, and mining, while women are over-represented in the service sector. This means that due to the existence of culturally gender-prescribed roles, men tend to self-select themselves for sectors that are experiencing declining employment, which may explain the persistence of male unemployment.

Thus, given the different order of integration between male unemployment and GFR, ARDL Panel techniques are not only useful but also necessary in this case.

Table 3 reports the estimated breaks for the three series for each panel units. With the exception of some Central regions (Marche, Latium, and Umbria), the break-dates are coherent with the findings reported by the 2019 report by Eurostat showing that the 2008-2013 recession hit men before women.[4]

Table 2. Test for stationarity of the General Fertility Rate and the Unemployment rate in Italy.

Log(unemp_male)		
	Statistic	Prob
Im, Pesaran, and Shin W-stat	2.52007	0.9941
Hadri Z-stat	18.6602	0.000
Heteroscedastic Consistent Z-stat	17.6466	0.000
Stationarity test with structural breaks in the mean (homogeneous)*:	3.999 (1.191)	0.000
Stationarity test with structural breaks in the mean (heterogeneous)*:	3.189 (1.667)	0.000
Log(unemp_female)		
Im, Pesaran, and Shin W-stat	0.32356	0.6269
Hadri Z-stat	17.6784	0.000
Heteroscedastic Consistent Z-stat	15.8904	0.000
Stationarity test with structural breaks in the mean (homogeneous)*:	5.387 (15.303)	0.000
Stationarity test with structural breaks in the mean (heterogeneous)*:	3.452 (19.764)	0.000
Log(GFR)		
Im, Pesaran, and Shin W-stat	5.51521	0.9999
Hadri Z-stat	19.9561	0.000
Heteroscedastic Consistent Z-stat	16.0938	0.000

4 https://ec.europa.eu/eurostat/statistics-explained/index.php/Unemployment_statistics

Stationarity test with structural breaks in the mean (homogeneous)*:	2.760 (8.008)	0.003
Stationarity test with structural breaks in the mean (heterogeneous)*:	3.115 (11.705)	0.001
Stationarity test with structural breaks in both trend and mean (homogeneous) *	-0.824 (6.098)	0.795
Stationarity test with structural breaks in both trend and mean (heterogeneous)*:	5.38 (10.325)	0.000

* In parentheses, critical values obtained from the bootstrap distribution as suggested by Maddala and Wu (1999). Maximum number of breaks allowed: 3

Considering the GFR, in all the regions, except for Lombardy, the break-dates are estimated after those associated with the increase in male unemployment. It should be noted that, according to the report drawn up by the Bank of Italy (2018), Lombardy experienced the lowest decrease of all Italian regions in regional GDP during the recession. Thus, it is possible that even though the economic downturn did not strongly affect this region, the uncertainty tied to the beginning of the economic difficulty was still able to exert an effect on fertility behavior. Note also that, with the exception of Calabria, in Southern Italy, we were not able to detect significant breaks in the time series, giving support to Livi Bacci's (2015) assertion that the recession had few tangible effects on fertility, at least in this part of the country.

Table 3. Estimated break-dates in GFR, Male and Female unemployment rates

Log(GFR)			Log(unemp_male)			Log(unemp_female)		
Reg.	Nr. Breaks	Date	Reg	Nr. Breaks	Date	Reg	Nr. Breaks	Date
Pie	1	2012q4	Pie	2	2000q2; 2009q3	Pie	2	2000q4; 2010q3
A. V.	1	2012q4	A. V.	2	2003q1; 2009q4	A. V.	2	2000q2; 2011q4
Lom	1	2008q1	Lom	1	2011q1	Lom	1	2011q2
Lig.	1	2010q4	Lig.	2	1998q2; 2009q2	Lig.	2	1998q4;2011q3
T.A.A.	1	2012q4	T.A.A.	2	2000q1; 2009q2	T.A.A.	2	1999q4; 2011q1
Ven.	1	2011q3	Ven.	3	2000q1; 2008q4; 2012q3	Ven.	3	1999q2; 2003q1; 2011q3
F. V. G.	1	2009q2	F. V. G.	2	1998q2; 2009q3	F. V. G.	3	1997q4; 2002q4; 2011q3
E. R.	1	2010q4	E. R.	3	1998q2; 2008q4; 2012q3	E. R.	2	1992q2; 2009q3
Tus	1	2012q4	Tus	2	1999q2; 2009q2	Tus	2	2000q1; 2011q3
Umb	1	2013q3	Umb	3	2003q1; 2008q4; 2012q3	Umb	2	2000q1; 2011q4
Mar	1	2013q2	Mar	1	2011q4	Mar	3	1999q2; 2003q1; 2011q3
Lat	1	2013q1	Lat	1	2011q3	Lat	2	2003q2;2011q3
Abr	0		Abr	0		Abr	2	2000q2; 2013q2
Mol	0		Mol	1	2012q3	Mol	0	
Cam	0		Cam	1	2011q4	Cam	2	2004q1; 2011q2
Bas	0		Bas	1	2012q3	Bas	0	
Apu	0		Apu	0		Apu	2	1996q3; 2006q1
Cal	1	2013q2	Cal	3	1996q3; 2003q2; 2011q4	Cal	0	
Sic	0		Sic	0		Sic	2	2004q1; 2012q3
Sar	0		Sar	1	2011q3	Sar	2	2004q2; 2013q3

Table 4 shows the results associated with long-run coefficients of both the PMG and MG model and the averaged short-time effects. According to the Hausman test (reported at the end of the table), PMG should be preferred to MG. It is worthwhile noting that only the long-run coefficient associated with male unemployment is larger than that associated with female unemployment. This evidence gives some support to the idea that Italy is a country where the traditional male breadwinner model is still strong (see Vignoli et al. 2012), and is coherent with the findings of Cazzola et al. (2016) regarding the stronger correlation for male unemployment and fertility with respect to the same correlation calculated for female unemployment.

For a 1% increase in the male unemployment rate we have a decrease in the GFR of about 0.13%. Considering that Southern Italy tends to be characterized by an unemployment rate of over 10%, this suggests that the reduction of unemployment in these regions may produce a considerable gain in fertility in the long run.

The error correction term is negative and highly statistically significant. If this term is not different from 0, then one may conclude that there is no evidence of a long-run relationship. Accordingly, our result suggests that when the long-run equilibrium is disturbed, about 15% of the shock is absorbed in the following quarter.

Table 4. The relationship between fertility and unemployment[a]

	(1)Δlog(GFR) PMG	(2) Δlog(GFR) MG
Long-run equilibrium		
Log(unemp_m(-3))	-0.132 (0.026)***	-0.096 (0.175)
Log(unemp_f(-3))	-0.089 (0.033)***	-0.036 (0.170)
Short-run equilibrium		
Error Correction Term	-0.149 (0.021)***	-0.205 (0.027)***
Δ Log(unemp_m(-3))	0.003 (0.008)	0.013 (0.008)
Δ Log(unemp_f(-3))	0.005 (0.009)	-0.001 (0.007)
N	1920	1920
Nr of lags selected	(5,1,1)	(5,1,1)
Hausman test	Chi-square st. 4.20 (p value: 0.12)	

[a]Lags were selected by minimizing the AIC indicator. Max lags allowed: 8
Standard errors in parentheses; *$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5 reports the adjustment speed from shocks and the short-run coefficients associated with the unemployment rates for each region.[5]

The short-run specification also includes dummies for the quarters and a dummy for the period 2008-2013 (not reported to save space). The results depict a very heterogenous situation across Italian regions. It turns out that we are only able to confirm the results obtained by Cazzola et al. (2016) regarding the positive relationship between male and female unemployment rates and fertility in Southern Italy for Abruzzo and Apulia. However, the same result has been found in Trentino Alto Adige (Northern Italy) and in Umbria (Central Italy).

This excludes the explanation suggested by Cazzola et al. (2016) about the possible role of the shadow economy, given that according to the 2017 ISTAT Report, Trentino Alto Adige is characterized by the lowest incidence of the shadow economy in Italy.

Table 5. Short-run coefficients associated with unemployment and speed of adjustment[a]

	Northern Italy							
	Piedmont	Aosta V.	Lombardy	Liguria	TTA	Veneto	Friuli	Emilia
ECT	-0.134***	-0.329***	-0.081***	-0.138***	-0.024**	-0.156***	-0.093***	-0.053***
	(0.005)	(0.011)	(0.003)	(0.008)	(0.004)	(0.006)	(0.005)	(0.001)
Δ Log(unemp_f(-3))	-0.019***	0.007***	-0.020***	-0.031***	0.030***	-0.047***	-0.013***	-0.035***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Δ Log(unemp_m(-3))	0.039***	-0.019***	0.012***	0.015***	0.002***	0.016***	0.021***	-0.001*
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	Central Italy							
	Tuscany	Umbria	Marche	Latium				
ECT	-0.032***	-0.048**	-0.181***	-0.370***				
	(0.003)	(0.011)	(0.008)	(0.023)				
Δ Log(unemp_f(-3))	-0.040***	0.027***	-0.016***	-0.030***				
	(0.001)	(0.000)	(0.000)	(0.003)				
Δ Log(unemp_m(-3))	-0.004***	0.003***	0.049***	0.040***				
	(0.000)	(0.000)	(0.000)	(0.002)				
	Southern Italy							

5 It should be remembered that the error correction term (ECT) can be interpreted as an indication of the speed at which a shock is absorbed; for instance, an ECT equal to -0.20 indicates that 20% of a shock is absorbed in one time period (in our case a quarter).

	Abruzzo	Molise	Campa-nia	Apulia	Basilica-ta	Calabria	Sicily	Sardinia
ECT	-0.197***	-0.150***	-0.122***	-0.131***	-0.161***	-0.148***	-0.136***	-0.308***
	(0.005)	(0.005)	(0.004)	(0.005)	(0.004)	(0.002)	(0.002)	(0.012)
Δ Log(unemp_f(-3))	0.028***	0.027***	0.052***	0.087***	-0.004**	-0.033***	0.100***	0.032***
	(0.000)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Δ Log(unemp_m(-3))	0.029***	-0.100***	0.002	0.030***	0.063***	-0.062***	-0.048***	-0.011***
	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)

Controlling for seasonal effects and including a dummy for the period 2008-2013.
[a]Standard errors in parentheses; *$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In Campania, male unemployment is not significant while female unemployment is positively correlated with fertility. In Sardinia, Sicily, and Molise, male unemployment depresses fertility while the opposite is true for female unemployment. The latter pattern is found also in the Aosta Valley (Northern Italy). It should be noted that Sardinia was the only Southern region where Cazzola et al. also found a negative correlation between unemployment and fertility. In a certain sense, this finding contradicts Livi Bacci (2015), since this region has the lowest fertility in Italy.

In Calabria, both unemployment rates are negatively related to fertility, as is also the case in Emilia Romagna (Northern Italy) and Tuscany (Central Italy).

In Basilicata (Southern Italy), male unemployment seems to be positively correlated with fertility while a negative relationship emerges for female unemployment. The latter region is, surprisingly, characterized by the same behavior as the majority of Northern regions (Piedmont, Lombardy, Liguria, Veneto, Friuli Venezia Giulia) and two Central regions (Latium and Marche).

If the sign of the relationship between female unemployment and fertility is theoretically ambiguous, the positive short-run relationship between male unemployment rates and fertility rates, which characterizes twelve out of twenty Italian regions, represents a puzzle for neoclassical economic theory. The same conclusion has been drawn by Özcan et al. (2010) who, performing an event history analysis aimed at identifying the timing of fertility for both men and women belonging to the 1971 cohort in both West and East Germany, could not confirm neoclassical predictions about the negative effect of unemployment on parenthood for men.

It should be noted that our model takes into account the effect of specific regional effects. Accordingly, the results are not driven by the different policies to support natality that are implemented at the regional level.

A possible explanation, at least for Northern regions, could be that when unemployment is expected to persist, couples who have postponed their first birth risk not having children. This may induce them to lower the desired "quality" (in the Beckerian sense) of the child and thus partly counteract the negative income effect (see also Kravdal (2002) and Özcan et al. (2010) for a similar argument), at least if having offspring is still considered an important life-goal. On the latter point, Fiori et al. (2017) show that compared to Great Britain (another country where childlessness is frequent), in Italy more couples fail to achieve their fertility intentions. In contrast, in Great Britain this outcome seems to be the result of a deliberate choice. As pointed out by the stationarity test in Table 2, male unemployment seems to be particularly persistent in Italy. Indeed, it should be noted that even though regional heterogeneity exists, the persistence in unemployment is quite high also in Northern Italy (see table 6) due to the rigidity of the Italian labor market[6]. Figure 3 reports the mean age of mothers at their first birth in European countries in 2017 (unfortunately, data are not available at the regional level). Italy is characterized by the highest mean age at first birth in Europe (31.1). Given the high female average age at first birth, we believe that a non-negligible fraction of Italian couples may be in the dilemma outlined above of continuing to postpone and thus increasing the likelihood of remaining childless or adjusting their expectations of child "quality". However, this possible factor should operate only for first order births but not for higher order ones. This may in turn explain why we observe a positive short-run effect and a negative long-run one.

Coherently with this view, using German data, Wagner et al. (2019) found that the family formation intentions of individuals who were in the declining phase of fecundity (35-37 years of age) were more likely to fall within this dilemma: having a child in the very short term or not having a child at

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6 Despite some recent improvements, according to OECD indicators, Italy is still among the countries with the most stringent labor market regulation. http://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection.htm

all. Fahlén and Oláh (2018) also confirmed that perceived income security is less important at higher ages for either gender, especially in the aftermath of the crisis. It must also be said that Busetta et al. (2019), using survey data for Italian couples, found that persistent joblessness, especially for men, discourages fertility intentions. However, even though in their multivariate analysis they control for age, they do not test the idea that the effect of joblessness may be different depending on the distance from the biological deadline for fecundity.

Perhaps the depicted mechanism is weaker in Southern regions such as Sardinia, Sicily, Calabria, and Molise where female participation in the labor market is low and, therefore, when men lose their job, the zero earning situation is more frequent, also causing an immediate negative effect. Another related explanation of the different positive short-run effect in Northern and Southern Italy may be traceable to the strength of the male breadwinner model. Indeed, we may expect that if the relationship within a couple is more equal, male unemployment could also be an ideal period for the man to support his partner during maternity.

It remains to establish why this is not true for Abruzzo, Apulia, and Basilicata. In the case of Abruzzo, the positive correlation is possibly driven by the fact that we are observing simultaneously a recovery of fertility after the 2009 earthquake and an increase in unemployment due to the economic crisis, while in the pre-crisis period both fertility and unemployment were quite stable.[7] For Apulia and Basilicata, we believe that the results are likely to be influenced by the fact that fertility had been declining since the beginning of the 1990s and thus we are capturing a positive correlation due to a similar evolution in the unemployment rates (at least until the beginning of the crisis).

Table 6. Share of long-term unemployed in Italian regions, 2016-17.

	2016	2017
North	52.3	52.2
Piedmont	53.6	55.0
Aosta V.	44.8	41.1
Liguria	45.9	48.6
Lombardy	52.9	51.3
TTA	33.4	36.1

7 https://www.nytimes.com/2009/04/07/world/europe/07italy.html

Veneto	50.0	49.7
Friuli-Venezia Giulia	44.1	49.5
Emilia-Romagna	48.6	45.2
Center	52.6	53.2
Tuscany	50.8	49.2
Umbria	51.2	49.4
Marche	50.1	56.1
Latium	54.4	55.2
South	64.6	64.2
Abruzzo	56.6	55.5
Molise	64.3	72.8
Campania	68.0	65.7
Apulia	62.1	61.3
Basilicata	61.3	62.2
Calabria	63.9	68.1
Sicily	64.2	66.7
Sardinia	55.0	56.4
Italy	57.4	57.9

Source: Eurostat

>>> Insert Figure 3 here <<<

Conclusions

As argued by Kerzer et al. (20), the case of Italian fertility has undermined confidence in the most influential theories (i.e., neoclassical economic predictions about the relationship between female labor market participation and fertility; and the Second Demographic Transition theory) to explain the very low fertility that characterizes the country. Even though, using individual data, Kerzer et al. were able to find elements to support both theories, large regional heterogeneity was not explained by their rich set of control variables, leading the authors to conclude that understanding low fertility in Italy still represents a challenge for social scientists. The analyses carried out in this paper confirm this view. Economic theory clearly predicts a negative effect of male unemployment on fertility, while the prediction is ambiguous for women. Even though we were able to confirm the existence of a negative long-run relationship between male unemployment and fertility, we obtained some surprising results for the short-run specification. Contrary to previous findings, according to which a weak positive relationship between male unemployment and fertility was detectable only in Southern Italy, we found that the positive short-run relationship between these two variables tends to characterize the Northern part of the country especially. In contrast, the opposite is true for Southern Italy (again with some exceptions).

Given that Italy is characterized by both the highest average age at first birth in Europe and a high persistence in unemployment rates, especially for men, a possible explanation of the short-run positive effect is that, in the case of unemployment episodes for the male partner, couples are confronted by dramatic choices: either postponing, and thus risking remaining childless while waiting for “better times”; or reducing the expected child “quality” and deciding to end the postponement. However, the latter decision is possible when at least one member of the couple is able to provide for family needs. The female participation in the labor market is still very low in Southern Italy, which represents an obstacle to choosing to end the postponement. In addition, if the male breadwinner model is stronger in the South than in the North (as labor market statistics seem to suggest) then in this part of the country, it is more difficult for men to accept having a child without being able to offer economic support. Some heterogeneity was also found across Southern Italy, but we believe that this is likely caused by the peculiar pattern in fertility of some of the regions there.

We believe that further research, perhaps using also a micro-level approach, is necessary to understand the complex relationship between unemployment and fertility. This paper contributes to the debate on the topic by suggesting that we have to distinguish short-run and long-run effects, and that when one is dealing with the short-run effect, then particular attention must be devoted, as previously suggested by Wagner et al. (2019), to the proximity to deadline marked by the “biological clock”.

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Figure 1. General Fertility rates and Unemployment rates in Italian Regions, 1992-2017

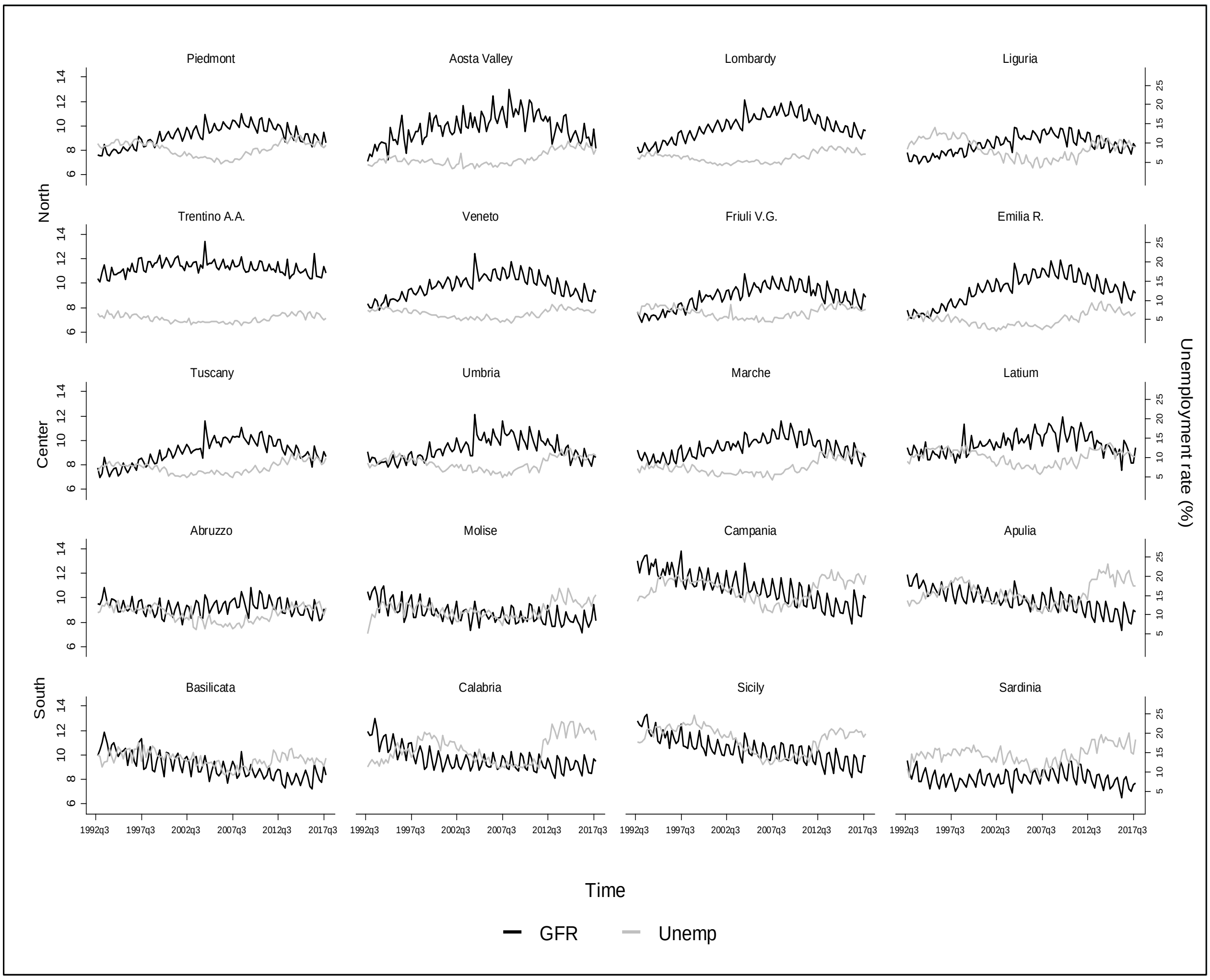

Figure 2. Male and Female Unemployment rates in Italian Regions, 1992-2017

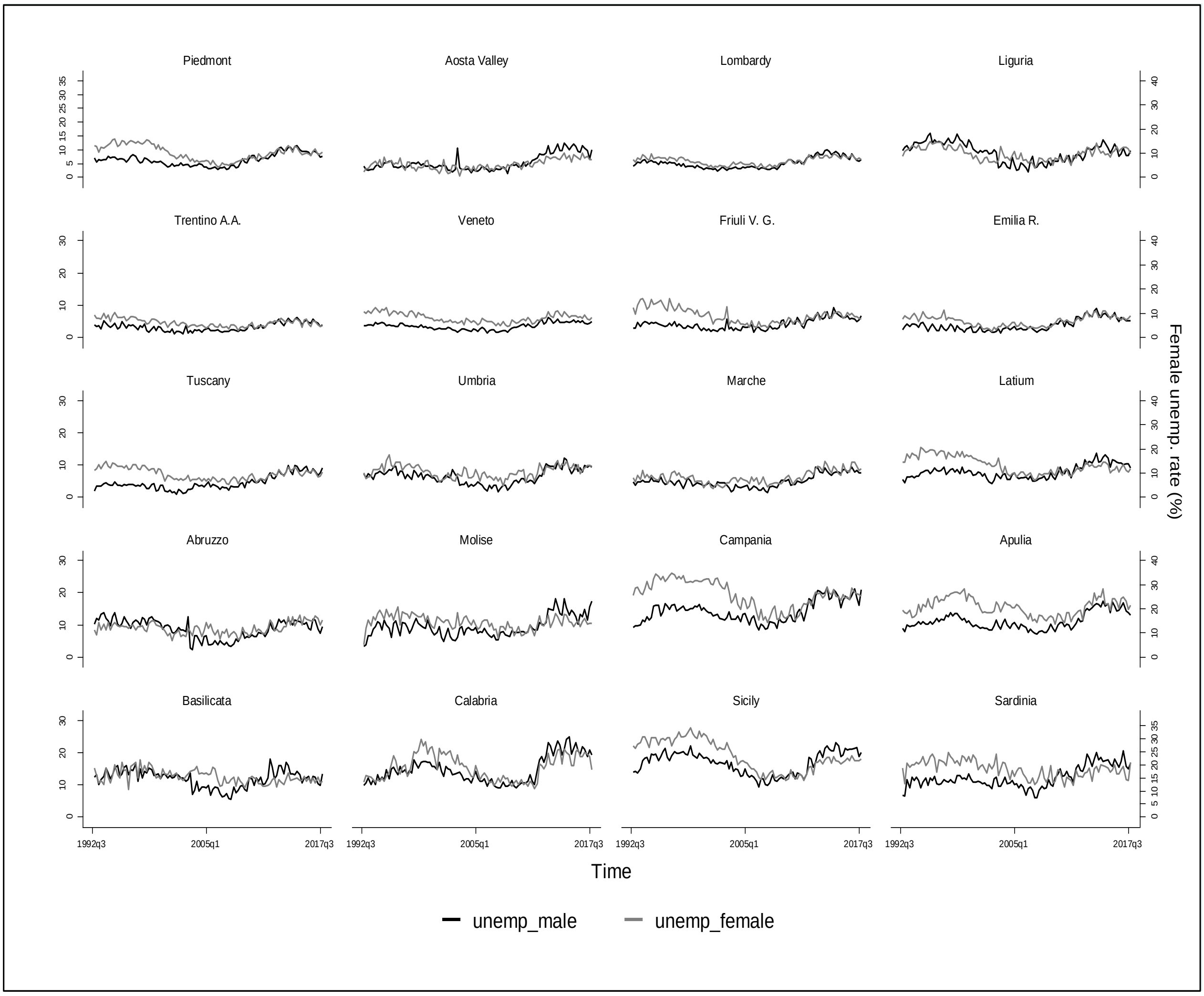

Figure 3. Mean age of the mother at the birth of first child across Europe, 2017