

THE SPATIAL AND TEMPORAL PATTERNS OF DECLARED INCOME ACROSS GREECE: 2001-8

Prodromos PRODROMÍDIS

Centre for Planning and Economic Research, and Athens University of Economic and Business
pjprodr@kepe.gr

Abstract

The paper studies the income mosaic of Greece at the local community level, from the time the country joined the EMU to the advent of the international crisis. It econometrically isolates the average income, income-filer population size, and annual effects, and brings to light sub-regional and cross-regional patterns that might otherwise go undetected. This provides a better understanding of the internal heterogeneity of the country and facilitates the formulation of better-targeted interventions aiming to reduce disparities and stimulate economic growth.

Keywords: *personal income, disaggregated data, delineation of micro-regional policy areas, urban and rural development*

JEL, classification R10, R40, R30

Introduction

Caught in the tide of an international economic crisis while having surrendered monetary-policy sovereignty for the operation of the euro-zone, the small and open Greek economy is faced with the prospect of a disheartening recession. Under the circumstances, it is imperative (among other things) to: (a) Stretch the funds permitted by the fiscal straitjacket to go further in treating social disparities and stimulating economic growth. For the greater good, this has to be performed with more sense and precision than ever before. Accordingly, policy-makers may have to question the way they put together plans and allocate resources, and analysts to question the way they study the data and offer advice. For instance: Are the (shapes of the) territorial zones for which policies are devised and implemented perpetually fixed along predetermined administrative lines or should they be treated as likely to have changed over time (as some or several policies bear fruits and the values of crucial variables change)? In the case of the latter, should not resources be targeted accordingly? And might the shapes of the policy areas be traced (revealed) through statistics? If these issues are linked, then we may be able to make some or considerable progress. (b) Identify the territorial zones that seem to perform better than the rest in order to improve the chances of deducing what the causes may be, and employ the recipe wherever possible.

The argument in favor of relying on disaggregated data

Most studies geared towards the preparation or assessment of sub-national economic development and social cohesion plans tend to rely on figures supplied at conventional territorial levels such as regions, provinces, counties, prefectures, cantons and the like. Against this tendency, and bearing in mind the issues raised above, the paper takes the view that if regions, provinces etc. are (or have become) internally heterogeneous in terms of the aspects relevant to the analysis, then they may not constitute as appropriate a spatial grid for policy interventions as generally considered. Drawn after geographic, historical, gerrymandering, geometric or other factors, these territorial partitions have for a long time been accepted as a convenient framework on the basis of which national and/or EU resources may be allocated and programs devised, implemented or appraised. However, to the extent they provide a blurred if not distorted view of micro-reality (Amrhein, 1995), reliance on their average or amalgamated statistics may affect the suboptimal use of scarce resources earmarked for alleviating disparities or stimulating growth. To prevent this from happening, disaggregated data have to be used and individual communities or clusters of communities (i.e., micro-regions) with diverging features to be identified. Indeed, to the extent some or several regions or provinces comprise all kinds of

communities, funds and efforts may be directed to places that are not in serious need or to places that need a different policy-mix compared to surrounding areas or the rest of the region or province. Sadly, while policy-makers recognize that their interventions ought to be tailored to local idiosyncrasies, nearly all discussions and analyses are conducted at the fairly aggregated territorial levels mentioned above.

The study of personal income across space and time in Greece

As monetary income constitutes an important (albeit not the sole) component of the individual (or household) utility and social welfare functions, its regional and sub-regional level, distribution, and growth (often traced through its crude proxy, the GDP) serve as decisive factors in the commencement, continuation or suspension of economic development and social cohesion policies. Understandably, by affecting the perceptions of policy-makers about people's living standards and ability to help their own selves, these aspects have profound implications on the state of the national and federal public purse.

Justifiably, the spatial distribution and the temporal evolution of personal income in Greece have attracted the attention of analysts (a) initially in the Centre for Planning and Economic Research (KEPE); (b) intermittently in research and academic institutions outside Greece; (c) in several such institutes within Greece, such as the University of Macedonia, the Bank of Greece, the Agricultural Bank of Greece, the National Centre for Social Research (EKKE), the Athens University of Economics and Business, the University of Athens; or (d) engaging in collaborations.

From the publications that either focused or touched on the spatial and/or temporal patterns of personal incomes observed at the population at large, a good number relied on the annual figures obtained from the individual and family tax statements collected by the Revenue Service of the Ministry of Finance. For the most part the analysts examined the evolution of inequality over time (occasionally looked at correlations), and in once instance attempted to probe the spatial dimension as well (Prodromidis, 1975).

However, the majority relied on data solicited via household surveys conducted from time to time on representative samples of the population by the National Statistical Service of Greece. For the most part the analysts examined inequality over time and across space (occasionally looked at correlations). As the cross-sectional nature of the data permitted the econometric isolation of various effects (including spatial effects), the opportunity was seized right from the start (Crockett, 1967). Eventually, a sophisticated treatment of the regional dimension was produced by Kanellopoulos (1986).

Researchers in the EKKE probably came close to providing a more detailed picture at the sub-regional level through their own surveys (Karagiorgas et al., 1988), which they apparently completed (Balourdos et al., 1990). However, their attention was diverted to answering other questions. So, the breakthrough on this front came from researchers in the Bank of Greece (Voloudakis and Panourgias, 1980, 1984), who by matching the population data from three censuses to personal income estimates obtained from the national accounts at the prefectural level were able to provide an alternative glimpse into the evolution of inequality across time and space. However, the relatively small number of observations did not favor an in depth econometric analysis. For that, one would need a dataset that could supply more observations, presumably disaggregated observations.

As technology in data management advanced, researchers in KEPE were able to proceed with a variant of the previous approach, by matching the *2001 Census* statistics against the household income data obtained from the 2002 tax reports (pertaining to the previous year) at the municipal and postal-area levels (hereinafter, revenue districts or districts). Hence, they managed to econometrically explain income formation in terms of local population density, household composition, occupational, educational and other factors (Prodromidis, 2006). This way, the spatial analysis of personal income, which for about forty years had been conducted in terms of two or three spatial states (e.g., Athens and rest of Greece; urban, rural and intermediate areas), and for about twenty years in terms of regions (twice in terms of prefectures) as well, was eventually carried out at the local community level. At first sight it provided a fresh look at the economy as a collection of clusters and communities, without preconceptions that certain units or sub-regions should fit in the inherited regional or prefectural framework. A closer look revealed that income disparities were larger within rather than across the (conventional) territorial formations considered by the national and EU authorities, policy makers,

advisors and analysts who devise implement and assess convergence and prosperity plans. In view of the above, it might make sense if territorial economic development and social cohesion policy were conducted at a rezoned or functional-area framework.

As additional series of disaggregate declared income data have been collected since then, we attempt to explore the patterns of personal (individual taxpayer, not household) income not only across space (the country's 932 revenue districts) but also time (between 2001 and 2008). The intent is to obtain a better sense of how the country's sub-national generation of personal income operated more or less (for it is intertwined with redistribution) from the time the country joined the European Monetary Union to the time the international financial and economic crisis reached its shores.

Two snap shots: one from the beginning and one from the end of the period

According to the revenue statistics from the period in question, personal incomes increased from about € 62.615 to 98.792 billion, at the compound rate of 57.78%, even as the consumer price index rose from one year to the next and subsequent years at a compound rate of 26.32% (Table 1).

TABLE 1

The evolution of declared personal income in Greece (2001-08)

| Year | Number of filers in thousands (1) | of statemen change (2) | Income declared per filer in euro (3) | change (4) | Total declared income in billion euro (5) | change (6) | Rate of inflation (7) |
|----------------|---|------------------------------|---|---------------|---|---------------|-----------------------------|
| 2001 | 7,734.7 | | 8,095.3 | | 62.61 | | |
| 2002 | 7,908.1 | 2.2 % | 8,590.3 | 6.1% | 67.93 | 8.5% | 3,6% |
| 2003 | 7,942.1 | 0.4 % | 8,911.0 | 3.7% | 70.77 | 4.2% | 3,5% |
| 2004 | 8,336.2 | 5.0 % | 9,259.9 | 3.9 % | 77.19 | 9.1% | 2,9% |
| 2005 | 8,259.0 | -0.9 % | 9,914.3 | 7.1 % | 81.88 | 6.1% | 3,5% |
| 2006 | 8,299.0 | 0.5 % | 10,523.9 | 6.1 % | 87.34 | 6.7% | 3,2% |
| 2007 | 8,308.3 | 0.1 % | 11,358.5 | 7.9 % | 94.37 | 8.1% | 2,9% |
| 2008 | 8,371.8 | 0.8 % | 11,800.6 | 3.9 % | 98.79 | 4.7% | 4,2% |
| Compound rate: | | 8.24% | | 45.77% | | 57.78% | 26.36% |

Sources: Columns (1)-(6): General Secreteriat on Information Systems of the Ministry of Finance.

Column (7): National Statistical Service of Greece. Own calculations.

At the disaggregated lever, both in the beginning and in the end of this period:

- The largest shares originated in (a) the principal population centers of the country, namely, the districts of Athens, Thessaloniki, Patras, Iraklion, Larisa, and four or five revenue districts situated near Athens; and (b) somewhat smaller shares in eleven smaller towns, eighteen districts near Athens, and two districts near Thessaloniki. Collectively, the personal incomes filed in the aforementioned districts accounted for nearly half the overall personal income that was reportedly earned in the country. To visually orient the reader, these 40-41 areas are listed and indicated in Maps 1 and 2 with black.
- Another quarter of the overall personal income originated in 35-39 urban districts around the

country,⁷⁸ 32-34 localities near Athens, six localities near Thessaloniki,⁷⁹ and one (Nea Ionia) near Volos. These 76-78 districts are indicated in Maps 1 and 2 with dark gray.

- The remaining 813-816 districts supplied the final quarter of the country's overall personal income. They are indicated in Maps 1 and 2 with light gray.

Although things appear to change little from one picture to the next, there are unmistakable signs of change both across as well as within the three sets of districts listed above. In some places, income shares increased considerably (esp. in the towns (revenue districts) of Arta, Grevena, Kozani, Ptolemais, Tripolis, and the Athenian suburb of Gerakas: by 6-8%). In other places they decreased (esp. in the Athenian suburbs of Spata and Imittos: by 11-12%; and also in the districts of Zakynthos, Kerkira, and the Athenian suburb of Voula: by 6-7%). As a result, the districts of Kozani and the Athenian suburb of Neon Iraklion (denoted in Map 1 with dark gray and in Map 2 with black), which at the outset were classified in the second set, by the end of the period had progressed to the first (as residents reported a larger share of income), while the district of Kavala had moved in the opposite direction; and the districts of Grevena, Ierapetra Igoumenitsa, Ialiso (denoted in Map 1 with light gray and in Map 2 with dark gray) had progressed from the third set to the second, while the Athenian suburb of Spata had moved in the opposite direction.

The close association between a district's reported income and taxpayer population is undeniable ($r \approx 99.1\%$ throughout the period). Yet, as we shall see, additional forces also played a role. To advance our understanding beyond the comparison between instances, we construct a model that allows us to (a) estimate the impact of components such as past average income, the size of the local income-filing population, and the annual effects, and (b) examine the spatial patterns of the residuals for they are likely to be associated with crucial, yet, omitted factors.

The model and the empirical analysis

The model is developed from a number of relationships which arise from the understanding that a community's overall personal income, Y , is equivalent to the product of its mean, in this case, average income, y , times the size of the income-earning (and -filing) population, n :

$$Y = y \times n. \quad (1)$$

Hence, in a particular year, $t+1$,

$$Y_{t+1} = y_{t+1} \times n_{t+1}. \quad (2)$$

To the extent y_{t+1} grows at an annual rate b_t ,

$$y_{t+1} = (1+b_t) \times y_t, \quad (3)$$

expression (2) may be rewritten as follows:

$$Y_{t+1} = (1+b_t) \times y_t \times n_{t+1}. \quad (4)$$

In linear format:

$$\ln Y_{t+1} = \ln (1+b_t) + \ln y_t + \ln n_{t+1}. \quad (5)$$

The incorporation of six temporal categorical dummies, d_i , in order to distinguish the annual effects, a_i , (if any) from the effects of the measured variables, renders the un-logged version of the expression (5) as follows:

$$Y_{t+1} = (1+b_t) \times y_t \times n_{t+1} \times e^{\sum(a \times d)}. \quad (6)$$

Though y_t and n_t are modestly correlated ($r=24,6$), the transformed regressors considered in expression (5) are further correlated ($r=41,5$). The empirical results associated with latter expression, recovered from (932 observations \times 7 years=) 6,524 observations, are provided in Table 2. The regular estimation attempt (version 1) finds the two coefficients to be close to one; so we resort to a modification (version 2) by which the two coefficients are set equal to one. From the second version's intercept's exponentiation, we deduce that the magnitude of b , which pertains to the reference period

⁷⁸ Namely, Komotini, Agrinion, Kavala (in 2008), Veria, Xanthi, Karditsa, Drama, Kozani (in 2001), Alexandroupolis, Corfu, Ptolemais, Arta, Giannitsa, Argos, Rethimnon, Mitilini, Pargos, Kilkis, Egion, Corinth, Hios, Thebes, Tripolis, Florina, Megara, Livadia, Edessa, Sparta, Grevena (in 2008), Naousa, Preveza, Zakynthos, Nafplion, Igoumenitsa (in 2008), Siros, Ierapetra (in 2008), Kastoria, Megalopolis, Kos, Ialissos (in 2008).

⁷⁹ Namely, Petroupolis, Haidarion, Neon Iraklion (in 2001), Alimos, Nea Filadelfia, Salamis, Argiroupolis, Agii Anargiri, Holargos, Agia Varvara, Aspropirgos, Metamorfofis, Ano Liosia, Kesariani, Elefsis, Perama, Vrilissia, Voula, Kropia, Dafni, Moskaton, Kamateron, Pefki, Melissia, Artemis, Gerakas, Ellinikon, Pallini, Markopoulon-in-Mesogea, Nea Erithrea Papagou, Rafina, Imittos, Spata (in 2001) near Athens; Evosmos, Sikee, Ampelokipi, Neapolis, Pilea, Thermi near Thessaloniki.

(2001-02), is, on average, 6.31%; and from the estimated coefficients of the annual dummies and the antilog device suggested by Halvorsen and Palmquist (1980), and Kennedy (1981), $\exp[b - (S_b^2/2)] - 1$, we deduce that the relative effect of each subsequent year is -2.66% (in 2002-03), -2.92% (in 2003-04), 3.04% (in 2004-05), -0.03% (in 2005-06), +1.86% (in 2006-07), -1.94% (in 2007-08).

TABLE 2

The econometric analysis of declared personal income in terms of average income, the size of income-filing population and temporal components, across the 932 revenue districts of Greece during 2001-08

| Dependent Variable Natural logarithm of the overall personal income | Version 1: obtained via a robust variance estimator | | Version 2: obtained on the condition that the se- cond and third coeffi- cients take the value "1" | |
|--|---|-------|---|-------|
| | Coefficients | P> z | Coefficients | P> z |
| Explanatory Variables | | | | |
| 1. Constant | 0.269 | 0 | 0.061 | 0 |
| 2. Natural logarithm of the previous year's average income | 0.976 | 0 | 1.000 | |
| 3. Natural logarithm of the income-filing population | 1.000 | 0 | 1.000 | |
| 4. Change from the second to the third year (2002-3) | -0.025 | 0 | -0.027 | 0 |
| 5. Change from the third to the fourth year (2003-4) | -0.027 | 0 | -0.030 | 0 |
| 6. Change from the fourth to the fifth year (2004-5) | 0.033 | 0 | 0.030 | 0 |
| 7. Change from the fifth to the sixth year (2005-6) | 0.005 | 0.109 | 0.000 | 0.885 |
| 8. Change from the sixth to the seventh year (2006-7) | 0.025 | 0 | 0.018 | 0 |
| 9. Change from the seventh to the eighth year (2007-8) | -0.011 | 0.006 | -0.020 | 0 |
| Statistics | R ² = 99.93 % | | | |

Sources: General Secretariat on Information Systems of the Ministry of Finance. Own calculations.

Note: The probability values are estimated as in analyses that rely on samples.

Some additional observations pertaining to the steady or not-so-steady evolution of income

The residuals recovered in the process reveal five districts that consistently experienced further (unexplained) income increases throughout the period and 40 districts in which such increases occurred in six out of the seven years. About one third of the aforementioned districts appear in clusters situated on a mountainous area separating West Macedonia from Thessaly, a mountainous area in the northern Peloponnese, on the mountain- and hill country of central Crete. A small number are found along the main transit corridors linking West Macedonia with Epiros and Thessaly (on the northern Pindos mountain-range), Thessaly with Central Greece (between the foothills of Mt.Othris and the Malian and Pagasean gulfs), Greece with the former Yugoslavia or Turkey. The rest (nearly one half of the said districts) are dispersed around the country. (They are listed in Map 2, and denoted with black.) All hosted fewer than 8 thousand income-filers in 2001. With the exceptions of Larimna and Leontarion they were associated with low levels of per capita income in 2001 (i.e., below the level found in the median community).

The city of Larisa and a number of large Athenian suburbs (Peristeri, Kallithea) along with 445 smaller districts stretching over most of the country turn out to be susceptible to more oscillations (with fewer "ups" and more "downs" than those mentioned in the previous paragraph). (See Map 3, areas in dark gray.)

Athens, Piraeus, Patras, Iraklion, Ioannina, Volos, along with 515 smaller districts (generally large and with high average income) covering large tracts or forming pockets and string of localities along the transportation network (see Map 4, areas in dark gray) often perform worse than the average district.

Finally, there also exist 47 districts which performed worse than the average in six out of the seven years, and nine districts in which this occurred throughout the period. (See Map 4, areas in back.) These comprise Thessaloniki and several of its suburbs, the towns of Hania and Rethimnon and other places along the northern coast of Crete, the towns of Komotini, Kalamata (and neighbouring Kardamila), Kerkira (and neighbouring Karousades), most of the island of Zakinthos and portions of

neighbouring Kefallinia, and other districts dispersed around the country. Under the circumstances, it is highly likely these communities and clusters of communities may be in need of territorial development planning assistance.

To the extent a good number of areas consistently perform better than predicted year after year, it would make a lot of sense to identify what the source for this of might be, with the prospect of replicating it across the country. Though the discovery process may require considerable thinking, mulling over these patterns (the extent, similarities and dissimilarities of the areas involved) ought to improve the chances of deducing what these factors might be, and design spatially targeted interventions.

References

- Amrhein C.G. (1995). "Searching for the elusive aggregation effect: evidence from statistical simulations." *Environment and Planning A* (27):105-19.
- Balourdos D., Ch.Kappi, A.Kostaki and Ch. Papatheodorou (1990). *Dimensions of poverty in the Greater Athens area*. [In Greek.] *Topos*, 1: 109-135.
- Crockett J. (1967). *Consumer expenditures and incomes in Greece*. Research Monograph 17. Athens: KEPE and NSSG.
- Halvorsen R. and P. Palmquist (1980). "The Interpretation of Dummy Variables in Semilogarithmic Equations." *American Economic Review*, 70.3: 474-475.
- Kanellopoulos C.N. (1986). *Determinants of individual income and poverty in Greece*. [In Greek.] Study 22. Athens: KEPE.
- Karagiorgas S., K. Kasimati and N. Pantazidis (1988). *Inquiry in the composition and distribution of income in Greece. Part First: Findings regarding the Greater Athens area*. [In Greek.] Athens: EKKE.
- Kennedy P. (1981). "Estimation with Correctly Interpreted Dummy Variables in Semilogarithmic Equations." *American Economic Review*, 71: 801.
- Prodromidis K.P. (1975). "Regional distribution of income and employment in Greece, 1961-71." [In Greek.] *Spoudai*, 25: 529-550.
- Prodromidis P.I.K. (2006). *A regional analysis of declared incomes in Greece*. Study 63. Athens: KEPE.
- Voloudakis E.A. and E.A. Panourgias (1980). "An estimation of the regional distribution (at the prefectorial level) of national income in 1961, 1971." [In Greek.] *The Greek Economy. Research essays and statistical series*. Vol. I. Athens: Bank of Greece, pp.11-39.
- Voloudakis E.A. and E.A. Panourgias (1984). "The regional distribution of national income in 1981." [In Greek.] *The Greek Economy. Research essays and statistical series*. Vol. III. Athens: Bank of Greece, pp.62-109.



