THE USE OF DISAGGREGATED DATA IN THE COMPREHENSION OF THE SUB-REGIONAL DIVERSITY AND THE FORMULATION OF POLICY IN GREECE♦

By

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Abstract

The paper analyses the spatial distribution of male and female employment, unemployment and non-participation population shares recorded in the 2001 Census across the country's 1034 municipalities. It estimates the impact of demographic composition, formal qualifications, population density, sector concentration, and develops a procedure for the detection of likely distressed areas through the spatial patterns of the residuals (thus capturing the spatial dimension of omitted variables). The construction of dummy variables standing for such localities or clusters of localities allows the juxtaposition of a model that is based on micro-regional and distinct community characteristics to specifications that are based on the official division of the country, i.e., the 13 administrative regions and the 54 prefectures. On the basis of the findings the paper makes a number of spatial and non-spatial policy proposals. Overall, a better understanding of the internal heterogeneity of the country's regions and sub-regions, and the factors driving economic activity, permits the designation of better targeted policy interventions.

Keywords: disaggregated territorial data; omitted variables; seemingly unrelated regressions; conventional and micro-regional development areas.

JEL-Codes: C31, C51, J21, R12

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1. Introduction

The purpose of this paper is to analyze the spatial allocation of the economically active population in Greece at the local authority level by employing disaggregated data from the *2001 Census*. By working with disaggregated figures, we are able to identify municipalities and clusters of municipalities characterized by low employment and/or high unemployment. The findings suggest that the geographic distribution of these areas bears little resemblance to the country's formal regional and sub-regional divisions, on the basis of which the national and EU regional economic policies are devised, implemented, and assessed. Instead, their distribution seems to be associated with morphological or other features. Obviously, this entails important policy implications for economic development and social cohesion policy. Indeed, both in Greece and the rest of the EU, the expansion of local employment and reduction of unemployment are seen as indispensable instruments for raising local incomes and sub-regional GDP, bringing about prosperity, improving living standards, checking and reversing sub-regional population decline, thus ensuring the continuation of communities and promoting national and territorial convergence.

Interestingly, while policy-makers recognize that territorial development policies ought to be tailored to local idiosyncrasies (Greek Government, 1998; EU, 2004; 2006a; 2006b), nearly all relevant data collected by government agencies are supplied at fairly aggregated levels, so that all discussions and analyses regarding regional employment and unemployment issues in Greece are conducted at these aggregated levels. The majority of the studies tends to rely on the quarterly *Labor Force Surveys*, which are drawn from urban, semi-urban, and rural samples of persons aged 15 years and older residing in each of the country's 13 administrative regions (NUTS level 2 areas).[1] Thus, the research is conducted either at the aforementioned territorial level or on the basis of a very broad (binary) urban/rural-area distinction, and includes, among others, recent works by Athanassiou et al. (1995a), Petraki-Kottis and Kottis (1997) and Konsolas et al. (2002). The remaining studies rely on the *Censuses* and the *Unemployment Registry*, and explore such issues at the level of the country's 51 or 54 prefectorial (NUTS level 3) areas.[2] Among these are recent works by Athanassiou et al. (1995b), Efstratoglou (2006) and Monastiriotis (2007).

[1] The *Nomenclature des Unités Territoriales Statistiques* (NUTS) is the five-tier hierarchical structure used in the EU to standardize territorial units. In Greece, the administrative regions (*periferies*) correspond to NUTS level 2 sized-districts; prefectures (*nomoi*) correspond to NUTS level 3 sized-districts; and municipalities (*demoi*/*koinotites*) to upper level Local Administrative Units (LAU 1, occasionally termed NUTS level 4). The 13 NUTS level 2 districts of Greece are: Attiki (where the capital city of Athens is located), Central Greece-Euboea, Central Macedonia (where the second largest city of Thessaloniki is located), Crete, East Macedonia-Thrace, Epiros, the Ionian Islands, the North Aegean Islands, Peloponnesos, the South Aegean Islands, Thessaly, West Macedonia, and Western Greece.

[2] The difference in the number of prefectures involved depends on the subdivision or not of Attiki, formerly a prefecture of Central Greece-Euboea.

Obviously, if some or all of the aforementioned regions and prefectures are internally diverse,[3] but these features are not known and, thus, not considered by policy-makers, then the regional policy interventions may have a limited impact in combating undesirable employment and unemployment disparities. Indeed, if the territorial development policy is based on regional or prefectorial averages that veil sub-regional heterogeneity, then the policy is bound to produce sub-optimal, even unanticipated and undesired, results at a considerable waste of resources. Given the country's idiosyncratic terrain, it is doubtful that the continental, insular or mixed regions and prefectures constitute homogeneous economic zones (or unified labor markets).[4] It follows that an understanding of the internal heterogeneity of the country's regions and prefectures, and the factors driving economic activity, may be valuable and very much desired. Indeed, the recovery of a more accurate picture of the micro-regional patterns allows for the designation of better targeted policy interventions.

Thus, in the rest of the paper we seek to devise a specification that picks up the various sub-regional, cross-regional or local differences, as well as crucial non-spatial determinants. In particular, we endeavor to identify the areas characterized by undesirable conditions such as low employment and/or high unemployment. To that end, we econometrically analyze the distribution patterns of the economically active population by utilizing disaggregated data from the country's 1034 municipalities. Given that in Greece all sub-national employment and unemployment discussions have been conducted at the prefectorial and regional levels, our approach is quite novel. Additionally, our cross-sectional analysis has the advantage of relying on fewer assumptions (as regards the question whether the territorial units are sufficiently homogeneous and constitute unified or functional labor markets), the entire population (unlike the *Labor Force Survey*'s reliance on representative samples of the regional populations), and on quite a few observations (1034 municipalities). Compared to the much smaller number of observations involved in the studies relying on regional and prefectorial data, the multitude of municipal observations allows for the consideration of a wider set of factors in order to explain the employment, unemployment, and non-

[3] For instance, some pockets or districts within a province may be well off, others may experience male or female unemployment, or both male and female unemployment, others may depend on one or more industries for jobs or on spillovers from a neighboring district, and so on.

[4] Located at the southern part of the Balkan peninsula, in south-eastern Europe, Greece is inhabited by 10.93 million residents and covers an area of some 132 thousand square kilometers (*2001 Census* figures). The territory is dominated by high mountain-chains (42.2% of the country's surface), small valleys traversed by rivers or inlayed with lakes; narrow coastal strips; a multitude of islands (18.8% of the country's surface); and a very jagged coastline, extending for 15 thousand kilometers. (To give measures of comparison: Greece's coastline accounts for 13.6% of the EU-27 total, all packed in a rather small area, about 3.1% of the EU landmass.) These natural features greatly fragment the country into a host of tiny districts. Obviously, the splintering impact of the landscape is tempered by the effectiveness of the transportation network linking these districts (coastal strips, plateaus, and islands). Under the circumstances, Prodromidis (2008) identifies some 677 travel-to-work areas on the basis of the *2001 Census* intra-municipal commuting data.

participation composition of local populations. This allows for the extraction of more information and, thus, for the formulation of more sophisticated policy interventions.

At the international level, a number of studies have already employed disaggregated data in order to econometrically analyze unemployment (e.g., Pehkonen and Tervo, 1998; Burgess and Profit, 2001; Ingham et al., 2005; and the sources cited therein). In this paper, as already mentioned, we look at the employed and non-participating components of the populations, as well. This allows for a more thorough examination.

In our view, localities and clusters of localities, larger territorial units, as well as the country as a whole may benefit from the assumption of diversified, spatially-targeted interventions in order to, reduce unemployment and raise employment. So our focus is to isolate and compare the various spatial effects (whether regional, prefectorial or other) and non-spatial effects, and draw attention to a number of policy aspects.

The rest of the paper is organized as follows: Section 2 provides a model that explains employment, unemployment, and non-participation according to spatial and labor supply/demand factors. It also develops a procedure for the detection of likely distressed areas through the spatial patterns of the residuals, and the construction of dummy variables standing for localities or clusters of localities exhibiting similar spatial effects. Section 3 estimates within a seemingly unrelated regression framework the male and female employment, unemployment, and non-participation functions at the regional, prefectorial, and distinct cluster/municipality levels. This section isolates as well the spatial from the demographic, sectoral, and other effects, and discusses the results. Section 4 offers a number of policy proposals at the territorial, qualification, and sectoral levels. Section 5 concludes.

2. Building a model

In this section, we set up a model that (a) isolates the impact of spatial factors from the impact of other factors affecting employment, unemployment, and non-participation; and (b) identifies spatial formations exhibiting symptoms of workforce involvement and social cohesion, often found distressing by policy-makers. These symptoms involve low employment and/or high unemployment and non-participation or exclusion from the labor market. It goes without saying that the more detailed our description and understanding of such patterns is, the higher the chance to devise effective prescriptions to deal with them.

i. Explaining economic participation in terms of spatial and non-spatial factors

The factors explaining the employment and unemployment of persons as well as their non-participation in economic activities may be grouped into two categories: (a) those associated with the characteristics of individuals, households, and firms that determine the supply and demand

schedules in a manner that is not community-specific; and (b) those associated with the characteristics of communities and clusters of communities, for they may also exert a distinctive influence on the behavior of residents, migrating individuals, households, and firms.[5] The prevalent mode of discriminating between spatial and non-spatial arguments in empirical economic analyses is to introduce the former via dummy variables.

Thus, the number of employed male and female residents, $L_{Emp,m}$ and $L_{Emp,f}$, respectively, unemployed male and female residents, $L_{Un,m}$ and $L_{Un,f}$, and abstaining residents $L_{Abst,m}$ and $L_{Abst,,f}$, across a country may be affected by spatial determinants which take the form of dummy variables, d_{1i}, where subscript *1* is used to distinguish the set of spatial dummies from other dummies employed in the model, and subscript *i* stands for the number of the country's (estimated or presumed) labor markets (regional, prefectorial, or other). At the same time, localities across the country may exhibit additional community-specific variations in the distribution of their economically active population on account of their population density, p. Indeed, densely (sparsely) populated areas are characterized by more (fewer) transactions, increased (reduced) specialization and more (fewer) employment opportunities relative to other more sparsely (or densely) populated communities that are situated on the same island, plain, mountain or plateau.[6] Therefore, variables $L_{Emp,m}$, $L_{Emp,f}$, $L_{Un,m}$, $L_{Un,f}$, $L_{Abst,m}$, and $L_{Abst,f}$ may be written as functions of d_{1i}, p, and other non-spatial factors determined by household and firm characteristics.

Moving on from the spatial-specific factors to the determinants of the labor supply and demand schedules in a typical labor market, we turn to the established tradition in labor economics (e.g., Becker, 1965; Killingsworth, 1983). Thus, we treat the households as small "factories" consisting of members utilizing their time, skills, and other resources in order to (a) engage in income-earning activities that allow them to purchase goods and services and/or (b) domestically produce goods and services, which they combine and consume. Consequently, the labor supplies of working-age male and female residents, notably, $L_{S,m} = L_{Emp,m} + L_{Un,m}$ and $L_{S,f} = L_{Emp,f} + L_{Un,f}$, respectively, depend on the gender and age composition of their households working-age membership, A_{1h}, the number of under-aged dependents in their respective homes, A_{2q} (that is, a second age-based variable), the level of people's education, E_y, the wage, W, the presence of non-labor income, I, and other factors, O, such as their culture (often proxied via their ethnicity, their parent's education and socio-economic status), their domestic technologies, etc. (Pencavel, 1986; Killingsworth and Heckman, 1986; von Merz, 1990; Blundell and MaCurdy, 1999; Chiuri, 2000; Christofides and Pashardes, 2000; Prodromidis, 2005). Likewise, these very factors determine the size of the working-age male

[5] For instance, groups of communities may constitute identifiable labor markets; clusters of contiguous localities or labor markets may share similar characteristics on account of the configuration of the land, the presence/absence or features of the transportation netweork,, the climate or other amenities and resources.

[6] Likewise, Bickford et. al. (1986), von Merz (1990), Chiuri (2000), Christofides and Pashardes (2000) employ dummy variables to indicate densely populated areas or urban districts.

and female population that opt to abstain from the workforce ($L_{Abst,m}$, $L_{Abst,f}$), as several may find wages to be below their reservation levels, a number of employed and/or discouraged job-seekers may withdraw from the workplace in order to care for other family members or further their education, retire, and so on.

At the same time, the demand for the various types of labor and their aggregate, L_D, is influenced by W, and other factors, Ω, such as the costs of other inputs, the level and price of output, the technologies employed by producers/industries, and the objectives of public sector employers (Hamermesh, 1986; Gregory and Borland, 1999). It follows, that the equilibrium levels of employment ($L_{Emp,m}$, $L_{Emp,f}$) and unemployment ($L_{Un,m}$, $L_{Un,f}$) that constitute the $L_{S,m}$ and $L_{S,f}$, along with their complements (the levels of $L_{Abst,m}$, $L_{Abst,f}$) are determined by these factors as well. Consequently, we may re-write W as $W(\Omega)$, to incorporate the factors of the L_D function as well. Overall, we have:

$$L_{j,k} = f_{j,k}(d_{1i}, p; A_{1h}, A_{2q}, E_y, I, O; W(\Omega)) \qquad (1).$$

This portrays the spatial, labor supply and labor demand components separated by semi-colons. The subscripts i = (1,…, n), j = (Emp, Unemp, Abst), and k = (m,f) correspond to the number of the various spatial labor markets, three types of economic involvement (employment, unemployment or abstention), and the gender (male, female) of residents aged 10 years and older. So, $L_{j,k}$ stands as the generic expression for $L_{Emp,m}$, $L_{Un,m}$, $L_{Abst,m}$, $L_{Emp,f}$, $L_{Un,f}$, $L_{Abst,f}$, while $L_{S,m} + L_{S,f} + L_{Abst,m} + L_{Abst,f} = \Sigma A_{1h}$, i.e., the sum of all persons aged 10 years and older. Additionally, subscripts h, q, and y denote, respectively, five age-groups aged 10 years and older, two age groups under the age of 10 years, and seven gender-and-qualification groups over the age of six.

ii. Reshaping the expression to resolve data-related and econometric issues

As the dataset lacks information on the wages earned by the residents of each locality, we have little choice but to try to integrate some of the factors responsible for wage differentials across industries and professions in some other way. This is accomplished through the utilization of the occupational information of the individuals earning the wages in question [7] (A number of other factors, such as age, gender, education factors, have already been incorporated in the model.) As the spatial distribution and concentration of employers, employees, and self-employed is available in terms of both the industry they are employed in,[8] and their profession,[9] we construct industry-and-profession

[7] Industry dummies are routinely used as explanatory variables for wages (e.g., Schmidt and Zimmermann, 1991; Oi and Idson, 1999; Svejnar, 1999; Christofides and Pashardes, 2000; Kanellopoulos and Mavromaras, 2002; and the sources cited therein). Thus, empirical analysts, especially concerned with unemployment (in which case wage figures are almost always not available) have arrived to similar solutions and explain the phenomenon in terms of supply and demand factors by employing demographics, family composition, qualifications, sectoral and occupational regressors (e.g., Brown and Sessions, 1997; Bell et al. 2000; Newell, 2001; Trendle, 2004; and the literature cited therein).

[8] Namely, agriculture-husbandry-forestry, fishing, mining-quarrying, manufacturing, energy-water, construction, trade-repairs, hotels-restaurants, transport-storage-communication, financial intermediation, real estate and business activities,

combination concentration dummies, d_{2z}, that take the value "one" when the location quotient (Isard, 1960) is equal to or greater than the rather high value of "3", and "zero" otherwise. (The particular threshold was chosen over a number of alternatives on the basis of the results produced in the course of some exploratory, preliminary regressions.) So, expression (1) may be re-written as:

$$L_{j,k} = f_{j,k}(d_{1i}, p, A_{1h}, A_{2q}, E_y, d_{2z}; W(\Omega \text{ net of the previously listed factor}s), I, O), \qquad (2)$$

where subscript $z = (1,\ldots 147)$ denotes 147 industry-and-profession combination dummies.[10]

Obviously, some portion of the wage information not captured by d_{2z} and the other factors entering the wage function, such as A_{1h} and E_y, i.e., $W(\Omega$ *net of the previously listed factor*s), will not be known. Additionally, the information pertaining to the other variables also missing from the data, such as I and O, is not known either. So, the semi-colon in expression (2) separates the factors for which we possess information from those we do not. Needless to say, the omission of regressors called for by the theory implies that they will be incorporated and be treated as a part of the error term. This creates the following problems: (a) The estimated intercept will be a biased and inconsistent estimator of the true intercept. (b) 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. (c) 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.

One way to deal with the complications caused by error terms follows from the recognition that the three types of economic involvement of men and women, i.e., the dependent variables ($L_{j,k}$), are not unrelated. This can be demonstrated by standardizing the population figures to one as if dealing with the "representative households" of the country's communities.[11] That is, the collective local labor force participants and non-participants, the overall gender-age composition and the total educational composition, $\Sigma L_{j,k} = 1$, $\Sigma A_{1h}+\Sigma A_{2q}=1$, $\Sigma E_y=1$. Thus, without loss of accuracy, we may re-write expression (2), in linear form as:

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public administration and social security, education, health and social work, ther personal and social services, private household work, extra-territorial bodies, unclassified.

[9] Namely, senior officials and managers, science and art professionals, technicians, clerks, service and sales workers, skilled primary sector workers, craft and trade workers, plant and machine operators and assemblers, unskilled (manual) workers, other ill-defined.

[10] Out of the 18*9 = 162 combinations (see footnotes 8 and 9) there are a few exceptions which refer to cases not exhibiting very high location quotients, thus resulting in vectors consisting entirely of zeros (senior officials and managers, clerks, service and sales workers, craft and trade workers employed in trade and repairs; clerks employed in transport-storage-communication; and service and sales workers employed in other service activities).

[11] This is not to say that the impact of community size is altogether lost, considering that population density is positively correlated with resident population (r=55%).

$$l_{j,k} = b_{j,k} + \Sigma \beta_{ij,k} d_{1i} + \Sigma c_{zj,k} d_{2z} + \gamma_{j,k} p + \zeta_{j,k} p^2 + \Sigma \delta_{hj,k} a_{1h} + \Sigma \delta_{qj,k} a_{2q} + \Sigma \varepsilon_{yj,k} e_y, \qquad (4)$$

where $l_{j,k} = L_{j,k} / \Sigma L_{j,k}$, $a_{1h} = A_{1h} / (\Sigma A_{1h} + \Sigma A_{2q})$, $a_{2q} = A_{2q} / (\Sigma A_{1h} + \Sigma A_{2q})$, $e_y = E_y / \Sigma E_y$. Variables d_{1i} and d_{2z} are dummies, and $l_{j,k}$, p, a_{1h}, a_{2q}, and e_y are fractions. The remaining symbols are coefficients. (See Table 1.)

TABLE 1

Factors explaining people's economic activity, and data availability

Regressands: $l_{j,k}$, where $j = Emp, Un, Abst$, and $k = f, m$. That is, female employment ($l_{Emp,f}$), unemployment ($l_{Un,f}$), abstention ($l_{Abst,f}$), and male employment ($l_{Emp,m}$), unemployment ($l_{Un,m}$), abstention ($l_{Abst,m}$) expressed in terms of population shares per locality.

Regressors:	Availability of data in the 2001 Census
(i) The characteristics of individuals, households and firms that determine the supply (LS) and demand (LD) schedules in a non community-specific way:	
• Gender, Age, Qualifications in terms of population shares (LS side)	
Gender & age combinations of all persons aged 10 or older (a_{1h})	5 types [a]
Under-aged dependents (a_{2q})	2 types [b]
Gender & qualification combinations of all persons aged 6 or older (e_y)	7 types [c]
• Non-Labor Income, Culture, Domestic Technology, etc. (LS side)	N/A
• Costs of other inputs, Output (level & price), Technologies employed by producers/industries, Objectives of public sector employers (LD side)	Partly captured by industry-and-profession combination dummies (d_{2z})[d]
• Wages (both LS and LD sides)	N/A, determined by the previous factors
(ii) The characteristics of communities and clusters of communities for they may exert a distinctive influence on the behavior of resident individuals, households and firms:	
• Population density (p), for densely (sparsely) populated areas are characterized by more (fewer) transactions, induce more (or fewer) transactions, increased (or reduced) specialization and more (or fewer) employment opportunities compared to other more sparsely (or densely) populated communities that are situated on the same island, plain, mountain, plateau, etc.	p and p-*square*
• Spatial factors associated with the configuration of the land, the transportation network, the presence of a certain resource, etc. These are often taken to correspond to the country's conventional regional and prefectorial divisions, the impacts of which are isolated through the use of the relevant dummy variables (d_{1i}). So i indicates the number of the country's presumed (or estimated) labor markets. (See Tables 3 and 4). In this paper an alternative specification makes use of spatial dummies that stand for specific travel-to-work areas or reflecting the spatial dimension of the omitted variables. (See Tables 2 and 5).	

Notes:

[a] a_{1h} stands for the population share of children aged 10-19, men aged 20-64, women aged 20-64, senior citizens aged 65-79, and senior citizens aged 80 or more.

[b] a_{2q} stands for the population share share of children aged 0-4, and children aged 5-9.

[c] e_y stands for the population share of women with primary school or lesser qualifications, secondary school qualifications, post-secondary school qualifications or bachelor degrees, men with primary school or lesser qualifications, secondary school qualifications, post-secondary school qualifications or bachelor degrees, and men and women holding postgraduate degrees.

[d] On the basis of 18 industry codes and 9 profession codes, with d_{2z} taking the value "one" when the location quotient is equal to or greater than the rather high value of "3", and "zero" otherwise.

Under the circumstances, one of the six $l_{j,k}$ equations (in our case, male abstention, $l_{Abst,m}$) may be recovered as a residual from the other five equations, and the other five equations, rather than

being estimated separately, can be estimated jointly within a seemingly unrelated regressions framework. This provides a remedy to one of the problems associated with the error terms for it takes into account the correlations between the residuals of the regressed equations. (The residuals are almost certainly correlated, since the error-vectors contain the same set of omitted variables.) Thus, the method produces more efficient estimators compared to estimating separately the six $L_{j,k}$ functions of expression (2). Consequently, the estimated coefficients (especially the unbiased ones) will now be associated with more reliable measures of statistical significance.

A second source of concern regards the spatial patterns of the non-spatial variables for they too, may be determined, to some extent, by the same spatial factors (Badinger and Url, 2002). Consequently, we should address the issue of correlation of the non-spatial variables with the chosen d_{1i}'s and with each other, not only to cope with collinearities that inflate the variances of the estimators, but 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 variable(s). To achieve this, (a) we weed-out the industry-and-profession combination dummies that are highly or modestly correlated with the spatial arguments used, and (b) remove from the remaining regressors (i.e., p, a_{1h}, a_{2q}, e_y, which are in fraction form) the linear effects of the d_{1i} and d_{2z} dummies. Next, (c) we remove the effects of p on all a_{1h}, a_{2q}, and e_y; and the effects of a_{1h} and a_{2q}, on e. As a result, these explanatory variables are reshaped into components lacking spatial dependence and immunized from possible collinearities, while the formal qualification regressors are net of the age effects as well. Briefly speaking, instead of regressing $l_{j,k}$ on d_{1i} , d_{2z} , p , e_y , a_{1h} , a_{2q}, we first regress p on d_{1i} and d_{2z}, predict π and estimate $\rho = p - \pi$; then regress a_{1h} (and its complement, a_{2q}) on d_{1i}, d_{2z}, and ρ, predict $\hat{a}_{1h}$ (and $\hat{a}_{2q}$), and estimate $\ddot{a}_{1h} = a_{1h} - \hat{a}_{1h}$ (and similarly estimate an $\ddot{a}_{2q}$ proxy); then regress e_y on d_{1i}, d_{2z}, ρ, $\ddot{a}_{1h}$ and $\ddot{a}_{2q}$, predict $\hat{e}_y$, and estimate $\ddot{e}_y = e_y - \hat{e}_y$. Thus, we explain $l_{j,k}$ in terms of d_{1i} , d_{2z} , ρ, $\ddot{a}_{1h}$, $\ddot{a}_{2q}$ and $\ddot{e}_y$. It follows that when we take into consideration alternative spatial formations, i.e., different measures of d_{1i} (regional, prefectorial, or other), the procedure is performed afresh, and we obtain different ρ, $\ddot{a}_{1h}$, $\ddot{a}_{2q}$ and $\ddot{e}_y$ vectors, and –by extension– different estimated coefficients. Under the circumstances, our remarks and final conclusions concentrate only on the proxies of ρ, $\ddot{a}_{1h}$, $\ddot{a}_{2q}$ and $\ddot{e}_y$ that exhibit a very low probability of error (less than 1%) under all spatial regimes: regional, prefectorial or other.

iii. The construction of a territorial specification through the use of the error terms

Turning to the construction of a third territorial specification (in addition to the regional and prefectorial specifications), it is apparent that if such a specification is to transcend the political/administrative regional and sub-regional typologies, and best capture the factors entering the model, then the only way to identify the remaining d_{1i}'s associated with the omitted variables, is through the error terms. As (a) the employment, unemployment, and non-participation population

shares ($l_{j,k}$) and patterns are known, (b) the existence of several clusters of municipalities in the form of travel-to-work areas (TTWAs), i.e., a set of some d_{1i}'s, has been ascertained by Prodromidis (2008), and (c) the remaining factors that are not place-specific (d_{2z} , ρ, $\ddot{a}_{1h}$, $\ddot{a}_{2q}$ and $\ddot{e}_y$) are computable, we describe the steps:

First, we regress the seemingly unrelated system of the five $l_{j,k}$ types on the 52 dummies standing for the country's TTWAs that comprise of two or more municipalities. We find that a number of these regressors yield coefficients that are statistically different from zero.[12] These are retained for the next step. Then we regress each of the six $l_{j,k}$'s types on a common set of variables comprising the selected TTWA dummies and the d_{2z} , ρ, $\ddot{a}_{1h}$, $\ddot{a}_{2q}$ and $\ddot{e}_y$ vectors associated with them. Next, we project the six sets of low employment and high unemployment and non-participation residuals on the layout of a map. Thus, we are able to identify (through the residuals) self-contained municipalities and clusters of contiguous municipalities or strings of detached municipalities whose high unemployment and/or low employment and/or non-participation features are not attributed to the factors entering the regression, while sidestepping problems that may arise from topography, where distances and adjacencies on a map may be deceiving (not always accounting for the undulations of the terrain, altitude differences, actual road conditions, etc.). In particular, the presence of such spatial concentrations suggests that the building blocks, i.e., the municipalities, involved, though not forming a well-defined labor market, may share similarities on account of a distinctive terrain or climate, relative remoteness, the culture or other unobserved local characteristics linked with the omitted factors (I, O, Ω), or a combination of them. Therefore, we proceed to construct additional spatial dummy variables for each of these localities.

Secondly, in estimating the system of seemingly unrelated regressions on all (new and retained) spatial dummies and the other variables (obtained by re-running the procedure described at the end of Sub-section 2.ii), we find that in many cases the coefficients associated with neighboring self-contained areas (whether TTWAs or other municipalities) are both very similar and statistically significant at the 1% level, conceivably due to the configuration of the land, access to the transportation network, culture, etc. So we band them together, thus allowing for increased degrees of freedom in subsequent regressions.

Thirdly, in Section 3 we proceed to regress the system of seemingly unrelated regressions on (a) the final edition of spatial dummies and (b) the other variables (see the procedure described at the end of Sub-section 2.ii); and seek to identify the coefficients that are statistically significant at the 1% level.

[12] Their statistical significance is also confirmed in a second experiment of seemingly unrelated regressions involving all 667 spatial dummies (i.e., those denoting the TTWAs comprising two or more municipalities, and those pertaining to the remaining self-contained municipalities), with the Athens TTWA serving as the reference.

To the extent the new spatial dummy variables reflect/capture the spatial dimension of the factors that had not entered the regression previously (and were hidden in the residuals) they are inoculated from possible correlation with them. To put it differently, by inserting in the regression these spatial dummies, the level of correlation between the models' spatial explanatory variables and the omitted variables is now reduced or eclipsed. This implies that the coefficients associated with the above spatial explanatory variables will be unbiased and consistent estimators of the true parameters as well. Additionally, to the extent the remaining explanatory variables capturing the prevalent combinations of industry-and-profession concentrations, and the population density and gender-age-education composition proxies of the representative local households are not correlated with the omitted variables (i.e., non-labor income, culture, domestic technology, the climate, etc.), the spatial dimension of which has also been removed, they will also be unbiased and consistent estimators of the true parameters.

iv. The approach departs from the spatial autocorrelation genre

By considering the statistically significant spatial patterns of the error terms (i.e., the spatial dimension of unobserved characteristics) and of the estimates pertaining to the conventional explanatory variables, policy-makers and stakeholders may formulate better focused economic development policies. In contrast, a good number of empirical analyses concerning employment, unemployment, and other socio-economic phenomena, though acutely aware of the importance of incorporating spatial information in models, tend to estimate *spatial autocorrelation-corrected* non-spatial coefficients, but no spatial coefficients for areas exhibiting diverging/distinct profiles (e.g., Molho, 1995; Anselin et al. 2000). Yet, without clues regarding the magnitude of the impact and the statistical significance at the regional or sub-regional level, it is probably difficult to design spatially differentiated policies on the basis of the recovered results.

In all probability, the irregular/idiosyncratic terrain of Greece and the inadequacies of the transportation system render (a) the instruments employed to treat spatial association inappropriate or misleading,[13] and/or (b) the conventions adopted to justify "close neighbor" connections, open to discussion or inconsistent – perhaps more than in other places.[14] Consequently, straight-line distances between localities are deceiving: They do not always reflect the undulations of the terrain and altitude differences nor translate to actual motorway or direct and steady ferry connectivity.

[13] For instance, the contiguity weight matrix that is often employed in such circumstances may not be able to handle the existence of islands or may relate inaccurate associations/connections in the cases of (i) moderately distant continental localities that are well linked through the transportation network, and (ii) contiguous localities that are not well linked (or areal units the borders of which are drawn in a manner to appear contiguous though their "centers" for all intents and purposes are cut off from each other).

[14] Such examples include the attachment of Greece in one instance to Bulgaria (Ertur and Koch, 2006) and in another to "close neighbor" Italy (Le Gallo and Ertur, 2003); and the attachment of Sicily and Sardenia to France rather than to the Italian mainland on the basis of "nearness" (Le Gallo and Dall'erba, 2006) regardless of the two islands' multi-faceted linkages with the Italian mainland (the currency and labor market integration being only two such features).

This raises concerns with regard to the appropriateness of employing measures of contiguity and proximity as definitive elements in the weight and/or covariance matrices. Additionally, the impact of proximity between two observations in affecting the similarity (or dissimilarity) of their respective values or residuals may also depend on the distinctiveness of each locality's terrain, climate, culture of residents, other unobserved local characteristics linked with one or more omitted factors. Indeed, if this process varies across the country, it is perhaps not appropriate to assume that the correlations between the values of observations or their residuals follow the same, neatly specified (decaying) function of distance which is often employed in the weight or covariance matrix. Given that the landscape of Greece does not even remotely resemble a geographically unified and homogeneous surface with a relatively smooth distribution of data across it, it is perhaps best if the issue of spatial association were treated rather as a "black box" where the data would guide our effort. (In more unified and homogeneous countries perhaps the dummy-variable approach and spatial association-correction approach can be combined.)

v. The spatial dummies recovered via this process

The visual projection of localities that exhibit statistically significant spatial coefficients, is provided in Map 3 and some of their descriptives are provided in Table 2. We identify the following formations:

(a) Seven micro-regions: (i) the plateaus of Kastoria, (ii) Grevena, (iii) Kozani and Ptolemais in West Macedonia, and (iv) the plain of Patras in Western Greece (their respective TTWAs included); (v) the island of Zakinthos in the Ionian region and a part of Western Greece across the water; (vi) the middle portion of northern Euboea; and (vii) the TTWA of Rodos in the South Aegean.

(b) Nine strings of municipalities situated: (i) on parts of Kerkira island and along the south-western Epirotan coast; (ii) a small-island cluster in the central Ionian Sea; (iii) along the plateau of Ioannina (the homonymous TTWA included) and parts of the southern Pindos and Athamanian mountains; (iv) in the narrow valleys between the southern Pindos, Panaetolian and Timfristos mountains; (v) on the highland country further south (across the Timfristos, Oxia, Oeti, Gina and Nafpaktian mountains); (vi) along the slopes of the western Peloponnesian mountains; (vii) along the southern and central part of the eastern Aegean; (viii) on the south Strimon valley, and (ix) about Mt.Kerkini in Central Macedonia.

(c) Twenty-four municipalities or clusters of municipalities, of which: (i) eight are situated along the mountainous spine of Greece in Epiros and Thessaly; (ii) three are situated on the western Halkidiki peninsula in Central Macedonia; (iii) two on the medium-sized islands of Limnos and Hios in the North Aegean; (iv) two in western Crete; one in (v) Thrace, (vi) West Macedonia, (vii) Thessaly, (viii) Western Greece, (ix) Peloponnesos; and (x) four regard small

TABLE 2

The micro-regions, clusters of localities, and individual localities with statistically significant low population shares of employed and/or high shares of unemployed and/or non-participating male or female residents

Micro-regions	Population	Area	Number of municipalities involved (across prefectures & administrative regions)	Item in Table 5	Color in Map 3
• Patras Travel-To-Work Area (TTWA)	245 thousand	1,261 km^2	12 in Ahaia pref. (W.Greece)	29	
• Kozani-Ptolemais TTWAs & environs	128 thousand	2,509 km^2	13 in Kozani pref., 1 in Grevena pref., 1 in Florina pref. (W.Macedonia)	11	
• Rodos TTWA	109 thousand	794 km^2	8 in Dodekanese pref. (S.Aegean)	38	
• Zakithos isl., neighboring mainland	93 thousand	1,007 km^2	5 in Zakinthos pref. (Ionian Isl.), 4 in Ilis pref., 1 in Ahaia pref. (W.Greece)	27	
• Kastoria TTWA & environs	51 thousand	1,357 km^2	12 in Kastoria pref. (W.Macedonia)	9	
• Grevena TTWA & environs	20 thousand	1,023 km^2	5 in Grevena pref., 1 in Kastoria pref. (W.Macedonia)	10	
• Middle portion of northern Euboea isl.	14 thousand	586 km^2	3 in Euboea pref. (C.Greece-Euboea)	33	
Strings of localities					
• Ioannina TTWA & environs, parts of S.Pindos and Athamanian Mts.	147 thousand	358 km^2	21 in Ioannina pref., 4 in Arta pref. (Epiros), 3 in Trikala pref., 1 in Karditsa pref. (Thessaly)	18	
• South and central part of E.Aegean	68 thousand	887 km^2	8 in Hios pref., 1 in Samos pref. (N.Aegean), 4 in Dodekanese pref. (S.Aegean)	35	
• Parts of Kerkira isl. & nearby mainland	24 thousand	270 km^2	3 in Kerkira pref. (Ionian Isl.), 1 in Preveza pref. (Epiros)	25	
• Vicinity of Mt.Kerkini	11 thousand	471 km^2	2 in Kilkis pref., 1 in Serre pref. (C.Macedonia)	3	
• Vicinity of west Peloponnesian Mts.	9 thousand	462 km^2	1 in Ahaia pref., 2 in Ilis pref. (W.Greece), 1 in Arkadia pref. (Peloponnesos)	30	
• South Strimon valley	6 thousand	227 km^2	2 in Serre pref. (C.Macedonia)	4	
• Vicinity of S.Pindos, Panaetolian and Timfristos Mts.	5 thousand	606 km^2	1 in Aetolia-Akarnania pref. (W.Greece), 1 in Karditsa pref. (Thessaly), 2 in Evritania pref. (C.Greece-Euboea)	22	
• Vicinity of Timfristos, Oxia, Oeti, Gkiona and Nafpaktian Mts.	4 thousand	506 km^2	2 in Aetolia-Akarnania pref. (W.Greece), 1 in Fthiotis pref., 1 in Fokis pref. (C. Greece-Euboea)	23	
• Small-island cluster situated between Lefkas isl. and the Akarnanian coast	2 thousand	54 km^2	3 in Lefkas pref. (Ionian Isl.)	26	

Individual localities with over 1100 residents	Population	Area	Item in Table 5	Color in Map 3
• Gastouni (Ilis pref., W.Greece)	11 thousand	59 km^2	28	
• Siatista (Kozani pref., W.Macedonia)	7 thousand	159 km^2	12	
• Mastihohoria (Hios isl., N.Aegean)	4 thousand	213 km^2	36	
• Toroni (Halkidiki pref., C.Macedonia)	4 thousand	195 km^2	7	
• Panagia (Halkidiki pref., C.Macedonia)	3 thousand	205 km^2	5	
• Nea Koutali (Limnos isl., N.Aegean)	3 thousand	76 km^2	8	
• Ag. Oros (Halkidiki pref., C.Macedonia)	2 thousand	336 km^2	6	
• Trikerion (Magnesia pref., Thessaly)	2 thousand	27 km^2	34	
• Innahorion (Hania pref., Crete)	1 thousand	136 km^2	40	
• Therme (Xathi pref., Thrace)	1 thousand	90 km^2	2	

Clusters of localities with about a thousand residents or lesss	Area	Item in Table 5	Color in Map 3
• Erikousa and Othoni islands (Kerkira pref., Ionian Isl.)	15 km^2	24	
• Kalarites and Sirakon (Ioannina pref., Epiros)	70 km^2	19	

Localities with about a thousand residents or less	Area	Item in Table 5	Color in Map 3
• Aetomilitsa (Ioannina pref., Epiros)	51 km^2	15	
• Agathonision isl. (Dodekanese pref., S.Aegean)	14 km^2	37	
• Agkistrion isl. (Attiki)	1 km^2	32	
• Asi Gonia (Hania pref., Crete)	17 km^2	41	
• Aspropotamos (Trikala pref., Thessaly)	298 km^2	20	
• Dotsikon (Grevena pref., W.Macedonia)	30 km^2	14	
• Fourka (Ioannina pref., Epiros)	33 km^2	16	
• Kimolos and Donousa islands (Cyclades pref., S.Aegean)	70 km^2	39	
• Melissourgi (Arta pref., Epiros)	36 km^2	21	
• Timfi (Ioannina pref., Epiros)	18 km^2	13	
• Mesolourion (Grevena pref., W.Macedonia)	431 km^2	17	
• Tripila (Messinia pref., Peloponnesos)	70 km^2	31	

island communities in the north Ionian Sea, the Saronic gulf (assigned to Attiki), the Cyclades and the Dodekanese (in the South Aegean). A small number of these places host 2-11 thousand people. Therefore, the detection and treatment of undesirable conditions, such as high unemployment, is likely to have a positive impact in the lives of a good number of people residing there. In the smaller communities, the containment/treatment of the causes of local distress and emigration may be crucial for their survival and continuation.

We now turn to the cross-sectional analysis of the disaggregated male and female employment, unemployment, and non-participation population shares, utilizing three territorial specifications: the regional, the prefectorial, and the one listed above.

3. Econometric analysis

The econometric analysis deals with three alternative territorial versions. Each version explains the population shares of male and female economic activity observed across the country's 1034 municipalities at the time of the *2001 Census*. These are estimated as a system of five seemingly unrelated equations, with the sixth equation, male non-participation, being recovered from the other five as their complementary expression.

- The first version is based on the *regional organization* of the country. Here, we group the observations by (a) administrative region (involving 12 dummy variables), while taking into consideration, through another dummy, the possible differentiation of the very small municipalities (inhabited by 150 people or less) from the rest. In addition, we estimate the impact of (b) three types of industry-and-profession concentrations (through the use of additional dummies);[15] (c) population density and its square, (d) demographic composition represented by six explanatory variables, and (e) the qualification characteristics of the local populations represented by six explanatory variables as well. Variables (c) to (e) are net of the previously-mentioned factors (as per the procedure described at the end of Sub-section 2.ii) in order to avoid correlations among the independent variables.
- The second version is based on the *prefectorial organization* of the country. Here, we group the observations by (a) prefecture (involving 53 dummy variables);[16] and employ a set of fourteen

[15] These pertain to municipalities exhibiting a location quotient equal to or greater than "3"of (i) science and art professionals employed in the trade and repairs industry and/or (ii) extra-territorial bodies and organizations, as well as (iii) plant/machine operators and assemblers employed in manufacturing. 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.

[16] The dummy variable regarding small municipalities was dropped as it exhibited considerable correlation with the Grevena prefecture (r = 38.4%). Similarly, the sector-and-skill concentrations dummy variables (see fn.15) were dropped from the analysis as they were either associated with high employment and/or low unemployment and non-participation levels or exhibited higher levels of correlation with the spatial dummy variables compared to the previous model. In particular, the dummy variable capturing the concentration of science and art professionals employed in extra-territorial bodies and organizations exhibited an r=41.2% in connection with the Athens prefecture, the one

explanatory variables capturing the impact of (b) population density, (c) demographic composition and (d) qualification characteristics of the local populations, net of the previously mentioned factors.

- The third version is based on the spatial analysis presented in Sub-section 2.iv. Here we deal with (a) the 40 spatial formations already discussed, (b) four types of industry-and-profession concentrations (through the use of dummies); [17] and the fourteen explanatory variables employed in the previous versions aiming to capture the impact of (c) population density, (d) demographic composition and (e) the qualification characteristics of the local populations, net of the previously mentioned factors.

i. Version 1: Estimates originating from the regional organization of the country

The municipalities of Attiki serve as the reference area, and men aged 20-64 with minimal and primary school qualifications as the reference population. The estimated coefficients are given in Table 3, while the statistically significant spatial effects are also displayed on Map 1 in order to visually aid the reader.

It seems that this specification captures a modest part of the variation of the economically active and reserve workforce 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%, 59.0%, and 56.3%, respectively),[18] while the male unemployment function is associated with an R^2 = 30.3%.

In analyzing the population shares of women aged 10 years and older engaging in employed activities (column 1) we note that the intercept is estimated at 16%. This reflects the average population share of employed women observed in the baseline areas. At the same time, more than two-thirds of the remaining regional, labor concentration, population density, demographic and qualifications coefficients are statistically significant at the 1% level. In particular, the female employment shares are lower across most regions, with the exception of Attiki, Crete, and East Macedonia-Thrace; while the municipalities associated with high concentrations of science and art

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capturing the concentration of plant/machine operators and assemblers employed in manufacturing exhibited 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 Attiki prefecture.

[17] I.e., the three combinations mentioned in fn.15, 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 Hios travel-to-work area and a string of communities along the south and central part of the eastern Aegean basin and the localities exhibiting inordinately high concentrations of skilled primary-sector workers employed in agriculture and related activities.

[18] 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 14.0% 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.

TABLE 3

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

Explanatory variables (of which #2-19 are dummies)	Dependent variables: Share of employed F (1)	Share of employed M (2)	Share of unemployed F (3)	Share of unemployed M (4)	Share of others F (5)	Share of others M *Residual of functions (1)-(5)* [a]
1 Constant (reference population)	0.16 *	0.29 *	0.02 *	0.03 *	0.32 *	0.18 *
Spatial factors						
2 Attiki (reference)						
3 C.Greece-Euboea	-0.04 *	-0.02 *	-0.00	0.00	0.03 *	0.04
4 C.Macedonia	-0.01 *	-0.02 *	0.00	0.00 *	0.01	0.02
5 Crete	-0.01	-0.00	-0.00	0.00	-0.01	0.02
6 E.Macedonia-Thrace	-0.01	-0.02 *	-0.00	0.00	0.00	0.02
7 Epiros	-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 N.Aegean Islands	-0.05 *	-0.05 *	-0.01	0.00	0.03 *	0.07
10 Peloponnesos	-0.02 *	-0.02 *	-0.01 *	-0.00	0.01 *	0.04
11 S.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 W.Greece	-0.05 *	-0.03 *	0.00	0.01 *	0.03 *	0.03
14 W.Macedonia	-0.05 *	-0.04 *	0.02 *	0.01 *	0.03 *	0.03 *
15 Small municipalities: inhabited by 150 people or less	-0.01	-0.01	0.06 *	0.00	-0.06 *	0.02
Municipalities characterized by a high concentration of						
16 Science & art professionals employed in wholesale/retail trade and repairs [a]	0.05 *	0.05 *	-0.01 *	-0.01 *	-0.04 *	-0.04 *
17 Science & art professionals employed in extra-territorial organizations [a]	0.03 *	-0.01	0.00	-0.00	-0.02 *	-0.01
18 Plant/machine operators & assemblers employed in the manufacture industry [a]	-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
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-12 and k-15	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-12 and k-15	-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	1443	2270	5033	450	1327	
R^2	0.5903	0.6876	0.8296	0.3036	0.5633	

Notes:

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

Asterisks denote rejection of the hypothesis of equality to zero at the 1% margin of error. In the last column the asterisks indicate confidence for the signs of the residual function's coefficients on account of the low margins of error obtained *in all* previous regressions.

professionals employed in the wholesale/retail trade and repairs industry or extra-territorial bodies and organizations display larger population shares of employed women. Having isolated the above effects, we now turn to the (transformed) local population concentration and composition effects, and find that the share of employed women increases with population density up to the level of about 20.5 thousand people per square kilometer and decreases subsequently.[19] This suggests that the urban centers (and a modest or high, but not very high, degree of urbanization) provide increased employment opportunities to women. Additionally, measured up to the population share of men aged 20-64 (who serve as the group of reference), a marginal increment in the presence of children aged 0-4 is associated with increased female employment. Thus, it would appear that in communities with more young children, a larger portion of women engage in some form of market-oriented work in order to boost their family income. In contrast, a similar rise in the presence of children aged 5-9 dampens down female employment (conceivably on account of the time-claims associated with the expanding needs, extracurricular/social life, and the minding of the still-very-much-dependent children of that age). The corresponding coefficients in the other equations for females indicate that in this case a good number of women join the ranks of the unemployed rather than of the non-participants, which suggests that they are not (or they are no longer) easily matched with jobs. At the same time, a rise in the presence of women aged 20-64 is associated with increased female employment; a rise in the presence of folk aged 65-79 (many of whom retire) is associated with reduced female employment; and a similar rise in the population share of older senior citizens (aged 80 or older) is associated with increased female employment as many women gain employment as nurses/companions for ailing elderly people. According to the coefficients of the remaining (transformed) variables, a rise in the population share of (a) men with post-secondary and bachelor qualifications,[20] as well as (b) men with secondary school qualifications, are associated with negative effects on female employment (vis-à-vis a similar rise in the share of men possessing minimal or primary school qualifications, who serve as the group of reference); whereas a rise in the share of (c) women holding post-secondary and bachelor qualifications is associated with a positive effect on female employment. Of these results, item (c) suggests that women holding post-secondary and bachelor qualifications are probably better motivated and better-suited for the needs of their local job-markets compared to other women; while item (b) suggests that an increment in the presence of men with secondary school qualifications crowds out or discourages women from employment, more than an equivalent increase of men with lesser qualifications. As

[19] This is based on the result of the twice differentiable function with respect to the population density proxy (the value of the transformed variable estimated via the procedure described in Section 2.ii, being 16,815). The highly congested municipalities that exceed the above figure are Kallithea and Nea Smyrna (in the Athens metropolitan area), Thessaloniki and Neapolis (in the Thessaloniki metropolitan area).

[20] As this particular result is not statistically significant in the other two versions (see the end of Section 2.ii), we do not make much use of it.

we turn to the corresponding coefficients in the other equations for females across all three versions for some explanation, we note that a higher presence of men with secondary school qualifications is also associated with a negative effect on female unemployment and a positive effect on female abstention. But if the men with secondary school qualifications were in direct competition with women for particular types of jobs, would not the share of unemployed women at least inch up? It would seem that the female relatives of these men in the "typical household", feel less pressured/willing to join the job-market – if not encouraged to abstain.

The male employment regression is run on the same set of explanatory variables as its female counterpart, while preserving the reference population. The estimated coefficients are given in Table 3, column 2. Of these, the intercept is set at the population share of 29%, and more than two-thirds of the remaining coefficients are associated with high z-statistics. In particular, save the regions of Attiki, the South Aegean Islands and Crete, the male employment shares across most regions are bellow the intercept. Municipalities associated with high concentrations of science and art professionals employed in the wholesale/retail trade and repairs industry, and plant/machine operators and assemblers employed in the manufacturing sector, display higher rates of female employment compared to the rest of the country. Having isolated these effects, we find that, *ceteris paribus*, the population share of employed men increases with marginal increments in the population shares of children aged 0-4, [21] and women with post-secondary and bachelor qualifications (see fn.21). In contrast, the population share of employed men falls in the presence of higher-than-average population shares of (a) women aged 20-65, children aged 5-19, and senior citizens, i.e., nearly all gender-and-age combinations which occur at the expense of men aged 20-65, who constitute both the reference population and the bulk of the employed men; and (b) men with secondary school, post-secondary, and bachelor qualifications. The latter suggests that in municipalities possessing rather large shares of reasonably literate men (or men with average qualifications), the male portion of the population is underutilized in the regional labor market with an analogous impact on regional GDP. At first sight, it is unclear whether men with secondary school, post-secondary and bachelor qualifications (i) are not deemed economical or sufficiently qualified to be hired for the tasks needed to be performed as are the other gender-and-qualifications combinations, or (ii) are more work-averse, or (iii) are so active that they crowd out the other types of men from the job-market. However, if we turn for some explanation to the corresponding coefficients in the equations for males in all three versions, we note that the marginal increment in the population share of men with secondary and post-secondary school and bachelor qualifications is also associated with reduced male unemployment and increased male abstention. It is conceivable

[21] As this particular result is not statistically significant in the third version (see end of Section 2.ii), we do not make much use of it.

that through some unspecified process the above group of men discourages other groups of men by driving them out of employment (not in unemployment but) into retirement. On the other hand, it is simpler to assume that the said group of men is more work-averse.

The estimated coefficients of the female unemployment regression are given in Table 3, column 3. Of these, the intercept is set at the population share of 2%, and about two-thirds of the remaining coefficients are associated with high z-statistics. In particular, the female unemployment shares are lower in Epiros and Peloponnesos, and higher in West Macedonia and the very small municipalities inhabited by no more than 150 people. The municipalities associated with high concentrations of science and art professionals employed in the wholesale/retail trade and repairs industry display lower shares of female unemployment. Having isolated these effects, we find that, *ceteris paribus*, the population share of unemployed women (a) falls with marginal increments in the population shares of children aged 0-4, rises with comparable increments in the population shares of children aged 5-9, and falls again with marginal increments in the population shares of children aged 10-19.[22] Additionally, we find that the population share of unemployed women falls with similar increments in the population shares of senior citizens aged 65-79, women with post-secondary school and bachelor qualifications (fn.21 applies to both cases), and men with secondary school qualifications; and (b) rises with increments in the population shares of senior citizens aged 80 or older (see fn.21), women with minimal and primary school qualifications,[23] men with post-secondary school and bachelor qualifications,[24] men and women with postgraduate degrees (see fn.20), women aged 20-64, and women with secondary school qualifications (suggesting they are not as easily matched with jobs as women in the next tier of qualifications).

The estimated coefficients of the male unemployment regression are given in Table 3, column 4. Of these, the intercept is set at the population share of 3%. About one-half of the remaining coefficients are associated with high z-statistics. In particular, the male unemployment shares are higher along the northern and western regions of the country (Central Macedonia, West Macedonia, Epiros, Western Greece, the Ionian Islands) and the South Aegean Islands; while the municipalities associated with high concentrations of science and art professionals employed in the

[22] According to the coefficients of the other equations for females, in the first case (as the population share of infants and preschoolers increases) both female employment and non-participation expand. This suggests that new mothers either turn to acquire more resources or to spend time with their children. In the next situation (as the population share of children aged 5-9 increases) female employment declines. This suggests that a good number of women, whether due to their choirs or employer perceptions, is not easily matched with jobs. In the third occasion (as the population share of children aged 10-19 increases) female non-participation increases.

[23] As this particular result is not statistically significant in the second version (see the end of Section 2.ii), we do not make much use of it.

[24] According to the corresponding coefficients of the other equations for females in all three versions, the incident is weakly coupled with both reduced female employment and reduced female non-participation (the z-statistics of which are not very high). The overall picture conveys signs of a reduced need for income earning activity to deal with household expenses and signs of at least some financial distress that does not permit female abstention from the workforce altogether.

wholesale/retail trade and repairs industry display smaller shares of unemployed women. Having isolated these effects, we find that, *ceteris paribus*, the population share of unemployed men (a) falls with marginal increments in the population shares of children aged 5-9 (i.e., the exact opposite of the female response), senior citizens aged 65-79 (see fn.21); and (b) rises with increments in the population shares of children aged 10-19, seniors aged 80 or more (fn.20 applies to both cases), women aged 20-64 (see fn.21), women with minimal and primary school qualifications (see fn.23), as well as with secondary school qualifications (which suggests that their presence and competition in the workplace may be driving a good number of men into unemployment); as well as man and women with postgraduate degrees. The latter, may be explained in terms of (i) postgraduates driving less qualified men to unemployment, and/or (ii) a good number of postgraduate men not being suitable in terms of their chosen specialties or their asking wages by local employers, or not finding a considerable array of local jobs to their liking, or being ill-suited to start their own businesses, or being overwhelmed by the bureaucratic and other processes required for starting a business. With the exception of the former rationalization, the rest constitute a distressing set of explanations for the male holders of such qualifications and the society at large, as it suggests an inability of the economy to absorb or fully utilize the most educated segment of the male population, on whose education a great deal of time, public and private/family resources have been directed too.

The estimated coefficients of the female non-participation regression are given in Table 3, column 5. Of these, the intercept is set at the population share of 32%, and two-thirds of the remaining coefficients are associated with high z-statistics. In particular, it seems that the population share of unemployed women is higher in most regions with the exception of Central Macedonia, East Macedonia-Thrace, Attiki, Crete, and the South Aegean Islands; much lower in the very small municipalities (inhabited by no more than 150 people); and the municipalities associated with high concentrations of science and art professionals employed in the wholesale/retail trade and repairs industry or extra-territorial bodies and organizations. Having isolated these effects, we find that, *ceteris paribus*, the population share of non-participating women decreases with population density; and increases with marginal increments in the population shares of children aged 0-4 and 10-19 (see fn.22), people aged 65-79 (reflecting their retirement), men with secondary school qualifications (as discussed previously), women 20-64, and women of all educational credentials other than postgraduate degrees (presumably on account of the assumption of traditional homemaking roles by many such women).

The non-participation equation for males is estimated as the residual of the other regressions. (If regressed it yields a relatively high R^2 of 76.9%.) The recovered coefficients are given in Table 3, column 6. Of these, the intercept is set at the population share of 18%, while the values of five more coefficients (for the signs of which we may be reasonably confident on account of the high z-

statistics of their counterparts in the other five regressions) suggest that (a) Epiros, West Macedonia, and the municipalities inhabited by larger population shares of senior citizens aged 65-79 exhibit high male non-participation shares; and (b) the municipalities characterized by high concentrations of science and art professionals employed in the wholesale/retail trade and repairs industry and marginal increments in the population shares of women aged 20-64 (presumably at the expense of men) are associated with smaller population shares of non-participating men.

ii. Version 2: Estimates originating from the prefectorial organization of the country

The municipalities of the Athens prefecture serve as the reference area, and the males aged 20-64 with minimal or primary school qualifications as the reference population. The estimated coefficients are given in Table 4, while the statistically significant spatial effects are also displayed in Map 2. We note that 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 63.0% and 58.8%, respectively), while the male unemployment function displays a lower level of fitness (R^2= 42.0%).[25] However, as the new specification employs twice as many explanatory variables as the previous specification, 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.

In analyzing the population shares of women aged 10 and older engaging in employed activities (column 1), we note that the intercept is set at 20%. This reflects the average population share of employed women observed in the baseline area. At the same time, about nine-tenths of the remaining sub-regional, population density, demographic and qualifications coefficients are statistically significant at the 1% level. In particular, it seems that female employment shares are lower in all prefectures, except for the prefectures of Athens (in Attiki) and Rodopi (in Thrace). Having isolated these effects, we turn to the (transformed) local population concentration and composition effects, and find that the share of employed women increases with population density. Much like in the previous version, this suggests that urbanized areas provide women with increased employment opportunities. Additionally, measured up to a rise in the population share of men aged 20-64 (who serve as the group of reference), a marginal increment in the population share of children aged 0-4, women aged 20-64, and senior citizens aged 80 or older, is associated with increased female employment; while a similar rise in the population share of children aged 5-9, and

[25] 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 fn.18, the differences in the levels of fitness supply measures of the collective significance of population density and the other non-spatial factors.

TABLE 4

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	Attiki: Athens prefecture (reference)						
3	E.Attiki prefecture	-0.04 *	0.02 *	-0.00	0.00	0.01	0.02
4	Pireaus, Saronic coast & islands, Idra, Spetse, Kithira pref.	-0.08 *	-0.00	-0.00	0.01	0.05 *	0.03
5	W.Attiki prefecture	-0.07 *	0.01	-0.00	0.01 *	0.04 *	0.01
6	C.Greece-Euboea: Boeotia prefecture	-0.07 *	0.02 *	-0.00	0.01	0.02 *	0.02
7	Euboea & Skiros 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	C.Macedonia: Halkidiki 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	Serre 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: Hania prefecture	-0.06 *	0.00	-0.00	0.00	0.01	0.04
19	Iraklion 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	Rethimnon prefecture	-0.05 *	0.00	-0.00	0.00	0.01v	0.03
22	E.Macedonia-Thrace: Drama prefecture	-0.08 *	-0.04 *	0.01	0.02 *	0.05 *	0.05
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	Epiros: 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.: Kefallinia & Ithaki prefecture	-0.08 *	-0.03 *	0.00	0.01	0.04 *	0.06
32	Kerkira & Paxi prefecture	-0.06 *	-0.03 *	0.01	0.02 *	0.03 *	0.04
33	Lefkas & 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	N.Aegean Isl.: Hios & Psara, Inouse 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	Arkadia prefecture	-0.10 *	-0.05 *	-0.01 *	-0.00	0.06 *	0.10
40	Korinthia prefecture	-0.04 *	0.01	-0.01	-0.00	0.01	0.02
41	Lakonia prefecture	-0.05 *	-0.01	-0.01 *	-0.00	0.02	0.06
42	Messenia prefecture	-0.07 *	-0.02 *	-0.01	0.00	0.03 *	0.06
43	S.Aegean Isl.: The Cyclades	-0.08 *	-0.01	-0.01	-0.00	0.04 *	0.05
44	The Dodekanese	-0.07 *	0.02 *	0.01 *	0.02 *	-0.00	0.02

Note:

Asterisks denote rejection of the hypothesis of equality to zero at the 1% margin of error. In the last column the asterisks indicate confidence for the signs of the residual function's coefficients on account of the low margins of error obtained *in all* previous regressions.

TABLE 4 (continued)

	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*
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
48	Trikala prefecture	-0.08 *	-0.02 *	-0.01	0.01	0.05 *	0.04
49	W.Greece: Ahaia prefecture	-0.08 *	-0.03 *	0.01	0.02 *	0.03 *	0.05
50	Aetolia & Akarnania 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	W.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-12 and k-15	0.06	-0.01	0.57 *	0.25 *	0.36 *	-1.22
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-12 and k-15	-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	1729	2454	4678	750	1476	
	R^2	0.6309	0.7039	0.819	0.4206	0.5889	

senior citizens aged 65-79 dampens down female employment. At the same time, according to the coefficients of the remaining (transformed) variables, a comparable rise in the population share of men with secondary school qualifications is associated with a negative effect on female employment (vis-à-vis a similar rise in the share of men possessing minimal or primary school qualifications, who serve as the group of reference), whereas a rise in the share of women with post-secondary school and bachelor qualifications is associated with a positive effect on female employment.

The male employment regression is run on the same set of explanatory variables as its female counterpart, while preserving the reference population. The estimated coefficients are given in Table 4, column 2. Of these, the intercept is set at the population share of 28%, and more than half of the remaining coefficients are associated with high z-statistics. In particular, it seems that the

population share of employed men is higher in East Attiki and neighboring Boeotia; and lower (a) in most of the western part of the country, which includes the prefectures of Arkadia, Messinia (in Peloponnesos), Ilis, Ahaia, Aetolia-Akarnania (i.e., all in Western Greece), Fokis, Evritania (in Central Greece), Kefallinia, Lefkas, Kerkira (in the Ionian Islands), Preveza, Arta, Ioannina (in Epiros), Trikala, Karditsa (in Thessaly), Grevena, Kozani, Kastoria (in Western Macedonia); (b) in a portion of the northern part of the county (along the western Greek-Bulgarian border) comprising the prefectures of Kilkis, Serre (in Central Macedonia), Drama (in East Macedonia); and (c) the eastern part of the country comprising of the prefectures of Evros (in Thrace), Lesvos, Hios, Samos (i.e., all of the North Aegean), the Dodekanese (in the South Aegean), and Euboea. Having isolated these effects, we find that the population share of employed men increases with a marginal increment in the population share of children aged 0-4, and women with post-secondary and bachelor qualifications (fn.21 applies to both cases). In contrast, as in the previous version, the population share of employed men declines with marginal increments in the population shares of nearly all types of gender-and-age combinations, such as children aged 5-19, women aged 20-65, and senior citizens (vis-à-vis men aged 20-65, who constitute the reference population), and men with secondary school, post-secondary school, and bachelor qualifications (vis-à-vis men with lower qualifications).

The estimated coefficients of the female unemployment are given in Table 4, column 3. Of these, the intercept is set at the population share of 2%, and one-fifth of the remaining coefficients are associated with high z-statistics. In particular, it seems that the population share of unemployed women is lower in Arkadia and Lakonia (in Peloponnesos) and higher in the prefectures of Kastoria (in West Macedonia) and the Dodekanese (in the South Aegean). Having isolated these effects, we also find that the population share of unemployed women (a) falls with marginal increments in the population shares of children aged 0-4, children aged 10-19, and men with secondary school qualifications (as in the previous version); senior citizens aged 65-79 and women with post-secondary school and bachelor qualifications (fn.21 applies to each of the two cases); and (b) rises with similar increments in the population shares of children aged 5-9, women with secondary school qualifications, and men with post-secondary school and bachelor qualifications (as in the previous version); senior citizens aged 80 and older (see fn.21), and women aged 20-64.

The estimated coefficients of the male unemployment regression are given in Table 4, column 4. Of these, the intercept is set at the population share of 2%, and about two-fifths of the remaining coefficients are associated with high z-statistics. In particular, the population share of unemployed men is higher (a) in most of the western part of the country, which includes the prefectures of Ilis, Ahaia, Aetolia-Akarnania (i.e., all of Western Greece), Arta, Preveza, Ioannina (in Epiros), Karditsa (in Thessaly), Kastoria, Kozani, Florina (in Western Macedonia), Zakinthos, Kerkira (in the Ionian

Islands); (b) in a portion of the northern part of the country comprising the prefectures of Imathia, Thessaloniki, Kilkis, Serre (in Central Macedonia), Drama (in East Macedonia); (c) in the central Aegean consisting of the prefectures of Hios and Euboea; (d) in West Attiki; and (e) in the Dodekanese (in the South Aegean). Having isolated these effects, we also find that, much like in the previous version, the population share of unemployed men (a) falls with the marginal increment in the population shares of children aged 5-9, and senior citizens aged 65-79 (see fn.21); and (b) increases with similar increments in the population shares of women aged 20-64 (see fn.21), women with secondary school qualifications, and men and women with postgraduate degrees.

The estimated coefficients of the female non-participation regression are given in Table 4, column 5. Of these, the intercept is set at the population share of 30%, and three-fifths of the remaining coefficients are associated with high z-statistics. In particular, it seems that the population share of non-participating women is higher along a belt that spans the country from north-west to south-west, the center and the Aegean, up to the western half of the Greek-Bulgarian border, including the prefectures of Florina, Kozani, Grevena (in West Macedonia), Ioannina, Thesprotia, Preveza, Arta (i.e., all of Epiros), Kerkira, Lefkas, Kefallinia (in the Ionian Islands), Messinia, Arkadia (in Peloponnesos), Ilis, Ahaia, Aetolia-Akarnania (i.e., all of Western Greece), Karditsa, Trikala, Larisa, Magnesia (i.e., all of Thessaly), Euboea, Fthiotis, Evritania, Fokis, Boeotia (i.e., all of Central Greece-Euboea), West Attiki, Piraeus (in Attiki), the Cyclades (in the South Aegean), Samos, Hios, Lesvos (i.e., all of the North Aegean), Kavala, Drama (in East Macedonia), Serre, Halkidiki (in Central Macedonia). Having isolated these effects, we find that, much like in the previous version, the population share of non-participating women increases with marginal increments in the population shares of children aged 0-4, children aged 10-19, women aged 20-64, senior citizens aged 65-79, men with secondary school qualifications, and women of all types of qualifications other than postgraduate degrees.

The male non-participation equation is estimated as the residual of the other regressions. (If regressed it yields a relatively high R^2 of 78.1%.) The recovered coefficients are given in Table 4, column 6. Of these, the intercept is set at the population share of 17%, while the values of two more coefficients (for the signs of which we may be reasonably confident on account of the high z-statistics of their counterparts in the other five regressions, much like in the previous version) suggest that (a) a marginal increment in the population shares of senior citizens aged 65-79 is associated with a rise in the population share of non-participating men, and (b) a similar increment in the population shares of women aged 20-64 is associated with a fall in the population share of non-participating men.

iii. Version 3: Estimates originating from the micro-regional and distinct community characteristics

This version is based on the spatial dummies mentioned in Sub-section 2.v, with the rest of the country serving as the reference area, and the men aged 20-64 with minimal or primary school qualifications as the reference population. The relevant statistics and estimated coefficients are given in Table 5, while the statistically significant spatial effects are also displayed in Map 3 for illustrative purposes. It seems that this specification captures a considerable portion of the variation observed in the economically active and reserve workforce 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%).[26] As this version employs fewer explanatory variables than the previous one, and all R^2 statistics indicate higher levels of statistical fitness than those obtained previously, it appears that, on statistical grounds, it is more suitable.

iv. Analyzing the population shares of women aged 10 years and older in employment

The estimated coefficients of the female employment regression are given in Table 5, column 1. Of these, the intercept is set at the population share of 14%, which reflects the average population share of employed women observed in the baseline areas (i.e., the municipalities that are not associated with the spatial and industry-and-profession combination dummies and the other factors listed in the equation). At the same time, another 37 spatial, labor concentration, population density, demographic and qualifications coefficients that are statistically significant at the 1% level provide evidence of considerable heterogeneity.

More specifically, according to the spatial effects, the population share of employed women is smaller across: (a) A large tract of West Macedonian and Epirotan territory and a small portion of Thessaly, involving parts of the northern Pindos mountain-range and the plateaus of Kastoria, Grevena, Kozani, Ptolemais, and Ioannina, east and west of northern Pindos (including the municipalities of Dotsikon and Aetomilitsa); and the two strings of municipalities running across the southern Pindos-Panaetolian-Timfristos mountains that separate Epiros from Thessaly, and the Timfristos-Oxia-Oeti-Nafpaktian mountains that separate Thessaly from Central and Western Greece and Central from Western Greece. (b) The plain of Patras and the string of municipalities situated on the western Peloponnesian highlands. (c) The string of island communities in the south and central eastern Aegean (including Agathonision island). (d) The slice of northern Euboea. (e)

[26] 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 18 and 25), the differences in the levels of fitness provide measures of the collective significance of population density and the other non-spatial factors.

TABLE 5

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)* [a]
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 in Thrace	-0.01	-0.00	-0.01	-0.00	0.07 *	-0.04
3	String of localities about Mt.Kerkini in C.Macedonia (C.M.)	-0.03	-0.07 *	0.02 *	0.02 *	0.01	0.04
4	String of localities in the south Strimon valley in C.M.	-0.03	-0.04 *	0.01	0.02 *	0.03	0.01
5	Municipality of Panagia in the Halkidiki peninsula in C.M.	-0.06 *	-0.03	-0.01	-0.00	0.07 *	0.03
6	Monastic community of Ag. Oros in the Halkidiki peninsula	-0.14 *	-0.08 *	-0.02	-0.02	-0.33 *	0.60
7	Municipality of Toroni in the Halkidiki peninsula in C.M.	-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, including the Kastoria TTWA	-0.02 *	-0.03 *	0.11 *	0.02 *	-0.06 *	-0.03 *
10	Sub-region of W.Macedonia west of Mt.Vourinos, including the Grevena TTWA	-0.07 *	-0.11 *	0.05 *	0.03 *	0.06 *	0.05 *
11	Sub-region of W.Macedonia east of Mt.Askion, including the Kozani and Ptolemais TTWAs	-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 Epirotan 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 Epirotan side of the northern Pindos mountain-range	0.03	-0.07 *	0.00	0.03	0.02	-0.00
17	Municipality of Timfi on the Epirotan side of the northern Pindos mountain-range	-0.05	-0.07 *	0.02	0.01	-0.02	0.11
18	String of Epirotan municipalities west of the northern Pindos mountains (including the Ioannina TTWA), and Epirotan 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 & Sirakon on the Epirotan 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 Epirotan side of the Athamanian mountains	-0.08 *	0.01	-0.01	0.01	0.01	0.05
22	String of municipalities between the S.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	Cluster of Erikoussa and Othoni islands, northwest of Kerkira isl.	-0.07 *	-0.10 *	-0.01	0.02	0.08 *	0.08

Notes:

Asterisks denote rejection of the hypothesis of equality to zero at the 1% margin of error. In the last column the asterisks indicate confidence for the signs of the residual function's coefficients on account of the low margins of error obtained *in all* previous regressions.

TABLE 5 (continued)

Dependent variables:	Share of employed		Share of unemployed		Share of others	
	F	M	F	M	F	M
Explanatory variables (of which #2-45 are dummies)	(1)	(2)	(3)	(4)	(5)	*Residual*
25 String of localities involving parts of Kerkira isl. (Ionian Isl.) and the southern Epirotan coast	0.01	-0.01	0.02 *	0.03 *	-0.03	-0.03
26 Cluster of small islands situated between the Akarnanian coast and Lefkas isl. (Ionian Isl.)	-0.10 *	-0.12 *	-0.01	-0.00	0.10 *	0.13
27 Micro-region comprising Zakinthos 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 TTWA in W.Greece	-0.02 *	-0.01	0.01 *	0.02 *	-0.01	-0.00
30 String of municipalities along the west Peloponnesian highlands	-0.08 *	-0.10 *	-0.00	0.00	0.08 *	0.10
31 Municipality of Tripila in south-western Peloponnesos	-0.06	-0.07 *	0.01	0.01	0.02	0.08
Localities in the central part of the country:						
32 Agkistrion isl. in Attiki	-0.08 *	-0.02	-0.01	0.00	0.08 *	0.02
33 North-central sub-region of 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 String of localities along the south and central part of the E.Aegean, including the Hios TTWA, the islands of Inouse, Psara, Fourni Korseon, Lipsi, Kalimnos, Nisiros, and the northern part of Karpathos isl.	-0.05 *	-0.04 *	-0.01	0.01 *	0.06 *	0.03
36 Municipality of Mastihohoria on Hios isl. (N.Aegean)	-0.04	-0.10 *	-0.00	-0.01	-0.01	0.16
37 Island of Agathonision in the S.Aegean	-0.07 *	0.06 *	-0.01	0.02	-0.04	0.03
38 Rodos TTWA 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 [a]	0.06 *	0.05 *	-0.00	-0.01 *	-0.05 *	-0.04
44 Science & art professionals employed in extra-territorial organizations [a]	0.05 *	0.01	-0.00	-0.00	-0.03 *	-0.03
45 Plant/machine operators & assemblers employed in the manufacture industry [a]	-0.00	0.03 *	-0.00	0.00	-0.01	-0.02
46 Skilled primary-sector workers employed in agriculture, husbandry, hunting, and forestry [a]	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 2-48)						
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)						
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

Note:

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

TABLE 5 (continued)

	Dependent variables:	Share of employed		Share of unemployed		Share of others	
		F	M	F	M	F	M
	Explanatory variables	(1)	(2)	(3)	(4)	(5)	*Residual*
	Formal qualifications (net of effects 2-55)						
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-12, k-15	-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-12 and k-15	-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	2263	4152	6143	1008	2113	
	R^2	0.6942	0.8009	0.8560	0.4939	0.6725	

Two small island clusters in the north and central Ionian Sea, the islands of Kimolos and Donousa in the Cyclades, the island of Agkistrion in Attiki, the municipalities of Trikerion in Thessaly, Nea Koutali on the island of Limnos, Panagia in Central Macedonia, and the all-male monastic community of Ag.Oros in Central Macedonia, where –as probably expected– the respective coefficient (-14%) offsets the constant.

In contrast, a few localities that attract our interest on account of their excessively large population shares of unemployed men and women (in Sub-sections 3.vi-vii), exhibit higher-than-average population shares of employed women. These are the TTWA of Rodos in the South Aegean, and the cluster of Kalarites and Sirakon in Epiros.

In considering the effects associated with the idiosyncrasies and specializations of the local workforces, we notice that the localities associated with high concentrations of science and art professionals employed in the wholesale/retail trade and repairs industry, and extra-territorial bodies and organizations display large population shares of employed women.

Having isolated the above effects, we now turn to the (transformed) local population concentration and composition effects, and find that the population share of employed women increases with population density up to the level of about 20.5 thousand people per square kilometer and decreases subsequently [27] In short, this suggests that urban centers provide increased employment opportunities to women. Additionally, measured up to a rise in the population share of men aged 20-64 (who serve as the group of reference), a rise in the population-share of children aged 0-4 and 10-19 (see fn.20) is associated with increased female employment. Thus, as we have

[27] This is based on the result of the twice differentiable function with respect to the population density proxy (the actual value of the transformed variable being 16,807, estimated via the procedure described in Sub-section 2.ii). As in the regional version (see fn.19) the highly congested municipalities that exceed the above figure are Kallithea and Nea Smyrna (in the Athens metropolitan area), Thessaloniki and Neapolis (in the Thessaloniki metropolitan area).

already seen, it would appear that in communities with relatively more children of such ages (especially pre-schoolers), a larger portion of women engages in some form of market-oriented work in order to boost their family income. In contrast, a similar rise in the presence of children aged 5-9 dampens down female employment, conceivably on account of the time-claims associated with the expanding needs, extracurricular/social life, and the minding of these still-very-much-dependent children of that age. At the same time, a comparable rise in the population share of women aged 20-64 appears to be associated with increased female employment; while a rise in the presence of folk aged 65-79 (many of whom are retired) is associated with reduced female employment; and a similar rise in the local share of older senior citizens (aged 80 or older) is associated with increased female employment (as many women gain employment as nurses/companions for ailing elderly people).

According to the coefficients of the remaining (transformed) variables, a higher-than-average population share of women holding post-secondary and bachelor qualifications is associated with a positive effect on female employment. This suggests that compared to other women, women with the above qualifications are probably both better motivated and considered as better-suited for the needs of their local job-markets. On the other hand, a larger-than-average population share of men and women possessing postgraduate qualifications (see fn.20), and men with secondary school qualifications, is associated with a negative effect on female employment. As we have seen in Sub-section 3.i, when the latter of these results is considered in conjunction with the negative effect of the corresponding coefficient in the female unemployment function and the positive effect of the corresponding coefficient of the female abstention function, it suggests that women (presumably the spouses and female relatives of these men) may either face reduced pressures or have a reduced desire to join the job-market.

v. Analyzing the population shares of men aged 10 years and older in employment

The male employment regression is run on the same set of explanatory variables as its female counterpart, while preserving the reference population, i.e., men aged 20-64 with minimal or primary school qualifications, and municipalities not associated with the spatial and industry-and-profession combination dummies considered in the model. The estimated coefficients are given in Table 5, column 2. Of these, the intercept is set at the population share of 27%, while a set of 44 additional coefficients associated with high z-statistics provides evidence of considerable heterogeneity.

According to the spatial effects, the population shares of employed men are smaller across: (a) A large tract of West Macedonian and Epirotan territory and a small portion of Thessaly, involving parts of the northern Pindos mountain-range and the plateaus of Kastoria, Grevena, Kozani, Ptolemais, and Ioannina, east and west of the northern Pindos mountain-range (including the

municipalities of Dotsikon, Mesolourion, Aetomilitsa, Fourka, Timfi); and the two strings of municipalities running across the mountainous terrain that separates Epiros from Thessaly, Thessaly from Central and Western Greece and also Central from Western Greece. (b) The string of island communities in the eastern Aegean (including the municipality of Mastihohoria). (c) The slice of northern Euboea. (d) The municipality of Gastouni in Western Greece; the string of Central Macedonian municipalities around Mt.Kerkini; the string of municipalities running across the western Peloponnesian highlands; the municipality of Tripila on the south-western side of the peninsula, two small island clusters in the north and central Ionian Sea, the islands of Kimolos and Donousa in the Cyclades, the municipalities of Innahorion in Crete, Trikerion in Thessaly, Nea Koutali on the island of Limnos, and the monastic community of Ag.Oros in Central Macedonia.

In contrast, a number of localities with large population shares of unemployed men and women (see Sub-sections 3.vi-vii below), and inordinately small population shares of employed women (see Sub-section 3.iv), also exhibit larger-than-average population shares of employed men. These are the TTWA of Rodos, the micro-region of Zakinthos island and a neighboring part of Western Greece, a small cluster situated by the Athamanian mountains (comprising Kalarites, Sirakon, Aspropotamos), and the island of Agathonision in the Dodekanese.

In considering the effects stemming from industry-and-profession concentrations and the relative specialization of the local labor forces, we find that municipalities involving high proportions of science and art professionals in the wholesale/retail trade and repairs industry and plant/machine operators and assemblers in the manufacturing sector are associated with larger population shares of employed men. At the same time, the municipalities exhibiting a high proportion of skilled primary-sector workers employed in agriculture, husbandry, hunting, and forestry, which interest us on account of the dampening effect on male and (especially) female unemployment (see Sub-sections 3.vi-vii), are associated with smaller population shares of employed men.

Upon isolating the above effects, we find that, *ceteris paribus*, the population share of employed men increases in municipalities with large population density. This suggests that, in addition to a positive effect on female employment, urbanization may have a positive effect on male employment as well. At the same time, the population share of employed men decreases with marginal increments in the population shares of (a) all gender-and-age groups other than men aged 20-65 (who constitute the reference population), (b) women with secondary school and lower qualifications (whose higher-than-average presence presupposes a fall in the population share of men, see fn.20), and (c) men with secondary school, post-secondary, and bachelor qualifications. The latter result, when considered in conjunction with the negative effect on the male

unemployment function and the positive effect on the male abstention function, seems to indicate that the particular group is more work-averse than men with higher or lower qualifications.

vi. Analyzing the population shares of women aged 10 years and older in unemployment

The female unemployment regression is run on the same set of explanatory variables used in the previous equations and maintains the same reference population. The estimated coefficients are given in Table 5, column 3. Of these, the intercept is set at the population share of 2%, while a set of 19 coefficients that are statistically significant at the 1% level, provides evidence of further diversity.

According to the spatial effects, the population shares of unemployed women are larger across: (a) The island of Zakinthos and the neighboring part of the mainland, and the plain of Patras in Western Greece. (b) The TTWA of Rodos in the South Aegean. (c) The plateaus of Kastoria and Grevena on the West Macedonian side of the northern Pindos mountain-range. (d) Parts of the island of Kerkira and the southern coast of Epiros; the string of Central Macedonian municipalities around Mt.Kerkini; the municipality of Asi Gonia in Crete; and the cluster situated by the Athamanian mountains (comprising Kalarites, Sirakon, Aspropotamos).

Upon consideration of the effects stemming from industry-and-profession concentrations, we find that localities associated with a high proportion of skilled primary-sector workers employed in agriculture and related activities display smaller shares of female unemployment.

Having isolated the above effects, we find that, *ceteris paribus*, the population share of unemployed women falls with the marginal increment in the population shares of children aged 0-4 and 10-19 years old, and increases with similar increments in the population shares of children 5-9 and women aged 20-64, as well as women with minimal and primary school qualifications (see fn.23), and secondary school qualifications. The latter point suggests that women with higher qualifications may be more settled in the job-market. At the same time, a rise in the population share of men with secondary school qualifications is associated with a negative effect on female unemployment. This finding, in combination with the corresponding results from the other regressions (e.g., end of Sub-section 3.iv), suggests that the group of men under consideration, unlike the other groups with higher or lower qualifications, adversely affects female participation. Additionally, a rise in the population share of men with post-secondary school and bachelor qualifications is associated with a positive effect on female unemployment (see fn.24).

vii. Analyzing the population shares of men aged 10 years and older in unemployment

The male employment regression is run on the same explanatory variables employed in the previous equations and maintains the same reference population. The estimated coefficients are given in Table 5, column 4. Of these, the intercept is set at the population share of 3%, while a set of 30

statistically significant coefficients at the 1% margin of error, provides evidence of considerable diversity.

According to the spatial effects, the population shares of unemployed men are larger across: (a) A large area of West Macedonian and Epirotan territory and a small portion of Thessaly, involving parts of the northern Pindos mountain-range and the plateaus of Kastoria, Grevena, Kozani, Ptolemais, and Ioannina, east and west of it (including the municipalities of Fourka, Siatista), stretching to the southern Pindos and Athamanian mountains (including Kalarites, Sirakon, Aspropotamos), and the mountainous terrain separating Thessaly from Central and Western Greece. (b) The island of Zakinthos and the neighboring part of the mainland (including the municipality of Gastouni), and the plain of Patras in Western Greece. (c) The TTWA of Rodos. (d) The string of island communities in the eastern Aegean. (e) The string of municipalities comprising parts of the island of Kerkira and the south-western coast of Epiros; the slice of northern Euboea; the string of Central Macedonian municipalities about Mt.Kerkini, and along the southern Strimon valley, and the municipality of Toroni in the Halkidiki peninsula.

In contrast, a number of municipalities with small population shares of employed men and women (Dotsikon and Aetomilitsa on the northern Pindos mountain-range, and the Cycladic islands of Kimolos and Donousa), exhibit smaller-than-average population shares of unemployed men.

In considering the effects stemming from industry-and-profession concentrations, we find that localities associated with high concentrations of science and art professionals employed in the wholesale/retail trade and repairs industry, and skilled primary-sector workers employed in agriculture and related activities display smaller population shares of unemployed men.

Finally, upon isolating the above effects, we find that a rise in the population shares of children aged 5-9 years old and men with post-secondary and bachelor qualifications (see fn.20) are associated with lower population shares of unemployed men; while a rise in the population shares of children aged 10-19, women with minimal and primary school (fn.23 applies to both of these cases), as well as secondary school qualifications, and men and women with postgraduate qualifications, are associated with larger population shares of unemployed men. The two latter outcomes suggest that women with secondary school qualifications and men and women with postgraduate qualification crowd out of the job market men possessing minimal-to-bachelor level qualifications and/or that there exists a higher level of unemployment among men with postgraduate qualifications.

viii) Analyzing the population shares of women aged 10 years and older outside the workforce

The female non-participation regression is run on the same explanatory variables as the previous equations and maintains the same reference population. The estimated coefficients are given in Table 5, column 5. Of these, the intercept is set at the population share of 33%, while a set of 38

coefficients that are statistically significant at the 1% margin of error, provide evidence of considerable heterogeneity.

According to the spatial effects, the population shares of non-participating women are larger across: (a) A large tract of West Macedonian and Epirotan territory and a small portion of Thessaly, involving parts of the northern Pindos mountain-range and the plateaus of Kozani, Ptolemais, Grevena and Ioannina, east and west of northern Pindos (including the adjacent municipalities of Dotsikon, Mesolourion); and the two strings of municipalities running across the mountainous terrain that separates Epiros from Thessaly, Thessaly from Central and Western Greece and Central from Western Greece. (b) The string of island communities in the eastern Aegean. (c) The slice of northern Euboea; the string of municipalities running along the western Peloponnesian highlands; two small island clusters in the north and central Ionian Sea; the islands of Kimolos and Donousa in the Cyclades, the island of Agkistrion in Attiki, the municipalities of Trikerion in Thessaly, Panagia in Central Macedonia, and Therme in Thrace.

In contrast, a number of localities exhibit lower-than-average population shares of abstaining women. These are characterized by (a) large population shares of unemployed men and women (namely, the TTWA of Rodos, the island of Zakinthos and the neighboring part of Western Greece, and a small cluster situated by the Athamanian mountains consisting of the municipalities of Kalarites, Sirakon and Aspropotamos; (b) small population shares of employed men and women (Aetomilitsa and the monastic community of Ag.Oros); and (c) small population shares of employed men and women and large shares of unemployed men and women (the plateau of Kastoria). As expected, in Ag.Oros the share of abstaining women is practically null as the respective coefficient (-33%) offsets the constant.

In considering the effects stemming from industry-and-profession concentrations, we find that localities associated with high proportions of science and art professionals employed in the wholesale/retail trade and repairs industry and extra-territorial bodies and organizations display smaller population shares of abstaining women.

Having isolated the above effects, we find that, *ceteris paribus*, the population share of abstaining women (a) decreases with population density up to the level of about 20.3 thousand people per square kilometer and increases subsequently;[28] and (b) increases with the marginal increments of population shares of senior citizens aged 80 and older, men and women with postgraduate qualifications (fn.20 applies to each of these three cases), children aged 0-4 and 10-19 (whose presence seems to stimulate female involvement in homemaking choirs), women aged 20-

[28] This is based on the result of the twice differentiable function with respect to the population density proxy (the actual value of the transformed variable estimated via the procedure described in Section 2.ii being 15,846). The highly congested municipalities that exceed the above figure are Kallithea and Nea Smyrna (in the Athens metropolitan area), Thessaloniki and Neapolis (in the Thessaloniki metropolitan area). See also footnotes 19 and 27.

64 (which include many mothers and female students), senior citizens aged 65-79 years, women of all educational qualifications (including many homemakers), men with secondary school qualifications (whose presence has already been linked in Sub-section 3.iv with non-participation tendencies).

ix. Analyzing the population shares of men aged 10 years and older outside the workforce

The non-participation equation for males is estimated as the residual of the other regressions. (If regressed it yields a relatively high R^2 equal to 86.3%.) The recovered coefficients are given in Table 5, column 6. Of these, the intercept is set at the population share of 20%, while the values of five spatial coefficients for the signs of which we may be reasonably confident on account of the high z-statistics of their counterparts in the other five regressions provide evidence of (at least) modest diversity.

Thus, larger-than-average population shares of non-participating men may be found in the West Macedonian sub-region of the Grevena plateau. At the same time, smaller-than-average shares are found in the neighboring Kastoria plateau and a number of areas with inordinately large population shares of unemployed men and women (such as the TTWA of Rodos and the mountainous cluster of Kalarites and Sirakon).

4. Implications for policy intervention

i. Spatial effects and territorial development policy discussion

The visual display in Maps 1-3 of the spatial effects born by the three territorial versions of the model corroborates the concerns regarding the issues of data collection and analysis at the aggregate and disaggregated levels which we raised at the outset of the paper. For instance, in relation to the findings from the first set of regressions (Sub-section 3.i), West Macedonia[29] appears to be an obvious candidate for economic development intervention, for 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 most of the country. Yet, according to the second set of regressions (Sub-section 3.ii), only one of the West Macedonian prefectures, that of Kastoria,[30] 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 be significant). The other West Macedonian prefectures exhibit different combinations of male unemployment, male or female employment, along with female non-participation. Our analysis at an even more disaggregated level (Sub-sections 3.iii-ix) reveals that the combination of

[29] It has an area of 9,530 square kilometers, a population of 295 thousand, and is indicated in Map 1 with black.
[30] It has an area of 1,705 square kilometers, a population of 54 thousand, and is indicated in Map 2 with black.

low male and female employment and high male and female unemployment is encountered not only in the plateau of Kastoria but also in the plateau of Grevena, 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.[31] The plateaus of Kozani and Ptolemais [32] 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 reminds the profile of the Kozani prefecture in the previous specification. At the same time, the neighboring municipalities of Dotsikon and Mesolourion exhibit low population shares of employed men and high shares of non-participation women,[33] Siatista exhibits a high population share of unemployed men, while the other parts of West Macedonia exhibit different combinations of economic participation.

Obviously, depending on the level of aggregation, the 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 drawn at higher levels of territorial aggregation, such as the NUTS level 2 or 3 regions, then it is very likely that "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. 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 county or region. 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 neighboring townships that belong to different counties or administrative regions, and/or (b) across clusters of localities that may be far apart from each other and yet share similar characteristics.

We turn to the findings regarding the communities inhabited by populations that seem to rely on relatively small population shares of employed people and rather large shares of unemployed people, the patterns of which seem to be spatially related. By considering their similarities and differences we will try to outline some basic aspects of the remedial spatially-specific interventions. We focus

[31] Together these areas host 97% and 60% of the residents in the Kastoria and Grevena prefectures, respectively.
[32] These host 81%, 7% and 2% of the residents in the Kozani, Grevena and Florina prefectures, respectively.
[33] Mesolourion also exhibits low population shares of employed women and unemployed men.

on the municipalities or groups of municipalities that are inhabited by nine thousand or more people. These are:

(a) The plateau of Ioannina and a string of municipalities situated along the western slopes of the northern Pindos mountains, as well as the Athamanian and southern Pindos mountains. Their inhabitants exhibit smaller-than-average population shares of employed men and women (by 5%), along with larger-than-average population shares of unemployed men (by 1%), and abstaining women (by 5%).

(b) The plateaus of Kozani and Ptolemais. Their inhabitants exhibit smaller-than-average population shares of employed men and women (by 3% and 5%, respectively), along with larger-than-average population shares of unemployed men (by 1%) and abstaining women (by 5%).

(c) The string of island communities in the eastern Aegean. Their inhabitants exhibit smaller-than-average population shares of employed men and women (by 4% and 5%, respectively), along with larger-than-average population shares of unemployed men (by 1%) and abstaining women (by 6%).

(d) The plateau of Grevena. Its inhabitants exhibit smaller-than-average population shares of employed men and women (by 11% and 7%, respectively), along with larger-than-average population shares of unemployed men and women (by 3% and 5%, respectively) and abstaining men and women (by 5% and 6%, respectively).

(e) The slice of northern Euboea. Its inhabitants exhibit smaller-than-average population shares of employed men and women (by 6% and 5%, respectively) along with larger-than-average population shares of unemployed men (by 3%) and abstaining women (by 5%).

We note that in the areas of cases (a)-(c), the population shares of unemployed men are 1-2 percentage points higher than in the rest of Greece, while in the less populous areas the population shares of unemployed men are 3 percentage points above the average, and in the plateau of Grevena the population share of unemployed women is 5 percentage points above the average. In all five cases the population shares of abstaining women are quite large, conceivably including several discouraged job-seekers and/or people who might consider entering the job market when wage prospects and other factors improved. Thus, it would also be sensible if the attempts aiming to boost local employment were designed to unfold further in places where the initial creation of jobs attracted such a number of non-participants that the reduction in the population share of unemployed residents was deemed unsatisfactory. Furthermore, in the case of (e) and the pockets of (b) that are detached or remote, the policy might be further facilitated by road-construction/improvements binding the areas in question to wider labor markets, hence improving the residents' access to jobs in their immediate vicinity.

(f) The TTWA of Patras. Its inhabitants exhibit larger-than-average population shares of unemployed men and women (by 2% and 1%, respectively) and smaller-than-average population shares of employed women (by 2%).

(g) The plateau of Kastoria. Its inhabitants exhibit larger-than-average population shares of unemployed men and women (by 2% and 11%, respectively), and smaller-than-average population shares of employed men and women (by 3% and 2%, respectively) and abstaining men and women (by 3% and 6%, respectively).

(h) The string of peripheral municipalities on the island of Kerkira and the south-western coast of Epiros. Its inhabitants exhibit larger-than-average population shares of unemployed men and women (by 3% and 2%, respectively).

(i) The municipality of Gastouni in Western Greece. Its inhabitants exhibit a larger-than-average population share of unemployed men (by 4%) and a smaller-than-average population share of employed men (by 5%).

(j) The string of municipalities near Mt.Kerkini in Central Macedonia. Its inhabitants exhibit larger-than-average population shares of unemployed men and women (by 2%), and a smaller-than-average population share of employed men (by 7%).

We note that despite small differentiations in relative employment and unemployment levels, in all areas the population shares of abstaining male and female residents are quite close to those observed in the rest of Greece or [in the case under (g)] below the national average. As a result, compared to the previous set of cases, the attempts to reduce unemployment may be less likely to draw inordinate numbers of former/discouraged job-seeking residents into the local workforces. Finally, the siphoning of unemployed women and men into local employment will probably drive the respective employment shares closer to or above the national average.

(k) The TTWA of Rodos. Its inhabitants exhibit larger-than-average population shares of employed men and women (by 3% and 2%, respectively) and unemployed men and women (by 4% each), and smaller-than-average population shares of abstaining men and women (by 4% and 8%, respectively).

(l) The micro-region of Zakinthos island and a portion of the mainland across the water. The inhabitants exhibit larger-than-average population shares of unemployed men and women (by 2% and 1%, respectively) and employed men (by 3%), and smaller-than-average population shares of abstaining women (by 3%).

In these cases the population shares of employed residents appear to exceed the levels observed in the reference area. Thus, it would appear that a policy aiming at the reduction of unemployment might bring higher levels of employment in relation to the rest of Greece. At the same time, the corresponding shares of non-participants seem to be smaller than in most parts of

the country. So, the likelihood of attracting large numbers of abstaining residents into the workforce is reduced. This improves the likelihood of attaining the target of lower unemployment. As a result, it would be prudent if efforts aiming at the enhancement of local employment were gradual (and unfolded further only in those places where the creation of jobs attracted such a number of outsiders that the reduction in local unemployment was deemed unsatisfactory). To the extent that the combination of high employment and unemployment and low abstention levels in these tourist areas is a seasonal effect observed during the first quarter of the year (the *Census* was conducted in March), it could be sensible to design a policy oriented to the prolongation of the tourist-season and/or the introduction of other employment opportunities to keep people busy in the off-season.

(m) The string of municipalities along the western Peloponnesian mountains. Its inhabitants exhibit smaller-than-average population shares of employed men and women (by 10% and 8%, respectively), and a larger-than-average population share of abstaining women (by 8%).

In this case, while the employment shares may be relatively small, unemployment shares are close to those observed in the reference area (i.e., the rest of Greece). Consequently, an initiative aiming at boosting local employment toward the national average, in order to be successful, will probably have to be combined with (a) infrastructure projects that facilitate the commuting of locals to neighboring localities and the passing of visitors/tourists and others, and/or (b) schemes that either (i) attract former residents who migrated for want of better or different employment or (ii) draw other people from the outside to locate there, or (iii) appeal to locals who are not in the labor force.[34]

In considering the estimated coefficients associated with less populous, and often less accessible, mountainous or insular localities or clusters of localities, we note that by-and-large their situations resemble cases (a)-(m) at a much smaller scale. For instance, the string of municipalities situated at the southern Strimon valley in Central Macedonia resembles the case under (i); the string of municipalities situated in the vicinity of S.Pindos, Panaetolian and Timfristos mountains (in the tri-region area of Thessaly, Western and Central Greece) resembles the cases under (a)-(c) and (e); the string of municipalities situated in the vicinity of the Timfristos, Oxia, Oeti, Gkiona and Nafpaktian mountains (i.e., the highland country separating Western Greece from Central Greece) resembles case under (m), etc.

[34] To the degree that the latter are not discouraged job-seekers, and the terms of employment are not sufficiently attractive (although reasonably attractive to regular labor-marker participants), the hypothetical scenario to draw them into the local workforce will not be successful.

ii) The other effects and policy discussion

According to the remaining estimated coefficients of the third version, we deduce the following. Municipalities exhibiting high concentrations of:

- Science and art professionals employed in the wholesale, trade, and repairs industry are associated with larger-than-average population shares of employed men and women, and smaller-than-average population shares of unemployed men, and abstaining women. (These findings are backed up by the results of the first version. In fact, the regional analysis suggests that the particular industry-and-profession combination is associated with smaller population shares of unemployed women, and abstaining men, as well.)
- Science and art professionals employed in extra-territorial bodies and organizations are associated with larger-than-average population shares of employed women, and small shares of abstaining women. (These findings are corroborated by the regional version.)
- Plant/machine operators and assemblers employed in the manufacturing sector are associated with larger-than-average population shares of employed men. (The finding is corroborated by the regional version.)
- Skilled primary-sector workers employed in agriculture, husbandry, hunting and forestry are associated with smaller-than-average population shares of unemployed men and women, and employed men.

Consequently, at the particular state of the economy, the marginal expansion in the above combinations, especially, (a) science and art professionals employed in the wholesale-trade/repairs industry; (b) science and art professionals employed in extra-territorial bodies and organizations; (c) skilled workers (plant/machine operators and assemblers) employed in the manufacturing, may bring about, *ceteris paribus*, a rise in participation and a reduction in unemployment.

At the same time, all three analyses suggest that population density stimulates female employment, possibly at the expense of female abstention from the workforce (as per the regional and micro-regional versions).[35] Additionally, the micro-regional model finds that population density stimulates male employment. These suggest that even a modest level of urbanization may be associated with an increase in local employment and a decrease in abstention in the rural areas.

Moreover, all three analyses seem to suggest that (a) an incremental expansion of the male population aged 20-64 stimulates male employment vis-à-vis all other demographic groups over the age of five.[36] In contrast, (b) a similar expansion in terms of same-aged women swells all three functions for females (i.e., female employment, unemployment and abstention), which suggest that

[35] Indeed, it appears (see footnotes 19, 27) that female employment reaches a maximum at very high levels (20.5 residents per square kilometer) and possibly declines in the four most congested areas, notably the municipalities of Kallithea and Nea Smyrna (near Athens), Thessaloniki, and the neighboring suburb of Neapolis.

[36] Alternatively, the marginal increments in 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.

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. (c) 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; (d) an equivalent increment of children aged 5-9 appears to dampen female employment (presumably on account of the time-use adjustments made by mothers and other adult female relatives minding the children of that age as their extracurricular/social life expands); and (e) 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, (f) 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 (g) a similar rise in the presence of senior citizens over the age of 80 years has a negative impact on male employment (as those 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). Overall, the demographic composition of an area 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 by 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 are 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) 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 (b) the rise in the population-share of men with secondary school qualifications also seems to create lower female employment and unemployment and higher female abstention. The latter seems to suggest that their presence does

not merely crowd out women from employment but may discourage participation or encourage abstention.[37] At the same time, a rise 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 rise 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 females do not match well with jobs, and the rest may drive a fare 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 as well-suited for the needs of their local job-market. Lastly, a marginal increment of postgraduate degrees by male and female holders is associated with increased male unemployment. This may suggest 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 in the market-place. Unless self-selected, they could become better matches through continuous education and skill-upgrading processes. Furthermore, to reduce male and female unemployment, measures may have to be taken toward creating a culture and a suitable environment supporting the formation of businesses, including own businesses, which absorb people. To the extent that a rise in numbers of men and women with postgraduate qualifications is associated with increased male unemployment (and possibly female unemployment and increased female abstention) it is obvious that the orientation procedure by which young males (and possibly females) 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 in absorbing highly skilled persons in specialized activities.

[37] Despite the evidence of a positive female unemployment response to a marginal increase in the population-share of men with post-secondary school and bachelor-level qualifications, the z-statistics associated with the corresponding coefficients in the other equations do not exhibit comparable deductions.

5. Conclusions and policy proposals

The paper introduces the use of disaggregated data in the literature of employment, unemployment, and labor force participation in Greece, and advances the use of spatial analyses in economic research and the formulation of economic policy.

In particular, 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 seemingly unrelated regressions context. 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 TTWAs), with information extracted from the spatial patterns produced by the omitted (unknown) variables incorporated in the error terms. Thus, it identifies 40 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. Such conditions hinder prosperity, as well as the attractiveness of living in the TTWAs under consideration, while posing serious threats to the continuation of smaller communities. The largest of these areas are the TTWAs of Patras and Rodos, the plateaus of Grevena, Kastoria, Kozani and Ptolemais, the plateau of Ioannina and a string of municipalities running along the Pindos mountain-range ending into Thessaly, the micro-region of Zakinthos island and neighboring part of Western Greece, and peripheral parts of Kerkira island and the south-western coast of Epiros.

On the basis of their features, it would be sensible if policy interventions aiming at the reduction of unemployment, anticipated a larger-than-average response (or entry into the workforce) of non-participating residents in the cases of the plateaus of Grevena, Kozani and Ptolemais, Ioannina and the neighboring highlands; and smaller-than-average such responses in the cases of the TTWA of Rodos, the plateau of Kastoria, the micro-region of Zakinthos island and the neighboring mainland. . Additionally, it would be advisable in the cases of TTWA of Rodos, and the above-mentioned parts of Kerkira island and the south-western portion of Epiros that the interventions aimed to the prolongation of the tourist season or the creation of other off-season opportunities; while in the case of the remote pockets of the plateau of Ioannina and its neighboring highlands the interventions could be supplemented with road-construction linking the areas in question to a wider labor market, hence improving the residents' access to jobs in their immediate vicinity. Similarly, in the smaller micro-regions and clusters of municipalities that we identify in the text, interventions ought to be differentiated not according to the region (NUTS 2) or prefecture (NUTS 3) that they are assigned to, but according to their individual characteristics.

Indeed, compared to alternative versions relying on the formal groupings of municipalities into regional (NUTS 2) or prefectorial (NUTS 3) formations, the *micro-regional and distrinct community* version provides a more detailed picture which may be utilized for better focused, place-specific, territorial development and social cohesion policy interventions. Additionally, this version is preferable on statistical grounds (especially when compared to the prefectorial version), as it explains a larger portion of the total variation observed in the dependent variables.

The visual projection of the statistically significant coefficients on a map reveals that the spatially-specific results supplied by the three versions are very different. So it seems that while the regional version 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 is not homogeneous. If that is so, a region-wide economic development intervention is likely to direct funds and efforts to areas that are not in dire need of them and to areas that need a differentiated policy mix. Obviously, in order to be able to proceed further on their employment, unemployment, and non-participation, and formulate more informed, better targeted, economic policies, we need to collect disaggregated data more frequently than once in a decade.

Another important lesson emerging from the spatial 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/distinct-municipality) dummies, but from population density, gender and age composition, educational structure, and the combinations of industrial-and-professional concentrations. In particular, according to the estimated coefficients, is seems that:

(a) The spreading out of science and art professionals employed in the wholesale/retail trade and repairs industry and in extra-territorial bodies and organizations, 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; while a similar development in skilled primary-sector workers employed in agriculture, husbandry, forestry, hunting and related activities, may reduce male and female unemployment and male employment as well. However, the overall reduction in the two former exceeds the reduction in the latter.

(b) Urban areas seem to provide women with increased employment opportunities. Consequently, even a modest urbanization of rural areas is likely to bring about a growth in local employment and, conceivably, a reduction in abstention, in such areas.

(c) The demographic composition and educational make-up of an area affects the employment, unemployment, and non-participation of residents, and thus ought to be taken into account by

policy-makers. Thus, to the extent the aim is to (i) reduce unemployment, (ii) boost employment and (iii) lower non-participation in order to raise monetary incomes and the GDP (even if not individual and household welfare), we should take into account the following:

- The negative effect of children aged 5-9 on female employment could be weakened, and the expansion of day-care facilities might provide the means for that. The staffing of such facilities will bring about some additional employment opportunities as well.
- Working people over the age of 65, and men with secondary, post-secondary, and bachelor qualifications may have to be persuaded against withdrawal from the workforce. Additionally, several of those over the age of 65 years may wish to stay longer in active employment if the law concerning obligatory retirement due to age was revised.
- Men with secondary school qualifications may have to be persuaded in becoming more supportive of female relatives' participation.
- Women, especially those with secondary school or lower qualifications, may have to be persuaded of the benefits of consistent participation, and acquire the talents of a competent employee.
- To the extent the rise in male unemployment associated with a marginal increment in the population share of postgraduate degree holders is attributed to the displacement of men with lower qualifications by postgraduates, the men with lower qualifications (as the women mentioned above) should be informed and be persuaded that their competitiveness would increase with more knowledge. The improvement in the level of human capital is expected to have a positive effect on the overall competitiveness and growth of the economy. However, in order to reduce the consequences of male and female unemployment, measures may have to be taken to create a culture and environment supportive of businesses formation, including own businesses, which, in turn, helps in creating jobs. To the extent the rise in male unemployment associated with a marginal increment in the population share of postgraduate degree holders is attributed to the incompatibility of a good number of men with the needs of employers, a re-orientation of young males towards the number and type of postgraduate subjects needed in the economy ought to take place, and measures to be taken to set up a culture and appropriate environment that support the formation of businesses able to absorb persons with high qualifications in specialized activities, for it is this kind of activities that are most likely to add considerable value in the end product, contribute to the competitiveness of the economy and raise the welfare of the society.

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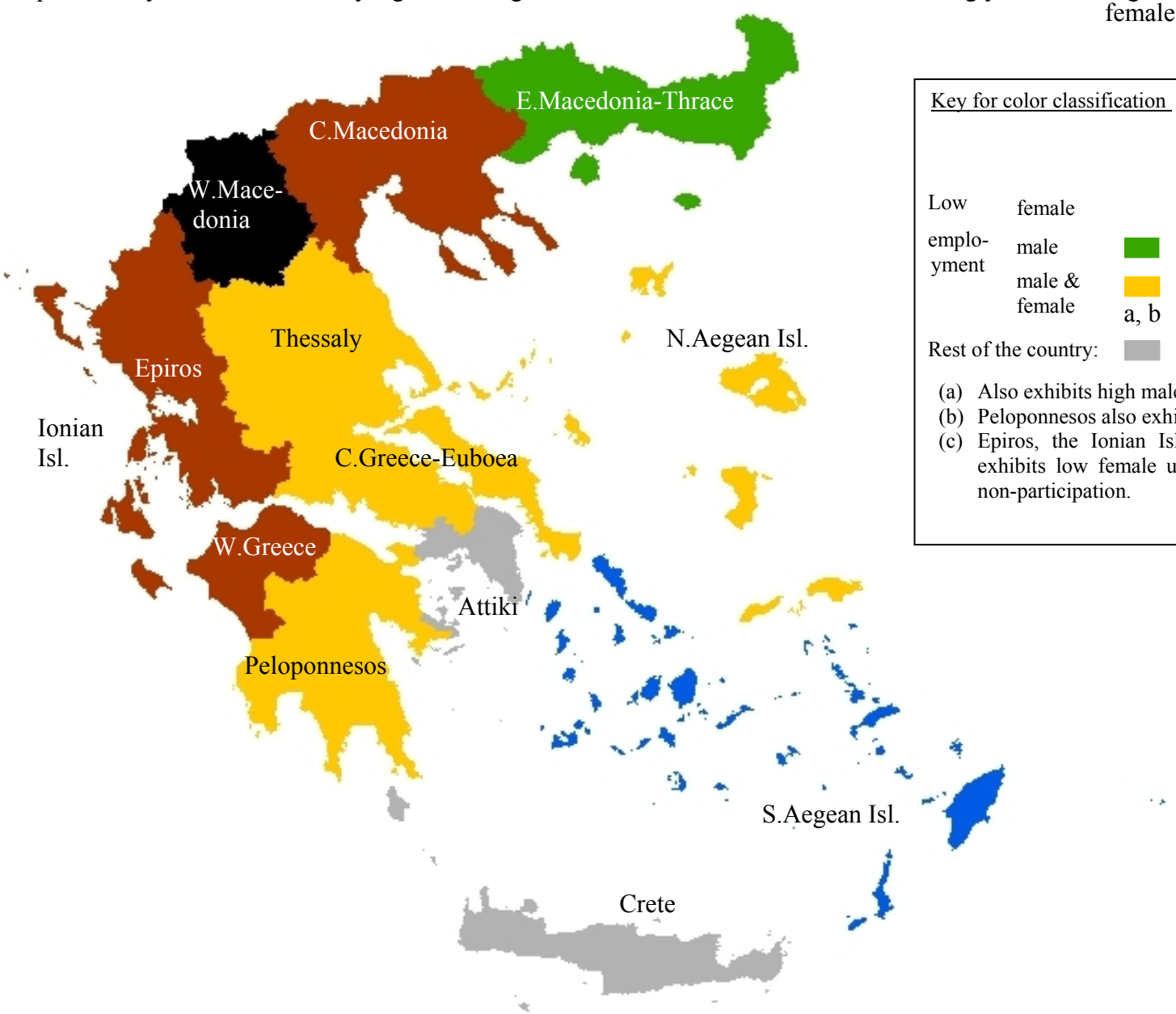
Map 1: Portrayal of the statistically significant regional coefficients recovered from a seemingly unrelated regression of the disaggregated male and female activity population share (Table 3).



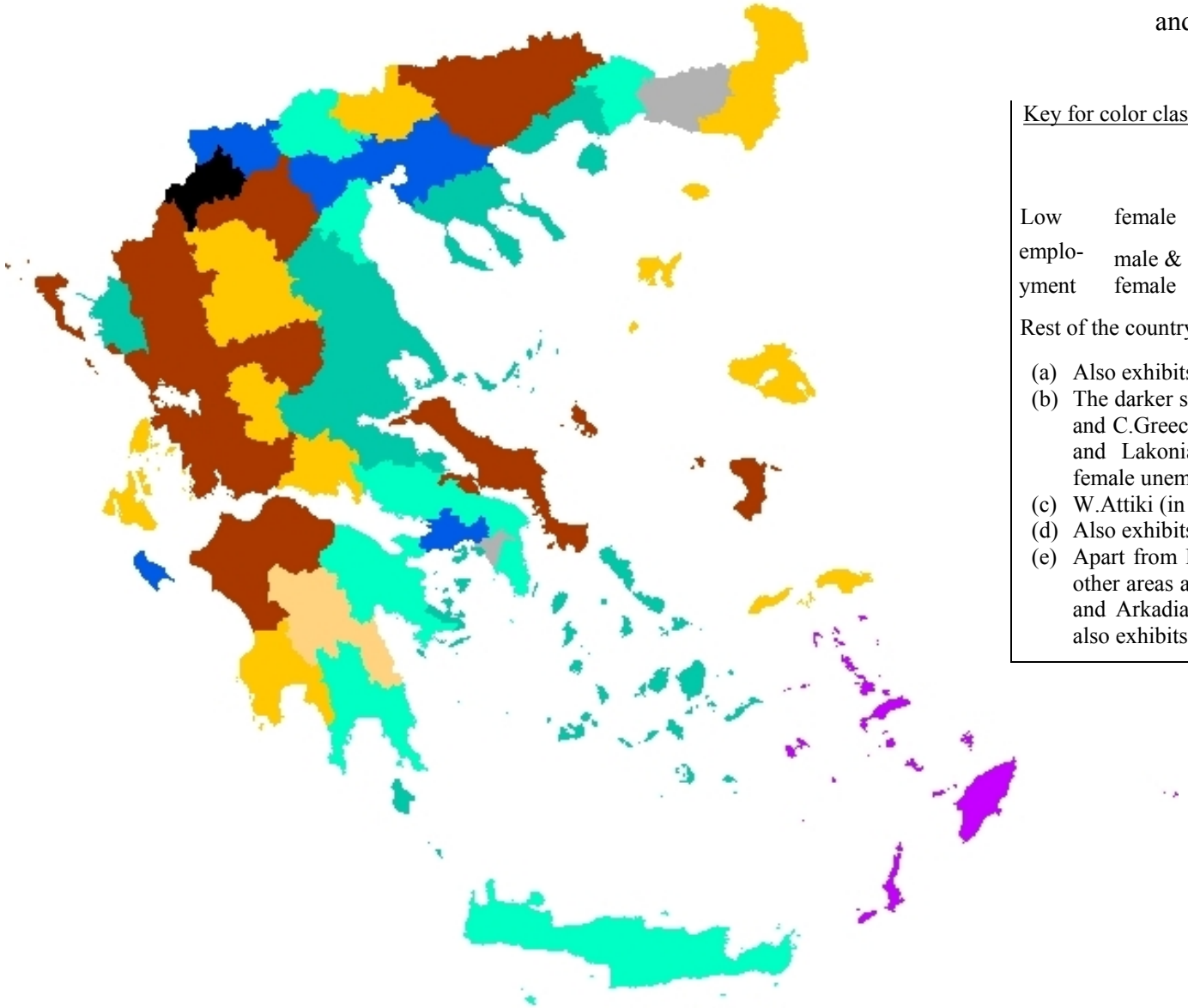
Key for color classification

		High unemployment		
		female	male	male & female
Low employment	female			
	male			
	male & female	a, b	c	a
Rest of the country:				

(a) Also exhibits high male and female non-participation.
(b) Peloponnesos also exhibits low female employment.
(c) Epiros, the Ionian Isl., and W.Greece as in (a); Epiros also exhibits low female unemployment, and high male and female non-participation.

The administrative regions

Map 2: Portrayal of the statistically significant prefectorial coefficients recovered from a seemingly unrelated regression of the disaggregated male and female activity population shares (Table 4).



Key for color classification

		High unemployment		
			male	male & female
Low employment	female	b	c	d
	male & female	e	a	

Rest of the country:

(a) Also exhibits high female non-participation.
(b) The darker shaded areas as in (a). E.Attiki and Boeotia (in Attiki and C.Greece, respectively) also exhibit high male employment; and Lakonia (in southern Peloponnesos) also exhibits low female unemployment.
(c) W.Attiki (in Attiki) and Florina (in W.Macedonia) as in (a).
(d) Also exhibits low female and high male employment.
(e) Apart from Evros (in Thrace) and Kilkis (in C.Macedonia), the other areas as in (a). Kilkis also exhibits high male employment, and Arkadia (in Peloponnesos, indicated with a lighter shade) also exhibits low female employment.

Map 3: Portrayal of the statistically significant municipal and micro-regional coefficients recovered from a seemingly unrelated regression of the dis-aggregated male and female activity population shares (Table 5).

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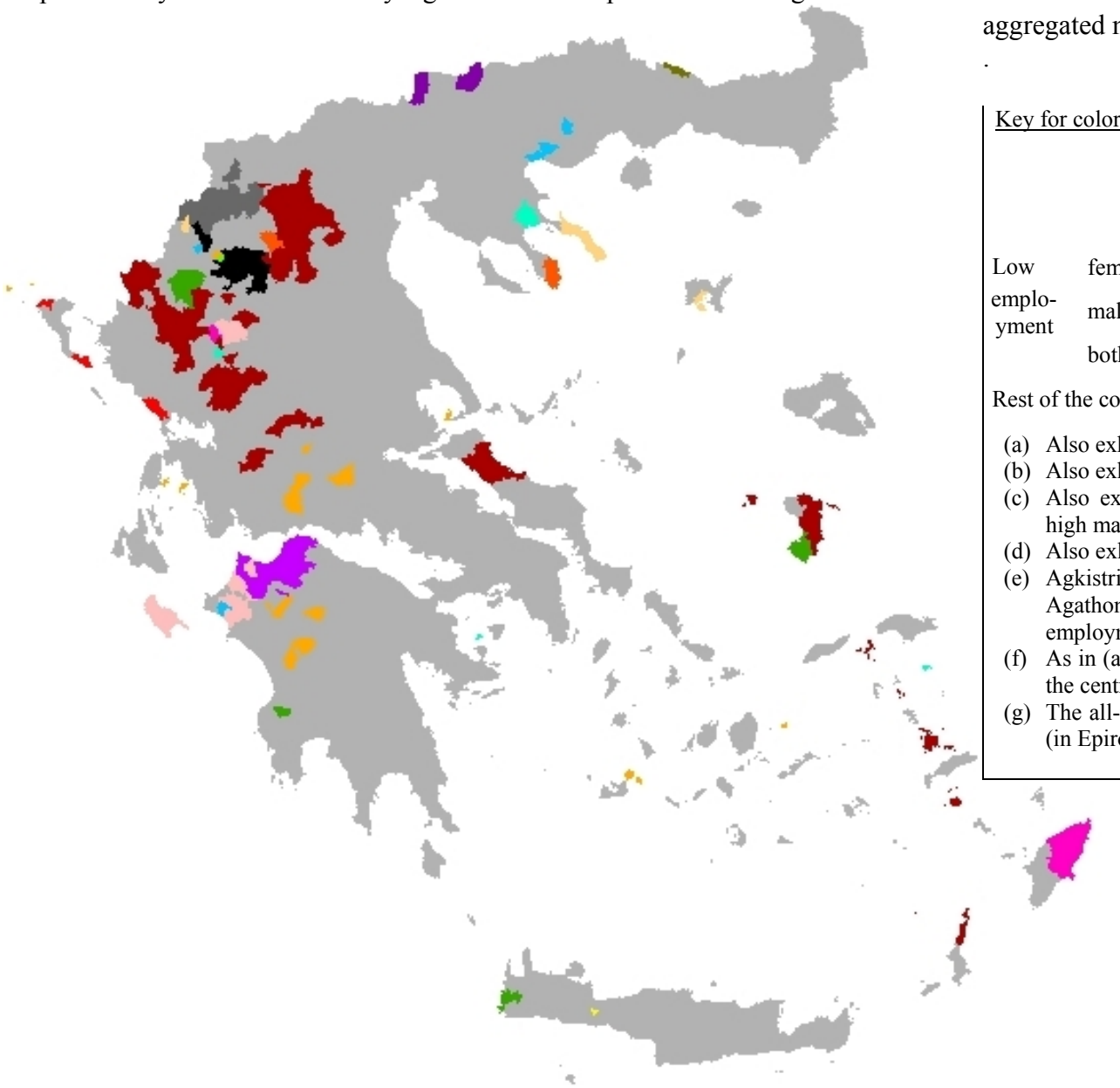

Key for color classification

		High unemployment		
		female	male	male & female
				c d
Low emplo-yment	female	e		
	male	a		
	both	f g	a	h i
Rest of the country:		a		

(a) Also exhibits high female non-participation.
(b) Also exhibits low male unemployment.
(c) Also exhibits high male and female employment, and low female and high male non-participation.
(d) Also exhibits high male employment and low female non-participation.
(e) Agkistrion isl. (in Attiki) and Panagia (in C. Macedonia) as in (a); Agathonision isl. (in the eastern S. Aegean) exhibits high male employment.
(f) As in (a); Dotsikon (in W. Macedonia), Donousa isl. and Kimolos isl. (in the central and western S.Aegean, respectively) as in (b).
(g) The all-male community of Ag. Oros (in C. Macedonia) and Aetomilitsa (in Epiros, near W. Macedonia) as in (a). Aetomilitsa as is (b) as well.
(h) Also exhibits low female and male non-participation.
(i) Also exhibits high male and female non-participation.