EUROPEAN SPATIAL RESEARCH AND POLICY
10.2478/v10105-010-0004-6
Volume 17 2010 Number 1

REVIEW ARTICLES AND REPORTS

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ANALYSING LOCAL EMPLOYMENT AND UNEMPLOYMENT IN GREECE UNDER CONVENTIONAL ZONING REGIMES AND PARTITIONS EXTRACTED FROM THE DATA

1. INTRODUCTION

The paper sets out to empirically analyse local employment, unemployment and non-participation in Greece under three zoning regimes using municipal-level data from the 2001 Census. More specifically, it considers the functional linkages among the country's municipalities as well as spatial patterns extracted from the data, and comes up with a territorial partition that diverges from the (two) conventional regional and subregional partitions typically used in studies regarding Greece. Furthermore, it compares the recovered spatial and non-spatial coefficients obtained under the three spatial specifications, and the econometric fits associated with them. It goes without saying that the selection of one specification over another may have important implications for policy formulation even if the underlying economic theory and the data considered are the same.

In labour economic literature, people's participation in the work-force, employment or unemployment are empirically explained in terms of demographic, educational and household composition factors (e.g., Pencavel, 1986; von Merz, 1990; Kahn and Lang 1991; Chiuri, 2000; Andrén, 2003; Vermeulen, 2006; Little, 2007). If the all-important factor of wage is not available, the impact of its sectoral and occupational determinants (e.g., Simpson, 1986; Kahn and Lang,

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1991; Oaxaca and Ransom, 1994; McCall, 1998; Christofides and Pashardes, 2000) may be taken into account, instead (e.g., Hotchkiss, 1991; Brown and Sessions, 1997); and when spatial arguments are considered, these take the form of categorical (dummy) variables pertaining to (i) conventional territorial partitions such as counties, administrative districts, provinces, regions etc., and/or (ii) large and small towns (e.g., all authors listed above).

As the choice of regressors affects the quality of estimated coefficients and, hence, the direction and magnitude of territorial development, social cohesion or other economic policy interventions, we question analysts' reliance on conventional territorial partitions. More often than not, the boundaries of these partitions are drawn on the basis of a variety (even a mixture) of criteria (e.g., geographical factors, historical memories, relics of commercial life, administrative contingencies, electoral considerations, geometry, chance). As a result, the spatial units considered may be internally heterogeneous. It follows that if the demographic, economic and social phenomena are not neatly aligned with the borders, then the incorporation in a regression of spatial controls standing for such units, may bring in some degree of misspecification. For instance, if these units are fashioned after ancient or medieval demarcations (as is often the case in Europe), they may constitute poor proxies for contemporary economic areas. Metaphorically speaking, their use in a regression may resemble the attempt to fit a body into an inherited suit (or describe and examine the said body in terms of the particular suit). Nevertheless, for some reason, more sophisticated treatments of space have received little interest in labour economic literature. These include attempts to deal with the consequence of:

– unsuitable zoning by grouping together localities in accordance with their economic interactions: specifically, by delineating labour market areas (travel-to-work areas) on the basis of their commuting flows. This is usually achieved via an iterative process (algorithm) that takes into account residence- and work-place-based self-containment criteria (e.g., Coombes *et al.*, 1986; Casado-Díaz, 2000; van der Laan and Schalke, 2001; Poper, 2005);

– spatial dependence by incorporating in the regression measures of spatial contiguity or proximity in order to estimate non-spatial parameters that are corrected for spatial-autocorrelation. This is usually achieved with the use of a weight matrix the elements of which capture contiguity, straight-line distances or travel times among the population centres of the localities involved (e.g., Molho, 1995; Badinger and Url, 2002; Elhortst and Zeilstra, 2005; Pattacchini and Zenou, 2007).[1]

[1] In theory, the approach may be enriched to include the impact of explanatory variables from neighbouring localities or to produce spatially-varying coefficients (i.e., locally different estimates of the parameters pertaining to education, wage, and the other non-spatial explanatory variables.)

Hence, it would seem that the discovery of some sort of middle ground, which combines (i) the extraction of spatial associations (whether seen as nuances or useful patterns) from the data with (ii) the insertion in the regression of relevant economic interaction information, and (iii) the use of spatial dummies that might turn out to be more suitable compared to conventional territorial dummies, may enhance our analytical approach. For instance, with regard to (a), the obvious next step would be to regress employment, unemployment or workforce participation data collected at fairly disaggregated levels using functional spatial regressors. With regard to (b), the path may have already been laid out by Badinger and Url's (2002) discovery of spatial patterns in the residuals of a specification lacking spatial regressors,[2] and the suggestion of constructing spatial regressors fashioned after these patterns (preferably orthogonal towards other regressors) and introducing them into the expression. The coefficients associated with them are obviously interpreted in the same manner as those corresponding to conventional territorial regressors in typical econometric analyses, i.e., as estimates of the level of dissimilarity of the areas in question from the intercept.

At the same time, the employment of dummies that capture or model spatial information in the manner proposed above may be very useful in cases the construction of a weight matrix is problematic. For instance, in Greece (figure 1) the contiguity matrix cannot handle the country's many islands; and the distance matrix does not fare much better by mixing land with sea distances or assuming neatly decaying features for the reason that some islands are linked by ferries to some (but not all) neighbouring islands or other islands and continental ports several times a day; other islands are linked to other islands or continental ports once or twice a week (weather permitting); and so on. Likewise, a good number of inaccurate spatial associations/connections may arise in cases of (a) somewhat

[2] The presence of such patterns may very well be attributed to the omission from the regression of required explanatory variables (whether spatial or other). Indeed, their omission implies that they will be incorporated in the error term and treated as part of it. Consequently, the following problems are created: (i) The estimated intercept will be a biased and inconsistent estimator of the true intercept. (ii) If the omitted variables are correlated with other explanatory variables entering the model, then the respective estimated coefficients will be biased and inconsistent estimators of the true parameters as well. (iii) As the disturbance variable will be incorrectly estimated, the conventionally measured variance of the estimated coefficients will be overestimated (which is further aggravated in the case of correlation between the omitted and included variables), thus yielding lower *t*-statistics even in the cases of unbiased estimators. As a result, the hypothesis testing procedure is likely to give misleading conclusions about the statistical significance of the estimated parameters. It follows that the introduction in the regression of good proxies of (a) the spatial variables or (b) the spatial dimension of other omitted variables is bound to improve the quality of the econometric results. If only a similar approach could be carried out along other dimensions of the omitted variables.

distant continental localities that are well linked through the road-and-rail network (and may, indeed, form travel-to-work areas), and (b) contiguous continental localities that are not well linked (as their borders are drawn along mountain-crests they appear contiguous but their population centres are cut off from each other).[3] In view of the above, it is perhaps better if the issue of spatial association were treated without assumptions regarding the manner in which it develops, but rather as a *black box*, the features of which might be discovered with the help of algorithms and econometrics.

Fig. 1. The geography and administrative organisation of Greece

[3] The alternative travel-time matrix may be less susceptible to such glitches. However, it is harder to collect reliable measures in all cases compared to collecting Eucledian distances.

In putting these pieces together, we will attempt to carry out the study of employment, unemployment and non-participation, and advance our understanding of how localities may be grouped together across space on the basis of their economic characteristics, by engaging in empirical analyses using municipal data under three spatial regimes: one after the country's conventional regional divisions, another after its conventional sub-regional divisions, and a third one on the basis of functional linkages and other patterns extracted from the residuals. Indeed, the disaggregated nature of the dataset permits the juxtaposition of alternative spatial models, and the estimation of a good number of spatial and non-spatial effects on the male and female employment, unemployment and non-participation equations. Overall, by treating the economy as a collection of communities and clusters of communities, and by departing from the conventional manner of grouping them together according to the inherited territorial framework, the paper offers a paradigm of how disaggregated data may be employed, how algorithmic and econometric tools may be used and zones of distressed areas identified. As one might expect, the findings entail important policy implications for regional development and resource allocation.

The rest of the paper is organised as follows: sections 2 describes the methodology and compares the three versions on the basis of their fitness. Sections 3 and 4 discuss the spatial and non-spatial results, respectively, and make policy proposals. Section 5 concludes.

2. EMPIRICAL ANALYSIS UNDER ALTERNATIVE TERRITORIAL SPECIFICATIONS

We proceed to analyse the six equations regarding the male and female employment, unemployment and non-participation population shares recorded in the 2001 Census across Greece's 1,034 municipalities, and estimate the impact of spatial and non-spatial factors within a seemingly unrelated regressions (SUR) framework.[4] As a result, one equation (in this case, male non-participation) is recovered from the other five as their complement. As already mentioned, in order to gain insights in the modelling of spatial information and use of spatial dummies, we engage in the econometric analysis under three spatial versions:

– Version I is based on the established regional organisation of the country, so observations are grouped by administrative region. The specification

[4] The SUR procedure allows for a supplementary treatment of complications associated with the (patterns embedded in the) error terms. As the dependent variables add up to one, it would seem that the equations are not unrelated. In fact, their disturbances (both spatial and other) are probably correlated. By treating them jointly within the SUR framework, efficiency is improved.

involves 12 spatial dummy variables, with the municipalities situated in Attiki serving as the reference area. An additional dummy is employed in order to allow differentiation between small municipalities (inhabited by 150 people or less) and the rest.

– Version II is based on the established prefectorial organisation of the country, so observations are grouped by prefecture. The specification involves 53 spatial dummy variables, with the municipalities of the Athens prefecture (one of Attiki's four prefectures) serving as the reference area.[5]

– Version III is based on micro-regional and distinct community characteristics. The spatial dummies are constructed according to (i) the economic interactions (functional linkages) observed among localities, and (ii) the spatial patterns evidenced in the residuals, in the following steps:

1. Localities are grouped together (i.e., they are assigned the same dummy) after the travel-to-work groupings provided by Prodromidis (2008) on the basis of the commuting flows reported in the very same dataset. As a result, the five regressands may be explained in terms of these spatial groupings and the other regressors employed in the literature.

2. The latter regressors are made orthogonal towards the spatial regressors and to each other so as to avoid correlations among the independent variables.[6] Following this, the five regressands are explained in terms of the spatial and other (transformed) regressors within a SUR framework.

3. The spatial dummies associated with negative employment coefficients and/or positive unemployment or non-participation coefficients that are statisti-

[5] The dummy variable regarding small municipalities (used in Version I) is dropped as it exhibits considerable correlation with the new vector of spatial dummies. For instance, in the case of the Grevena prefecture, $r = 38.4\%$.

[6] More specifically, in the context of a function $Y = b_0 + b_1D + b_2\Delta + b_3X + b_4Z$, where D stands for a spatial dummy, Δ for another kind of dummy (in this case: sectoral-and-occupational concentration), and X, Z for other regressors in fraction form (in the case: population density, demographic and qualification population shares), we (a) weed-out the Δ dummies that are highly or modestly correlated with D (see footnote 9), and then (b) remove from X the linear effects of D and Δ so that they do not account for them even partially, and remove the effects of D, Δ, X on Z. Briefly put, instead of regressing Y on D, X, Z, we regress X on D, predict x and estimate $\chi = X - x$; then regress Z on D and χ, predict z and estimate $\zeta = Z - z$; and end up explaining Y in terms of D, χ and ζ. Ultimately, the explanatory variables are reshaped into components both lacking spatial dependence with D and immunised from possible collinearities. It follows that when we take into consideration alternative spatial formations, i.e., different measures of D (regional, prefectorial, or other), the procedure is performed afresh, and we obtain different measures of Δ, χ and ζ, and – by extension – different estimated coefficients. Under the circumstances, in the present paper our remarks and final conclusions concentrate only on the proxies of χ and ζ that exhibit a very low probability of error (less than 1%) under all spatial regimes: regional, prefectorial or other. Obviously, if the emphasis were placed on the analysis of a particular specification, then a more thorough discussion regarding other coefficients as well (not only those that are significant in all specifications) would be in order.

cally different from zero at the 1% level are retained. Neighboring travel-to-work areas are banded together (i.e., they are assigned the same dummy instead of the initial ones) if their spatial coefficients carry the same signs across all regressions. (For instance, the dummies that stand for the Kozani and Ptolemais travel-to-work areas are replaced by a single one.) Naturally, the degrees of freedom increase. The system is re-estimated with the new dummies.

4. The six vectors of residuals (one per equation) are estimated. Hence, each observation may be characterised (even differentiated from other observations) by the values and combination of values of its six residuals.[7] These residuals are projected on the layout of a map, colored by range and combination, so that potential spatial patterns may reveal themselves easily.

5. Neighboring travel-to-work areas and self-contained municipalities as well as travel-to-work areas and self-contained municipalities situated on opposite coasts (separated/connected by water) are experimentally banded together (i.e., are assigned a common dummy) if (a) all six of their residuals are similar;[8] and (b) the coefficient associated with the new dummy is statistically significant in at least one of the seemingly unrelated functions. Thus, micro-regions with similar distressing features that cannot be explained by the available factors are identified on the basis of the magnitude and combination of the residuals. Steps 2–3 are repeated slightly modified. The dependent variables are regressed on the new edition of spatial dummies and the other (transformed) variables. The spatial dummies associated with statistically significant effects at the 1% level in one or more SUR functions are retained. As some are banded together, steps 4 and 5 are repeated so that the re-zoning of localities (in practice: of nearby localities) on the basis of the residuals may be considered.

In the end, the iterative process yields 40 spatial formations corresponding to clusters of contiguous municipalities (or strings of municipalities which are in proximity) and isolated outliers with high unemployment and/or low employment and/or non-participation features (which policy-makers often find distressing) that are not attributed to the non-spatial factors entering the regression. The rest of the country serves as the reference area.

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[7] For instance, one locality may exhibit (be associated with) a large negative residual value in the male employment equation, another locality may exhibit large negative residuals values in both the male and female employment equations, a third locality may exhibit a large negative residual value in the male employment equation and a large positive residual value in the male unemployment equation, and so on.

[8] The presence of spatial concentrations of municipalities exhibiting similar residual values and combinations of values of the type mentioned in footnote 7, suggests that the building blocks (i.e., the municipalities), whether forming a well-defined labour market or not, may share similarities on account of a distinctive terrain or climate or remoteness, culture or other unobserved local characteristics associated with the omitted factors.

The spatial factors are complemented by:

i) dummy variables capturing the impact of sectoral-and-occupational concentrations (three types in the case of the Version I, four types in the case of the Version III);[9]

ii) population density and its square (with the latter capturing the rate of change),

iii) six explanatory variables regarding demographic composition (namely, the population shares of children aged 0–4, children aged 5–9, children aged 10–19, men aged 20–64, women aged 20–64, senior citizens aged 65–79, senior citizens aged 80 or more), and

iv) six explanatory variables regarding the qualification characteristics of the local populations (namely, the population shares of women with primary school or lesser qualifications, secondary school qualifications, post-secondary school or bachelor qualifications, men with primary school or lesser qualifications, secondary school qualifications, post-secondary school or bachelor qualifications, and men and women holding postgraduate degrees), in line with the divisions available in the dataset, net of the previously-mentioned factors.

As a result, the vectors regarding variables (ii)–(iv) are rendered orthogonal to the spatial arguments and to each other in order to avoid collinearities that inflate the variances of the estimators (see footnote 6) and also because, in principle, we want to isolate the spatial effects from the other effects in order to obtain a better picture of their separate influences on the dependent variables.

[9] In Version I, these pertain to municipalities exhibiting a location quotient of (i) science and art professionals employed in the trade and repairs industry and/or (ii) extra-territorial bodies and organisations, as well as (iii) plant/machine operators and assemblers employed in manufacturing, equal to or greater than '3'. (The threshold is chosen after some preliminary experimentation among many quotients on the basis of their performance and rather low level of correlation *vis-à-vis* the regional dummies.) The highest association (r = 12.6%) is observed between the localities of Central Macedonia and the localities exhibiting inordinately high concentrations of plant/machine operators and assemblers employed in manufacturing. In Version III, they pertain to municipalities exhibiting a location quotient equal to or greater than '3' in the three combinations mentioned in Version I, as well as skilled primary-sector workers employed in agriculture and related activities. The highest association (r = –8.9%) is observed between the localities of the Hios travel-to-work area and a string of communities along the south and central part of the eastern Aegean basin (on one hand) and the localities exhibiting inordinately high concentrations of skilled primary-sector workers employed in agriculture and related activities (on the other). In Version II, the sector-and-skill concentrations dummy variables are dropped as they exhibit high or modest levels of correlation with the spatial dummy variables. The dummy variable capturing the concentration of science and art professionals employed in extra-territorial bodies and organisations exhibits an r = 41.2% in connection with the Athens prefecture, the one capturing the concentration of plant/machine operators and assemblers employed in manufacturing exhibits an r = 23.1% in connection with the Thessaloniki prefecture, and the one capturing the concentration of science and art professionals employed in the trade and repairs industry an r = 14.2% in connection with the East Attica prefecture.

The results are provided in annex 1–3. Men aged 20–64 with minimal and primary school qualifications serve as the reference population. We note that Version I captures a modest part of the variation of the economically active population across Greece. Indeed, apart from the female unemployment function that exhibits a high level of statistical fitness (R^2 = 82.9%), the male and female employment functions, along with the female non-participation function, exhibit modest levels of fitness (with R^2 values of 68.7%, 59%, and 56.3%, respectively),[10] while the male unemployment function is associated with a lower level of fitness (R^2 = 30.3%). In Version II, the female unemployment and male employment functions exhibit high levels of statistical fitness (with R^2 values of 81.9% and 70.3%, respectively), the female employment and non-participation functions exhibit modest levels of fitness (with R^2 values of 63% and 58.8%, respectively), while the male unemployment function displays a lower level of fitness (R^2 = 42%).[11] As Version II employs twice as many explanatory variables as Version I and one of its recovered R^2 measures is lower than its regional counterpart, it is unclear whether the prefectorial specification is superior to the regional specification in terms of explaining the variation of the economically active population across Greece. Version III captures a considerable portion of the variation observed in the economically active population across Greece. Indeed, of the five equations, the female unemployment and male employment functions exhibit high levels of statistical fitness (with R^2 values of 85.6% and 80.1%, respectively), the female employment and non-participation functions exhibit modest levels of fitness (with R^2 values of 69.4% and 67.3%, respectively), while the male unemployment function displays a lower level of fitness (R^2 = 49.4%).[12] As Version III employs fewer explanatory variables than Version II, and all R^2 statistics indicate higher levels of statistical fitness than those obtained in Version II, it appears that, on statistical grounds, Version III is

[10] In contrast, the R^2 values associated with the simultaneously estimated regressions of female and male employment, female and male unemployment, and female non-participation on the twelve regional dummies and the small-municipality dummy are 21.1%, 12.6%, 9.7%, 12.9%, and 14% respectively. It follows that the differences in the levels of fitness of the two sets provide measures of the collective significance of population density and the other non-spatial factors.

[11] The R^2 values associated with the simultaneously estimated regressions of female and male employment, female and male unemployment, and female non-participation on the 53 prefectorial dummies are 38.2%, 29.1%, 11.8%, 27.6%, and 23.6% respectively. Consequently, much like in footnote 10, the differences in the levels of fitness supply measures of the collective significance of population density and the other non-spatial factors.

[12] The R^2 values associated with the simultaneous estimation of the female and male employment, female and male unemployment, and female non-participation regressions on the 40 spatial dummies are 25.8%, 25.7%, 17.6%, 37.8%, and 32.6%, respectively. Consequently, as in the previous versions (see footnotes 10 and 11), the differences in the levels of fitness provide measures of the collective significance of population density and the other non-spatial factors.

probably superior. It also supplies a better fit compared to the other two versions in terms of adjusted R^2s when equations are estimated separately, outside the SUR framework.

3. THE SPATIAL EFFECTS

We turn to the statistically significant spatial effects of each version. These are also displayed in figures 2–4, in order to visually aid the reader. With note that the pictures vary considerably. With due apology for the manner colors and patterns are expressed into dry, tedious sentences, we discuss the results.

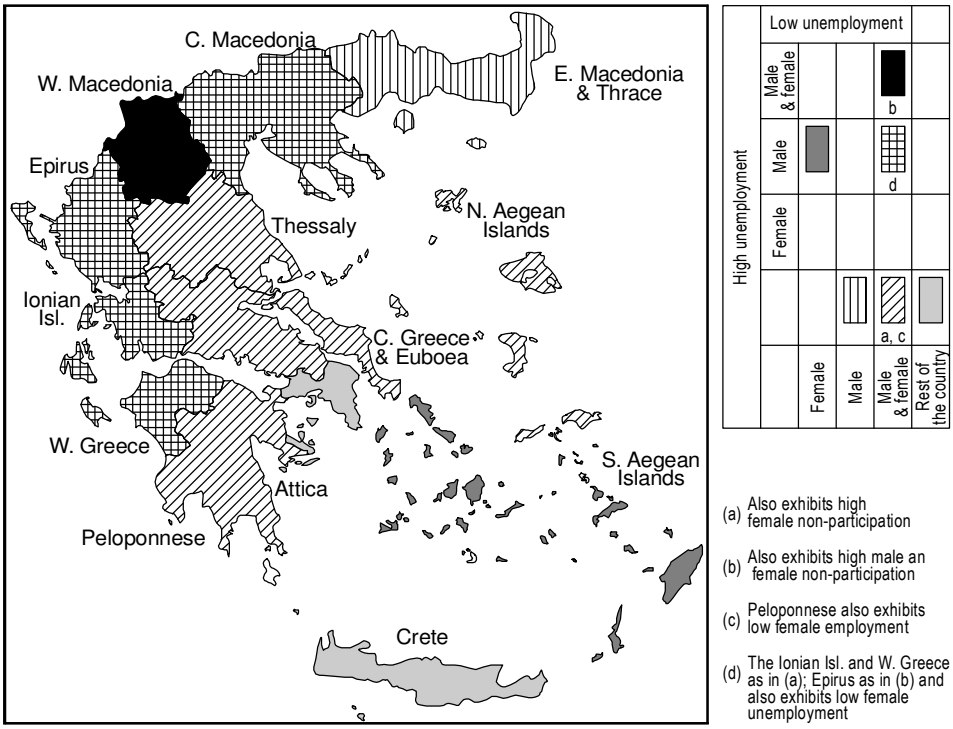

Fig. 2. Portrayal of the statistically significant regional coefficients recovered from a seemingly unrelated regression of the disaggregated male

According to Version I (annex 1), the municipalities located: (i) in East Macedonia and Thrace appear to rely on small population shares of employed men; (ii) in Thessaly, Central Greece and Euboea, North Aegean on small population

shares of employed men and women and large population shares of abstaining women; (iii) in Peloponnese on populations with similar features and small population shares of unemployed women; (iv) in the South Aegean on small population shares of employed women and large population shares of unemployed men; (v) in Central Macedonia on small population shares of employed men and women and large population shares of unemployed men; (vi) in the Ionian Islands and Western Greece on populations with similar features and large population shares of abstaining women; (vii) in Epirus on small population shares of employed men and women and large population shares of unemployed men and abstaining men and women; (viii) in West Macedonia on small population shares of employed men and women and large population shares of unemployed and abstaining men and women, compared to the municipalities located in Attica and Crete.

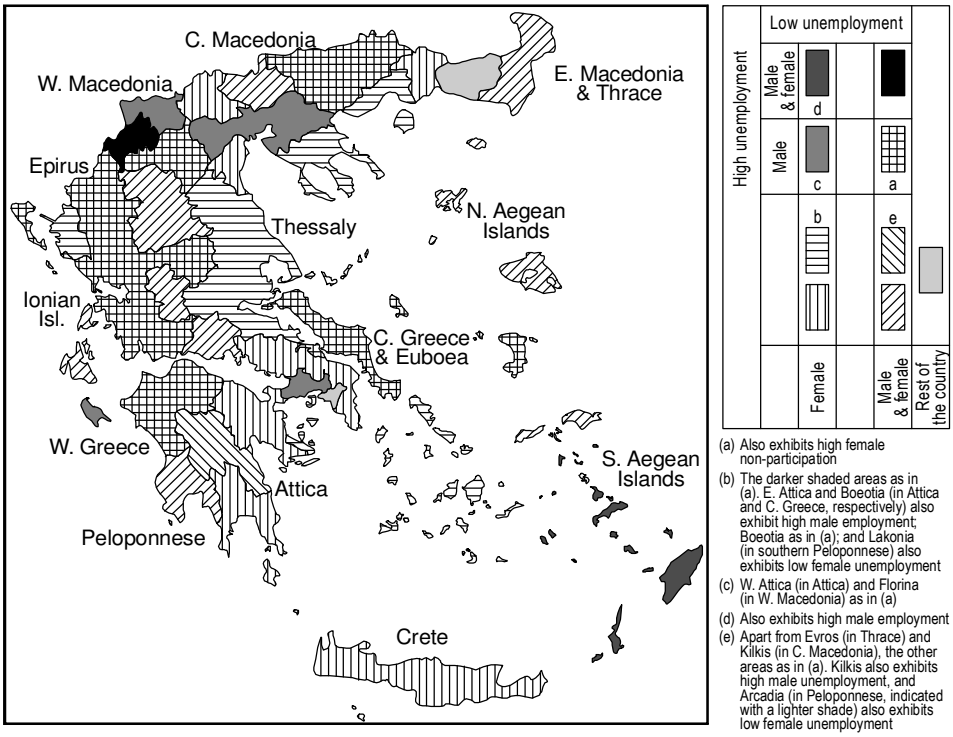

Fig. 3. Portrayal of the statistically significant prefectorial coefficients recovered from a seemingly unrelated regression of the disaggregated male

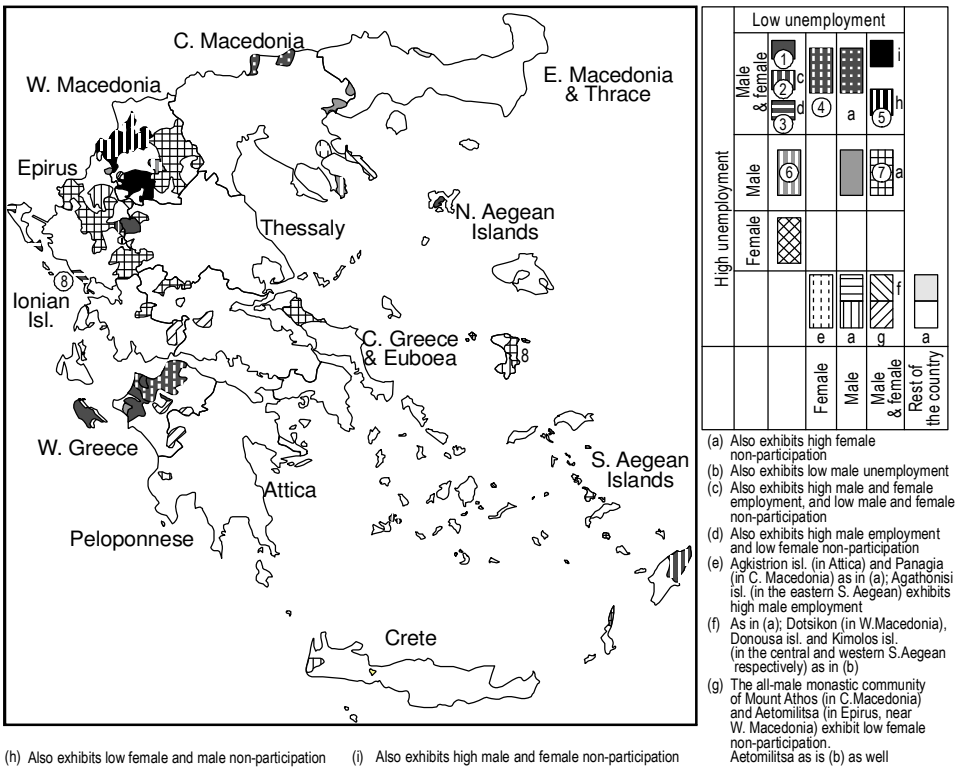

Fig. 4. Portrayal of the statistically significant municipal and micro-regional coefficients recovered from a seemingly unrelated regression of the disaggregated male

According to Version II (annex 2), the municipalities located: (i) in East Attica appear to rely on large population shares of employed men and small population shares of employed women; (ii) in Boeotia on populations with similar features and large population shares of unemployed man and abstaining women; (iii) in the prefectures of Xanthi, Pella, Pieria, Corinth, Argolis and in Crete on small population shares of employed women; (iv) in Evros on small population shares of employed men and women; (v) in the prefectures of Thessaloniki, Imathia and Zakynthos on small population shares of employed women and large population shares of unemployed men; (vi) in Kilkis prefecture on small population shares of employed men and women and large population shares of unemployed men; (vii) in Kastoria prefecture on small population shares of employed and large population shares of unemployed men and women; (viii) in the prefectures of Thesprotia, Cyclades, Piraeus and a belt comprising of the Kavala, Khalkidiki, Larisa, Magnesia, Fthiotis prefectures on small population shares of employed and large population shares of abstaining women; (ix) in the prefectures of Messinia,

Kefallinia, Levkas, Evritania, Fokis, Trikala, Lesvos, Samos on small population shares of employed men and women and large population shares of abstaining women; (x) in the prefectures of West Attica and Florina on small population shares of employed women and large population shares of unemployed men and abstaining women; (xi) in the prefectures of Drama, Serrai, Khios, Euboea and a belt comprising of the prefectures of Corfu, Ioannina, Kozani, Karditsa, Arta, Preveza, and the whole of Western Greece on small population shares of employed men and women and large population shares of unemployed men and abstaining women; (xii) in Laconia on small population share of employed and unemployed women; (xiii) in Arcadia and the Dodecanese on populations with similar features and small population shares of employed men (as well as a large population share of abstaining women in the former, and a large population share of unemployed men in the latter), *vis-à-vis* the municipalities located in prefectures of Athens and Rodopi.

According to Version III (annex 3), the municipalities: (a) in the travel-to-work area of Patras[13] rely on large population shares of unemployed men and women, and a small population share of employed women; (b) on the plateau of Ioannina and a string of municipalities running along the Pindos mountain-range,[14] (c) on the plateaus of Kozani and Ptolemais,[15] as well as (d) in the travel-to-work area of Khios and a string of island communities along the eastern Aegean[16] on small population shares of employed men and women, and large population shares of unemployed and abstaining men and women; (e) in the travel-to-work area of Rhodes[17] on large population shares of both employed and unemployed men and women, and small population shares of abstaining men and women; (f) in the micro-region of Zakynthos island and the Peloponnesian Pinios valley[18] on large population shares of employed men and unemployed men and women, and a small

[13] It is situated in Western Greece, spans 1,261 km^2, hosts 245 thousand people (i.e., 77% of the Ahaia prefecture resident population), and is indicated in figure 4 by patern 4.

[14] It involves parts of Epirus and Thessaly, spans 3,205 km^2, hosts 147 thousand people (i.e., 82%, 16%, 2% and 1% of the Ioannina, Arta, Trikala and Karditsa prefecture residents, respectively), and is illustrated in figure 4 in the form of two closely clusters (patern 7).

[15] The energy-center of Greece, situated in West Macedonia. It spans an area of 2,509 km^2, hosts 128 thousand people (i.e., 81%, 7% and 2% of the Kozani, Grevena and Florina prefecture residents, respectively), and is indicated in figure 4 by patern 7.

[16] They occupy an area of 887 km^2, host 68 thousand people (i.e., 89%, 3% and 2% of the Khios, Dodecanese and Samos prefecture populations, respectively) and are indicated in figure 4 by patern 7.

[17] A renowned tourist destination in the South Aegean. It spans a surface of 794 km^2, hosts 109 thousand people (i.e., 58% of the Dodecanese prefecture residents), and is indicated in figure 4 by patern 2.

[18] Situated in the Ionian and Western Greece regional administrations, occupies an area of 1,007 km^2, hosts 93 thousand people (i.e., 100%, 27% and 1% of the Zakynthos, Ilis and Achaea prefecture residents, respectively), and is indicated in figure 4 by patern 1.

population share of abstaining women; (g) on the plateau of Kastoria[19] on large population shares of unemployed men and women, and small population shares of employed and abstaining men and women; (h) in parts of Corfu island and the south-western coast of Epirus[20] on large population shares of unemployed men and women; (i) on the plateau of Grevena[21] on rather large population shares of unemployed and abstaining men and women, and small population shares of employed men and women, *vis-à-vis* the rest of Greece (with the exception of a small number of less populated places listed in table 3 and indicated in figure 4, which we skip in the interest of brevity).

Overall, the spatial effects born by the three versions (regional, prefectorial, micro-regional and distinct community) corroborate the concerns raised at the outset of the paper. For instance, in relation to the findings of Version I, West Macedonia[22] appears to be the obvious candidate for economic development intervention considering that the area's communities seem to be inhabited by populations with smaller shares of employed men and women, and larger shares of unemployed and non-participating men and women than the rest of the country. Yet, according to Version II, only one of the West Macedonian prefectures, that of Kastoria,[23] appears to exhibit low population shares of employed men and women, and high population shares of unemployed men and women (while the levels of non-participation do not seem to vary significantly) compared to the rest of the country. The other West Macedonian prefectures exhibit different combinations of male unemployment, male or female employment and female non-participation. The results of Version III reveal that the combination of low male and female employment and high male and female unemployment is encountered not only on the plateau of Kastoria (see footnote 19) but also on the plateau of Grevena (see footnote 21) and is associated with high male and low female non-participation in the case of the former, and high male and female non-participation in the case of the latter. The plateaus of Kozani and Ptolemais (see footnote 15) are quite homogeneous in terms of their employment, unemployment, and non-participation distributions, and exhibit a profile of low male and female employment, high male unemployment and female non-participation that recall the features of the Kozani prefecture in Version II. At the same time,

[19] A renowned fur-center in West Macedonia. It spans an area of 1,357 km^2, hosts 51 thousand people (i.e., 97% of Kastoria prefecture residents), and is indicated in figure 4 by patern 5.

[20] A popular tourist destination situated in the Ionian and Epirus regional administrations, with an area of 270 km^2. It hosts 24 thousand people (i.e., 17% and 8% of the Corfu and Preveza prefecture residents, respectively), and is indicated in figure 4 by patern 3.

[21] Situated in West Macedonia, it spans an area of 1,023 km^2, hosts 20 thousand people (i.e., 60% of the Grevena prefecture residents), and is indicated in figure 4 with black.

[22] It has an area of 9,530 km^2, a population of 295 thousand, and is indicated in figure 2 with black.

[23] It has an area of 1,705 km^2, a population of 54 thousand, and is indicated in figure 3 with black.

the neighbouring municipality of Siatista[24] possesses a high population share of unemployed men, while the other parts of West Macedonia exhibit different combinations of economic participation. In fact, many of them do not exhibit distressing features (i.e., low employment and/or high unemployment) at all.

To sum up, it seems that while Version I singles out West Macedonia as the area that exhibits both low male and female employment, as well as high male and female unemployment, and non-participation, the other two versions suggest that the region in question is not homogeneous. Consequently, a region-wide economic development intervention that aimed at the reduction of unemployment on the basis of conventional regional divisions would, in all likelihood, result in the direction of funds and efforts to areas that were not in dire need of them and to areas that needed a differentiated policy mix. By contrast, a similar intervention based on the findings of Version III would not only be able to identify sub-regions with different features, but also anticipate a larger-than-average response (or entry into the workforce) of non-participating residents in areas under cases (b)–(d) and (i), smaller such responses in areas under cases (a) and (g), and so on. This may be critical in assessing proposals aiming to reduce unemployment around the country.

Indeed, compared to Versions I and II which group municipalities into regional or prefectorial formations, Version III provides a more detailed picture which may be utilised for better focused, place-specific, territorial development and social cohesion policy interventions. Additionally, it does not impose a spatial structure which may affect the explanatory capacity of the other regressors. Indeed, it constructs the spatial dummies after the residuals (i.e., the part that is not explained by the other regressors) without presuming a spatial structure. Lastly, it is preferable on statistical grounds (especially when compared to Version II) as it explains a larger portion of the total variation observed in the dependent variables.

4. THE OTHER EFFECTS

Another lesson that emerges from the analysis concerns the impact of the non-spatial factors. Indeed, it appears that a great deal of the explained variation of the economically active male and female population is accounted not from the spatial (regional, prefectorial, or micro-regional and distinct municipality) dummies, but from population density, gender and age composition, educational

[24] It has an area of 159 km^2, hosts 7 thousand people (4% of Kozani prefecture residents), and is indicated in figure 4 by patern 6.

structure, and the combinations of industrial-and-professional concentrations.[25] In particular:

a) according to the estimated coefficients that are statistically significant in Version I and Version III, it appears that the spreading out of science and art professionals employed in the wholesale/retail trade and repairs industry and in extra-territorial bodies and organisations, as well as skilled workers (plant/machine operators and assemblers) employed in manufacturing, may bring about, *ceteris paribus*, a rise in participation and a reduction in unemployment and abstention.

b) according to the estimated coefficients that are statistically significant in all three versions, it appears that urban areas provide women with increased employment opportunities. Consequently, even a modest urbanisation of rural areas is likely to bring about a growth in local employment and, conceivably, a reduction in abstention, in such areas.

Additionally, an incremental expansion of the male population aged 20–64 (who comprise the majority of employed men, and constitute the reference population) appears to stimulate male employment *vis-à-vis* all other demographic groups over the age of five;[26] and a similar expansion in terms of same-aged women appears to swell all three functions for females (i.e., female employment, unemployment and abstention). The latter suggests that while many women get jobs, a good number of them do not make good job-matches in the workplace, and many are attached to homemaking roles. A marginal increment in the population share of children aged 0–4 appears to incite female employment (presumably to boost family income) and abstention (presumably to care for the children) while dampening female unemployment. An equivalent increment of children aged 5–9 appears to dampen down female employment (presumably on account of the time-use adjustments made by mothers and other adult female relatives minding the children aged 5–9 as their extracurricular and social life expands). A similar increment of children aged 10–19 appears to reduce female unemployment and incite female abstention (as the presence of these children seems to stimulate female involvement in homemaking choirs). At the same time, a rise in the presence of senior citizens aged 65–79 years exerts a negative effect on male and female employment, and a positive on female abstention from the workforce (as a fair number of working men and nearly all working women retire); while a similar rise in the presence of senior citizens over the age of 80 years has a negative impact on male employment (as men who delay their retirement eventually retire or pass away), and a positive one on female employment (as a number of women enter the workforce to nurse/care for the ailing elderly).

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[25] A comparison between the R^2s provided in tables 1–3 and footnotes 10–12 will suffice.

[26] Alternatively, the marginal increments in the population shares of the various age-and-gender groups (apart from preschoolers) *vis-à-vis* the reference population yield negative effects in the male employment function.

Overall, demographic composition, though not easy to manipulate in the short and medium term, affects the employment/unemployment/non-participation distribution of residents and, thus, ought to be taken into account by policy-makers. To the extent the latter aim to boost employment and reduce unemployment and non-participation, women may have to be persuaded of (if not enticed to) the benefits of participation. To reduce the likelihood of setting off a situation whereby one segment of the population drives another to unemployment, the supply of jobs ought to increase, and in the medium- and long-run this can be achieved through economic growth. At the same time, in order to weaken the negative effect of children aged 5–9 on female employment, the expansion of day-care facilities might be a solution. Similarly, in order to weaken the negative effect of senior citizens aged 65–79 on the employment of their family members, and the positive effect on female (and possibly male) abstention, more senior-citizen facilities might be established. Additionally, the normal retirement age could be extended. All in all, the expansion of facilities for children and senior citizens is bound to bring about more jobs to those staffing these facilities. Coupled with the relaxation of the compulsory retirement-age, this may bring about a growth in GDP, if not in individual and household welfare.

Compared to the presence of men with negligible or elementary schooling, a marginal increment in the population share of men with secondary school, post-secondary, and bachelor-level qualifications appears to be associated with time-allocations that yield lower male employment, presumably due to a lower drive towards work; while a similar increment in the population-share of men with secondary school qualifications seems to stimulate lower female employment and unemployment and higher female abstention. The latter suggests that the presence of such men does not merely crowd out women from employment but may discourage their participation (or encourage abstention). At the same time, a similar increment in the population share of women (of any of the above-mentioned qualifications) is associated with increased female abstention, probably reflecting female attachment to domestic activities; while a marginal increment in the population share of women possessing secondary school qualifications is associated with higher shares of female and male unemployment. This indicates that despite their involvement in the job-market, many women do not match well with jobs, and the rest may drive a fair number of men to unemployment. Additionally, a rise in the population share of women holding post-secondary school and bachelor degrees is associated with higher shares of female employment. This indicates that such women are both well motivated and considered well-suited for the needs of their local job-market. Lastly, a marginal increment of male and female postgraduate degrees holders is associated with increased male unemployment. This suggests that they drive less qualified men to unemployment and/or that the men with the highest qualifications are not well matched with jobs and/or are ill-suited to start their own businesses or somehow are hindered in selling their expertise.

To the extent policy-makers desire to boost employment and reduce unemployment and non-participation, men with secondary school, post-secondary school, and bachelor qualifications, as well as women of all educational backgrounds, will have to be persuaded of (if not enticed to) the benefits of participation. Additionally, women with secondary school qualification, and possibly women with lesser qualifications, will have to become more competitive (i.e., supply better matches) in the market-place. Unless they self-select, this could be achieved through continuous education and skill-upgrading processes. Furthermore, to reduce male and female unemployment, measures may have to be taken towards creating a culture and a suitable environment supporting the formation of businesses, including own businesses, which absorb people. To the extent that a marginal increment in the numbers of men with postgraduate qualifications is associated with increased unemployment among those with such qualifications, it would seem that the orientation procedure by which young males select their postgraduate subjects could improve, and steps could be taken to set up conditions for a culture and an environment favoring the formation of businesses capable to absorb such highly skilled persons in specialized activities.

5. CONCLUSIONS

The paper takes a fresh look at the economy as it truly is, i.e., a collection of clusters and communities, without preconceptions that the country's economic spaces match the inherited administrative territorial framework. To further our understanding, it econometrically isolates the effects of the spatial factors from the effects of the non-spatial factors on male and female employment, unemployment, and non-participation in the labor force, within a SUR context. Additionally, in order to improve the quality of the estimated coefficients, it supplements the explanatory capacity of the available/known independent variables (namely, population density, gender and age composition, educational make-up, concentrations of industrial-and-professional combinations, inclusion in broader travel-to-work areas), with information extracted from the spatial patterns produced by the omitted (unknown) variables incorporated in the residuals. Thus, it identifies micro-regions and distinct municipalities that are inhabited by populations possessing smaller-than-average shares of employed men or women or both, and/or larger-than-average shares of unemployed or non-participating persons of either gender. Such conditions hinder prosperity, as well as the attractiveness of living in large travel-to-work areas and pose serious threats to the continuation of smaller communities.

Obviously, depending on the zoning method used results vary; and if the findings vary so do the prescriptions proposed by the national and EU economic

development agencies. In particular, if the analysis is based on estimates and averages drawn at higher levels of territorial aggregation, such as regions and prefectures, then it is very likely that the 'micro-reality' is blurred, especially in very heterogeneous regions. And if the picture is distorted, then the quality of the conclusions based on the particular snap-shot is bound to be affected. Consequently, the policy proposals may be misguided to some extent, resulting in interventions directed to places that do not need intervention or need a different kind of a policy-mix. We take the view that as in Medicine, the expert doctors who do not wish to play with people's lives and stamina, do all the tests and minute scans in order to identify the area where the anomaly is observed or the pain is acute in order to understand the causes before performing surgery, so in regional development policy the experts should not play with people's lives and stamina. And if the intent is to raise employment and/or reduce unemployment in communities facing such difficulties, then the interventions ought to be tailored to local idiosyncrasies. Overall, employment and unemployment are phenomena, the spatial determinants of which turn out to be associated with significant parameters. However, they do not manifest themselves in the same intensity and manner in all parts of a region or its constituent subregions (prefectures, counties and the like). Consequently, the implementation of a singular solution beyond the locality or cluster of localities that ought to be targeted may constitute a waste of resources. Additionally, solutions may be similar (a) within belts consisting of contiguous or neighbouring townships that belong to different administrative regions and prefectures, and/or (b) across clusters of localities that may be far apart from each other and yet share similar characteristics. These may be complemented by nation-wide policies that are particular to the demographic, educational or other characteristics of the population.

Annex 1. The seemingly unrelated system of male and female employment, unemployment, non-participation regressions of all persons aged 10 years and older at the regional level, across Greece's 1,034 municipalities (2001 Census)

Dependent variables:	Share of employed		Share of unemployed		Share of others	
	F	M	F	M	F	M
Explanatory variables (of which #2–19 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual of functions (1)–(5)*[*]
1 Constant (reference population)	**0.16**	**0.29**	**0.02**	**0.03**	**0.32**	**0.18**
Spatial factors						
2 Attica (reference)						
3 Central Greece & Euboea	**–0.04**	**–0.02**	–0.00	0.00	**0.03**	0.04
4 Central Macedonia	**–0.01**	**–0.02**	0.00	**0.00**	0.01	0.02

Annex 1 (cont.)

Dependent variables:	Share of employed		Share of unemployed		Share of others	
	F	M	F	M	F	M
Explanatory variables (of which #2–19 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual*
5 Crete	–0.01	–0.00	–0.00	0.00	–0.01	0.02
6 East Macedonia-Thrace	–0.01	**–0.02**	–0.00	0.00	0.00	0.02
7 Epirus	**–0.05**	**–0.05**	**–0.01**	**0.01**	**0.04**	**0.05**
8 Ionian Islands	**–0.04**	**–0.04**	0.00	**0.01**	**0.03**	0.04
9 North Aegean Islands	**–0.05**	**–0.05**	–0.01	0.00	**0.03**	0.07
10 Peloponnese	**–0.02**	**–0.02**	**–0.01**	–0.00	**0.01**	0.04
11 South Aegean Islands	**–0.04**	–0.00	0.00	**0.01**	0.01	0.02
12 Thessaly	**–0.03**	**–0.02**	–0.00	0.00	**0.03**	0.03
13 Western Greece	**–0.05**	**–0.03**	0.00	**0.01**	**0.03**	0.03
14 West Macedonia	**–0.05**	**–0.04**	**0.02**	**0.01**	**0.03**	**0.03**
15 Small municipalities (≤ 150 inhabitants)	–0.01	–0.01	**0.06**	0.00	**–0.06**	0.02
Municipalities characterised by a high concentration of						
16 Science & art professionals employed in wholesale/retail trade and repairs*	**0.05**	**0.05**	**–0.01**	**–0.01**	**–0.04**	**–0.04**
17 Science & art professionals employed in extra-territorial organisations*	**0.03**	–0.01	0.00	–0.00	**–0.02**	–0.01
18 Plant/machine operators & assemblers employed in the manufacture industry*	–0.00	**0.03**	0.00	0.00	–0.01	–0.02
19 Other combinations of skills & industries (reference)						
Population density (net of effects 2–19)						
20 People per km^2	**0.00**	–0.00	0.00	0.00	**–0.00**	–0.00
21 People per km^2 – square (capturing the rate of change)	**–0.00**	0.00	–0.00	0.00	0.00	–0.00
Population composition (net of effects 2–21)						
22 % aged 0–4 years	**0.41**	**0.68**	**–0.88**	0.01	**0.93**	–1.14
23 % aged 5–9 years	**–0.45**	**–0.66**	**1.49**	**–0.10**	–0.09	–0.18

Annex 1 (cont.)

Dependent variables:	Share of employed		Share of unemployed		Share of others	
	F	M	F	M	F	M
Explanatory variables (of which #2–19 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual*
24 % aged 10–19 years	0.10	**–0.49**	**–0.17**	**0.10**	**0.51**	–0.05
25 % women aged 20–64 years	**0.48**	**–0.41**	**0.21**	**0.07**	**0.62**	**–0.97**
26 % men aged 20–64 years (reference)						
27 % women & men aged 65–79 years	**–0.21**	**–0.64**	**–0.05**	**–0.04**	**0.88**	**0.06**
28 % women & men aged 80+ years	**0.30**	**–0.46**	**0.18**	**0.11**	0.19	–0.32
Formal qualifications (net of effects 2–28)						
29 % women with primary level or lower schooling	0.22	–0.07	**0.24**	**0.14**	**0.51**	–1.05
30 % women with secondary school diploma, i.e., k–9 and k–12	0.04	–0.09	**0.58**	**0.28**	**0.37**	–1.18
31 % women with post-secondary diploma or bachelor degree	**0.82**	**0.60**	**–0.33**	–0.12	**0.54**	–1.51
32 % men with primary or lower schooling (reference)						
33 % men with secondary school diploma, i.e., k–9 and k–12	**–0.24**	**–0.20**	**–0.07**	–0.00	**0.29**	0.22
34 % men with post-secondary diploma or bachelor degree	**–0.24**	**–0.83**	**0.27**	–0.00	–0.06	0.87
35 % women and men with postgraduate degree	–0.06	0.04	**0.38**	**0.32**	–0.04	–0.65
Statistics: X^2	1,443	2,270	5,033	0,450	1,327	
R^2	0.5903	0.6876	0.8296	0.3036	0.5633	

[*] The location quotient pertaining to the skill-industry combination is equal to or exceeds the value of '3'.

Explanation: bold fonts denote rejection of the hypothesis of equality to zero at the 1% margin of error. The probability figures are provided below. In the last column bold fonts indicate confidence for the signs of the residual function's coefficients on account of the high *z*-stats obtained *in all* previous regressions.

Annex 2. The seemingly unrelated system of male and female employment, unemployment, non-participation regressions of all persons aged 10 years and older at the prefectorial level, across Greece's 1034 municipalities (2001 Census)

Dependent variables:	Share of employed		Share of unemployed		Share of others	
	F	M	F	M	F	M
Explanatory variables (of which #2–55 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual of functions (1)–(5)*
1 Constant (reference population)	**0.20**	**0.28**	**0.02**	**0.02**	**0.30**	**0.17**
Spatial factors						
2 Attica: Athens prefecture (reference)						
3 E. Attica prefecture	**–0.04**	**0.02**	–0.00	0.00	0.01	0.02
4 Pireaus, Troezina and their environs, Saronic islands, Idra, Spetses, Kithira, Antikithira pref.	**–0.08**	–0.00	–0.00	0.01	**0.05**	0.03
5 W. Attica prefecture	**–0.07**	0.01	–0.00	**0.01**	**0.04**	0.01
6 Central Greece & Euboea: Boeotia prefecture	**–0.07**	**0.02**	–0.00	0.01	**0.02**	0.02
7 Euboea & Skyros prefecture	**–0.08**	**–0.02**	–0.00	**0.01**	**0.05**	0.05
8 Evritania prefecture	**–0.10**	**–0.05**	–0.01	0.01	**0.07**	0.08
9 Fokis prefecture	**–0.10**	**–0.05**	–0.00	0.01	**0.06**	0.09
10 Fthiotis prefecture	**–0.07**	–0.01	–0.01	0.00	**0.04**	0.05
11 Central Macedonia: Khalkidiki prefecture	**–0.08**	–0.00	–0.00	0.00	**0.02**	0.06
12 Imathia prefecture	**–0.05**	–0.01	0.00	**0.01**	0.02	0.02
13 Kilkis prefecture	**–0.07**	**–0.04**	0.01	**0.01**	0.02	0.06
14 Pella prefecture	**–0.04**	0.00	–0.00	0.01	0.02	0.02
15 Pieria prefecture	**–0.05**	–0.01	–0.00	0.00	0.02	0.04
16 Serrai prefecture	**–0.06**	**–0.04**	–0.00	**0.01**	**0.04**	0.05
17 Thessaloniki prefecture	**–0.04**	0.01	0.00	**0.01**	0.01	0.01
18 Crete: Khania prefecture	**–0.06**	0.00	–0.00	0.00	0.01	0.04
19 Heraklion prefecture	**–0.03**	0.01	–0.00	0.00	0.00	0.02
20 Lasithion prefecture	**–0.03**	–0.01	–0.00	0.00	–0.00	0.04
21 Rethymnon prefecture	**–0.05**	0.00	–0.00	0.00	0.01	0.03
22 East Macedonia & Thrace: Drama prefecture	**–0.08**	**–0.04**	0.01	**0.02**	**0.05**	0.05

Annex 2 (cont.)

Dependent variables:	Share of employed		Share of unemployed		Share of others	
	F	M	F	M	F	M
Explanatory variables (of which #2–55 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual*
23 Evros & Samothrace prefecture	**–0.06**	**–0.04**	–0.01	–0.00	0.02	0.09
24 Kavala & Thasos prefecture	**–0.06**	–0.02	–0.00	0.00	**0.04**	0.04
25 Rodopi prefecture	0.01	0.02	–0.01	0.00	–0.02	–0.00
26 Xanthi prefecture	**–0.04**	0.01	–0.00	0.01	0.02	0.01
27 Epirus: Arta prefecture	**–0.09**	**–0.04**	–0.01	**0.01**	**0.07**	0.06
28 Ioannina prefecture	**–0.09**	**–0.06**	0.00	**0.01**	**0.05**	0.08
29 Preveza prefecture	**–0.07**	**–0.02**	0.00	**0.01**	**0.04**	0.04
30 Thesprotia prefecture	**–0.06**	–0.01	–0.00	0.00	**0.04**	0.03
31 Ionian Isl.: Kefalonia & Ithaka prefecture	**–0.08**	**–0.03**	0.00	0.01	**0.04**	0.06
32 Corfu & Paxi prefecture	**–0.06**	**–0.03**	0.01	**0.02**	**0.03**	0.04
33 Levkas & Meganision, Kalamos, Kastos prefecture	**–0.11**	**–0.07**	–0.01	–0.00	**0.09**	0.11
34 Zakinthos prefecture	**–0.05**	0.02	0.01	**0.02**	0.00	0.00
35 North Aegean Isl.: Khios & Psara, Inousses prefecture	**–0.11**	**–0.07**	–0.01	**0.01**	**0.07**	0.11
36 Lesvos & Limnos, Ag. Efstratios prefecture	**–0.09**	**–0.04**	–0.01	0.01	**0.05**	0.08
37 Samos & Ikaria, Fourni Korseon prefecture	**–0.09**	**–0.02**	–0.01	0.00	**0.04**	0.08
38 Peloponnesos: Argolis prefecture	**–0.04**	0.00	–0.00	0.01	0.00	0.03
39 Arcadia prefecture	**–0.10**	**0.05**	**–0.01**	–0.00	**0.06**	0.10
40 Corinth prefecture	**–0.04**	0.01	–0.01	–0.00	0.01	0.02
41 Laconia prefecture	**–0.05**	–0.01	**–0.01**	–0.00	0.02	0.06
42 Messinia prefecture	**–0.07**	**–0.02**	–0.01	0.00	**0.03**	0.06
43 South Aegean Isl.: The Cyclades	**–0.08**	–0.01	–0.01	–0.00	**0.04**	0.05
44 The Dodecanese	**–0.07**	**0.02**	**0.01**	**0.02**	–0.00	0.02
45 Thessaly: Karditsa prefecture	**–0.08**	**–0.05**	–0.00	**0.01**	**0.06**	0.06
46 Larisa prefecture	**–0.06**	–0.00	–0.01	–0.00	**0.04**	0.03
47 Magnesia & Sporades prefecture	**–0.07**	–0.01	–0.00	0.00	**0.04**	0.04

Annex 2 (cont.)

Dependent variables:	Share of employed		Share of unemployed		Share of others	
	F	M	F	M	F	M
Explanatory variables (of which #2–55 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual*
48 Trikala prefecture	**–0.08**	**–0.02**	–0.01	0.01	**0.05**	0.04
49 Western Greece: Achaea prefecture	**–0.08**	**–0.03**	0.01	**0.02**	**0.03**	0.05
50 Aetolia & Acarnania prefecture	**–0.08**	**–0.03**	–0.00	**0.01**	**0.05**	0.05
51 Ilis prefecture	**–0.09**	**–0.03**	0.00	**0.02**	**0.05**	0.05
52 West Macedonia: Florina prefecture	**–0.08**	–0.01	–0.00	**0.01**	**0.04**	0.05
53 Grevena prefecture	**–0.10**	**–0.05**	0.01	0.01	**0.05**	0.08
54 Kastoria prefecture	**–0.08**	**–0.03**	**0.08**	**0.03**	–0.02	0.02
55 Kozani prefecture	**–0.10**	**–0.04**	0.00	**0.02**	**0.07**	0.04
Population density (net of effects 2–19)						
56 People per km^2	**0.00**	–0.00	0.00	0.00	–0.00	–0.00
57 People per km^2 – square (capturing the rate of change)	–0.00	–0.00	–0.00	–0.00	0.00	0.00
Population composition (net of effects 2–57)						
58 % aged 0–4 years	**0.51**	**0.63**	**–0.84**	0.06	**0.78**	–1.15
59 % aged 5–9 years	**–0.44**	**–0.66**	**1.43**	**–0.15**	–0.04	–0.14
60 % aged 10–19 years	0.07	**–0.46**	**–0.37**	0.03	**0.77**	–0.05
61 % women aged 20–64 years	**0.43**	**–0.42**	**0.21**	**0.08**	**0.69**	**–0.99**
62 % men aged 20–64 years (reference)						
63 % women & men aged 65–79 years	**–0.25**	**–0.62**	**–0.10**	**–0.05**	**0.97**	**0.06**
64 % women & men aged 80+ years	**0.40**	**–0.42**	**0.15**	0.09	0.18	–0.39
Formal qualifications (net of effects 2–64)						
65 % women with primary level or lower schooling	0.19	–0.03	0.12	0.09	**0.67**	–1.04
66 % women with secondary school diploma, i.e., *k*–9 and *k*–12	0.06	–0.01	**0.57**	**0.25**	**0.36**	–1.22

Annex 2 (cont.)

Dependent variables:	Share of employed		Share of unemployed		Share of others	
	F	M	F	M	F	M
Explanatory variables (of which #2–55 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual*
67 % women with post–secondary diploma or bachelor degree	**0.74**	**0.54**	**–0.54**	–0.13	**0.87**	–1.48
68 % men with primary or lower schooling (reference)						
69 % men with secondary school diploma, i.e., *k*–9 and *k*–12	**–0.24**	**–0.25**	**–0.14**	–0.02	**0.37**	0.28
70 % men with post-secondary diploma or bachelor degree	–0.18	**–0.71**	**0.34**	–0.03	–0.21	0.78
71 % women and men with postgraduate degree	–0.15	–0.01	0.14	**0.22**	0.31	–0.50
Statistics: X^2	1,729	2,454	4,678	0,750	1,476	
R^2	0.6309	0.7039	0.819	0.4206	0.5889	

Explanation: as in annex 1.

Annex 3. The seemingly unrelated system of male and female employment, unemployment, non-participation regressions of all persons aged 10 years and older at the micro-regional level, across Greece's 1034 municipalities (2001 Census)

Dependent variables:	Share of employed		Share of unemployed		Share of others	
	F	M	F	M	F	M
Explanatory variables (of which #2–44 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual of functions (1)–(5)*[*]
1 Constant (reference population)	**0.14**	**0.27**	**0.02**	**0.03**	**0.33**	**0.20**
Spatial factors						
Localities in the north-eastern part of the country:						
2 Municipality of Therme on Mt. Rodopi	–0.01	–0.00	–0.01	–0.00	**0.07**	–0.04
3 String of municipalities in the south Strimon valley	–0.03	**–0.04**	0.01	**0.02**	0.03	0.01
4 String of municipalities about Mt. Kerkini	–0.03	**–0.07**	**0.02**	**0.02**	0.01	0.04

Annex 3 (cont.)

	Dependent variables:	Share of employed		Share of unemployed		Share of others	
		F	M	F	M	F	M
	Explanatory variables (of which #2–44 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual*
5	Municipality of Panagia in the Khalkidiki peninsula	**–0.06**	–0.03	–0.01	–0.00	**0.07**	0.03
6	Monastic community of Mt Athos in the Khalkidiki peninsula	**–0.14**	**–0.08**	–0.02	–0.02	**–0.33**	0.60
7	Municipality of Toroni in the Khalkidiki peninsula	–0.04	0.02	–0.00	**0.03**	0.03	–0.05
8	Municipality of N. Koutali on Limnos isl. (in the N. Aegean)	**–0.07**	**–0.05**	–0.01	0.00	–0.03	0.16
	Localities in the western part of the country:						
9	Sub-region of W. Macedonia west of Mt. Vernon, incl. the travel-to-work area of Kastoria	**–0.02**	**–0.03**	**0.11**	**0.02**	**–0.06**	**–0.03**
10	Sub-region of W. Macedonia west of Mt. Vourinos, incl. the Grevena travel-to-work area	**–0.07**	**–0.11**	**0.05**	**0.03**	**0.06**	**0.05**
11	Sub-region of W. Macedonia east of Mt. Askion, incl. the Kozani and Ptolemais travel-to-work areas	**–0.05**	**–0.03**	–0.00	**0.01**	**0.05**	0.01
12	Municipality of Siatista in W. Macedonia	–0.01	0.03	0.03	**0.08**	–0.01	–0.12
13	Municipality of Mesolourion in W. Macedonia	–0.04	**–0.13**	–0.01	–0.00	**0.08**	0.11
14	Municipality of Dotsikon in W. Macedonia	**–0.14**	**–0.07**	–0.01	**–0.03**	**0.07**	0.18
15	Municipality of Aetomilitsa on the Epirusian side of the northern Pindos mountain-range	**–0.09**	**–0.10**	0.01	**–0.03**	**–0.19**	0.38
16	Municipality of Fourka on the Epirusian side of the northern Pindos mountain-range	0.03	**–0.07**	0.00	0.03	0.02	–0.00

Annex 3 (cont.)

	Dependent variables:	Share of employed		Share of unemployed		Share of others	
		F	M	F	M	F	M
	Explanatory variables (of which #2–44 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual*
17	Municipality of Timfi on the Epirusian side of the northern Pindos mountain-range	–0.05	**–0.07**	0.02	0.01	–0.02	0.11
18	String of Epirusian municipalities west of the northern Pindos mountains (incl. the Ioannina travel-to-work-area), and Epirusian and Thessalian municipalities along the southern Pindos and Athemanian mountains	**–0.05**	**–0.05**	–0.00	**0.01**	**0.05**	0.04
19	Cluster of Kalarites and Sirakon on the Epirusian side of Mt. Lakmos	**0.17**	**0.04**	**0.12**	**0.08**	**–0.23**	**–0.18**
20	Municipality of Aspropotamos on the Thessalian side of the Lakmos and Athemanian Mts.	–0.01	**0.08**	**0.04**	**0.04**	**–0.10**	–0.05
21	Municipality of Melissourgi on the Epirusian side of the Athamanian mountains	**–0.08**	0.01	–0.01	0.01	0.01	0.05
22	String of municipalities between the Pindos, Panetolian and Timfristos mountains, spanning Thessaly, Central and Western Greece	**–0.06**	**–0.08**	0.00	**0.02**	**0.05**	0.07
23	String of municipalities along the Timfristos, Oxia, Oeti, Gkiona and Nafpaktian mountains, in Central and Western Greece	**–0.08**	**–0.09**	–0.01	–0.00	**0.07**	0.11
24	Erikoussa and Othoni islands, northwest of Corfu isl.	**–0.07**	**–0.10**	–0.01	0.02	**0.08**	0.08
25	String of localities along the southern Epirusian coast and parts of Corfu isl. (Ionian Isl.)	0.01	–0.01	**0.02**	**0.03**	–0.03	–0.03

Annex 3 (cont.)

Dependent variables:	Share of employed		Share of unemployed		Share of others	
	F	M	F	M	F	M
Explanatory variables (of which #2–44 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual*
26 Small island-cluster situated between the Akarnanian coast and Levkas isl. (Ionian Isl.)	**–0.10**	**–0.12**	–0.01	–0.00	**0.10**	0.13
27 Micro-region comprising of Zakynthos isl. (Ionian Isl.) and a part of W. Greece across the water	0.00	**0.03**	**0.01**	**0.02**	**–0.03**	–0.04
28 Municipality of Gastouni in W. Greece	–0.05	**–0.05**	0.01	**0.04**	0.03	0.02
29 Patras travel-to-work area in W. Greece	**–0.02**	–0.01	**0.01**	**0.02**	–0.01	–0.00
30 String of municipalities along the west Peloponnesian highlands (W. Greece & Peloponnese)	**–0.08**	**–0.10**	–0.00	0.00	**0.08**	0.10
31 Municipality of Tripila in southwestern Peloponnese	–0.06	**–0.07**	0.01	0.01	0.02	0.08
Localities in the central part of the country:						
32 Agkistrion isl. in Attica	**–0.08**	–0.02	–0.01	0.00	**0.08**	0.02
33 Cluster of Elimnii, Kirefs, Nilefs in northern Euboea isl.	**–0.05**	**–0.06**	0.00	**0.03**	**0.05**	0.03
34 Municipality of Trikerion in Thessaly	**–0.07**	**–0.07**	–0.01	–0.01	**0.11**	0.04
Localities in and around the archipelago:						
35 Hios travel-to-work area, the islands of Inouse, Psara, Fourni Korseon (N. Aegean Isl.), Lipsi, Kalimnos, Nisiros, and the northern part of Karpathos isl (S. Aegean Isl.)	**–0.05**	**–0.04**	–0.01	**0.01**	**0.06**	0.03
36 Municipality of Mastihohoria in the N. Aegean	–0.04	**–0.10**	–0.00	–0.01	–0.01	0.16
37 Island of Agathonisi in the S. Aegean	**–0.07**	**0.06**	–0.01	0.02	–0.04	0.03

Annex 3 (cont.)

	Dependent variables:	Share of employed		Share of unemployed		Share of others	
		F	M	F	M	F	M
	Explanatory variables (of which #2–44 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual*
38	Rodos travel-to-work area in the S. Aegean	**0.02**	**0.03**	**0.04**	**0.04**	**–0.08**	**–0.04**
39	Kimolos and Donousa islands in the S. Aegean	**–0.08**	**–0.15**	–0.02	**–0.02**	**0.09**	0.17
40	Municipality of Innahorion in western Crete	–0.03	**–0.05**	–0.01	–0.01	0.03	0.06
41	Municipality of Asi Gonia in western Crete	–0.02	0.04	**0.05**	–0.01	–0.07	0.01
42	Rest of Greece (reference)						
	Municipalities exhibiting a high concentration of						
43	Science & art professionals employed in wholesale/retail trade and repairs*	**0.06**	**0.05**	–0.00	**–0.01**	**–0.05**	–0.04
44	Science & art professionals employed in extra-territorial organisations*	**0.05**	0.01	–0.00	–0.00	**–0.03**	–0.03
45	Plant/machine operators & assemblers employed in the manufacture industry*	–0.00	**0.03**	–0.00	0.00	–0.01	–0.02
46	Skilled primary-sector workers employed in agriculture, husbandry, hunting, and forestry*	0.00	**–0.00**	**–0.01**	**–0.00**	–0.00	0.01
47	Other combinations of skills & industries (reference)						
	Population density (net of effects 2–46)						
48	People per km^2	**0.00**	**0.00**	0.00	–0.00	**–0.00**	–0.00
49	People per km^2 – square (capturing the rate of change)	**–0.00**	–0.00	–0.00	0.00	**0.00**	0.00
	Population composition (net of effects 2–49)						
50	% aged 0–4 years	**0.56**	0.16	**–0.77**	0.03	**0.70**	–0.67
51	% aged 5–9 years	**–0.46**	**–0.81**	**1.55**	**–0.07**	–0.12	–0.09
52	% aged 10–19 years	**0.22**	**–0.93**	**–0.23**	**0.08**	**0.58**	**0.30**
53	% women aged 20–64 years	**0.58**	**–0.82**	**0.19**	–0.02	**0.55**	–0.47
54	% men aged 20–64 years (reference)						

Annex 3 (cont.)

Dependent variables:	Share of employed		Share of unemployed		Share of others	
	F	M	F	M	F	M
Explanatory variables (of which #2–44 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual*
55 % women & men aged 65–79 years	**–0.16**	**–0.98**	0.04	–0.02	**0.79**	0.34
56 % women & men aged 80+ years	**0.31**	**–0.62**	0.02	–0.04	**0.37**	–0.03
Formal qualifications (net of effects 2–56)						
57 % women with primary level or lower schooling	–0.05	**–0.33**	**0.38**	**0.16**	**0.64**	–0.80
58 % women with secondary school diploma, i.e., k–9 and k–12	–0.16	**–0.30**	**0.67**	**0.25**	**0.47**	–0.92
59 % women with post-secondary diploma or bachelor degree	**0.57**	–0.01	–0.12	0.09	**0.60**	–1.13
60 % men with primary or lower schooling (reference)						
61 % men with secondary school diploma, i.e., k–9 and k–12	**–0.15**	**–0.17**	**–0.09**	–0.00	**0.23**	0.19
62 % men with post-secondary diploma or bachelor degree	–0.10	**–0.35**	**0.27**	**–0.11**	–0.23	0.52
63 % women and men with postgraduate degree	**–0.46**	–0.21	0.12	**0.22**	**0.62**	–0.30
Statistics: X^2	2,263	4,152	6,143	1,008	2,113	
R^2	0.6942	0.8009	0.8560	0.4939	0.6725	

[*] The location quotient pertaining to the skill-industry combination is equal to or exceeds the value of '3'.

Explanation: as in annex 1.

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