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LARGE FIRE DISASTER AND THE REGIONAL ECONOMY: THE 2007 CASE OF THE PELOPONNESE

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Abstract
The article explores the evolution of annual personal incomes in the Peloponnese, in southern Greece, at the disaggregated (local community) level from 2001 to 2010, i.e., before and after the 2007 fires, in order to better understand the medium-term economic effects of these fires in the burned and other areas of the region outside the fire path. The paper considers a number of econometric approaches and ends up engaging in a series of cross-sectional regressions of income-filer figures and average incomes to study the situation year after year. Findings indicate that, by and large, no inordinate drop or rise in average income figures or income-filer numbers is detected in the aftermath of the fires, especially in the communities damaged by them.

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1. Introduction

The article examines the medium-term effects of the large fires that occurred in 2007 in the Peloponnese on the region's economic welfare. To that end, it explores the evolution of personal local incomes in the region before and after these fires. To our knowledge, the impact of the particular fires on people's income has not been empirically studied yet.

Large fires, like other large scale disasters, bring about many more consequences over and above those that are classified as "economic", with local income being an easily and frequently measured variable, though not the only economic variable affected. In fact, measuring other economic dimensions may be quite challenging (Butry *et al.*, 2001; Hesseln *et al.*, 2004; Loomis, 2004; Masvar *et al.*, 2012; Richardson *et al.*, 2012; Kalabokidis *et al.*, 2014). A good number of large fires, especially the very large fires with extreme behavior characteristics that cause significant loss of assets and high fire suppression costs, are classified as megafires, partly on account of their economic impact (Bartkett *et al.*, 2007). A number of the fires that occurred in the Peloponnese in 2007 are, indeed, regarded as megafires, while the rest are related as large fires or wildfires (Maditinos and Vassiliadis, 2011; San-Miguel-Ayanz *et.al.*, 2013). That said, the issue of a fire's impact on income or output is not straightforward. In this day and age, disasters may have quite dissimilar short- and medium-term consequences around the world (e.g., Noy, 2009).

The rest of the article is organised as follows: Section 2 reviews the literature on the issue. Section 3 provides background information on the region and the 2007 fires. Section 4 describes the data. Section 5 deals with certain methodological issues. Section 6 describes the model considered for the empirical analysis. Section 7 discusses the results, and Section 8 provides the conclusions.

2. Literature review

The literature underscores different large fire effects on average wages and incomes, as well as on the number of employees and income earners (i.e., the two components of overall output or income) depending on regional or local idiosyncrasies, such as population density and size, sectoral concentration and specialisation, spatial proximity to the fire, and other factors.

For instance, Kent *et al.* (2003) studied the effects of Colorado's 2002 Hayman wildfire on economic activity (wages, employment and retail sales) in three sectors and the overall economy during two periods: the two-month fire period and the two-month post-fire period. The geographic area taken into account included the four counties where the fire occurred (primary impact area) and thirteen counties bordering the primary impact area (secondary impact area). The authors used monthly data and linear regression models in order to estimate the economic activity that could be expected without the fire. To the extent that the difference between the estimated and the actual economic activity provides a measure of the fire impact, no strong evidence of positive or negative effects was detected.

Mosley *et al.* (2013) studied the effects of large wildfires on county-level employment and wages across eleven western states of the USA (346 large wildfires in 124 counties) from 2004 to 2008. The authors used quarterly data and linear regression models to estimate the effects of suppression spending on average employment and wage rate growth by controlling for past fires, population size and sectoral specialisation, and found that employment and average wages in the affected counties increased during the fire period. Neighbouring counties were also affected, exhibiting modest increases in both employment and average wages. However, the results varied depending on the characteristics of each county. Although the short-term effects of the wildfires were mostly positive, the medium-term effects (one to two years after the wildfire) tended to exhibit increased volatility, suggesting that wildfires amplified existing seasonal economic patterns.

Nielsen-Pincus *et al.* (2014) studied the impact of large wildfires that occurred in eleven western states of the USA during 2004-2008, on total and sectoral local employment growth. Monthly data from 413 counties were examined via linear regressions aiming to compare (a) the average change in the 24-month period that followed the end of wildfire suppression activities in the counties that experienced wildfires to (b) the average change in the counties that did not experience wildfires, while controlling for population size and the impact of the economic recession. The results suggest that, in counties with over 250,000 people, total employment growth was not significantly affected, and most sectoral effects were relatively small. However, leisure and hospitality services were associated with significant positive effects, while federal employment was associated with significant negative effects. On the other hand, in smaller counties, federal employment growth and employment growth in natural resources and mining increased significantly, while employment growth in leisure and hospitality, as well as manufacturing, shrank. As a rule, employment growth increased during the summer the fire occurred in and during autumn, returned to expected growth rates during winter, and dropped below expected growth rates during the next 12-18 months.

Nielsen-Pincus *et al.* (2013) also analysed quarterly county-level employment and earnings growth data from 122 western US counties affected by 346 wildfires during 2004-2008. By using generalised autoregressive conditional heteroskedasticity (GARCH) models and controlling for state growth and suppression spending, the authors found that employment and average wages increased during the quarter the wildfire occurred in. At the county-level the wildfire effects depended on population size and sectoral specialisation. For instance, counties with smaller population, specialising in recreation activities, exhibited an increase in employment growth, while service-specialised counties faced a decrease in employment growth. Moreover, employment and average wage volatility increased in the year following the fire as seasonal fluctuations were amplified. By and large, this loss-and-gain cycle was repeated for a second year to a lesser (and sometimes non-significant) magnitude.

Davis *et al*. (2014) used quarterly employment and wage data, as well as qualitative interview information, to study the effects of large wildfires that occurred in 2008 in Trinity County, California. The authors used a GARCH model to estimate employment and wage growth rates and volatility, and found that employment and wage growth rates increased more than expected during the fire period, but the effects varied across sectors. For instance, employment growth in the government sector was not affected, while average wage growth declined in the natural resource sector during wildfires. For the most part, the interviews confirmed the outcomes of the empirical analysis.

With these techniques and findings in mind –findings regarding diverse, predominantly short-term sectoral reactions and comparisons between places that were affected by wildfires and places that were not- we turn to the situation in the Peloponnese –a different part of the world– to study the economic impact of large fires through a different *lens*. The available data allow the consideration of several factors on an annual basis (from year to year), i.e., from a medium-term perspective, albeit lacking disaggregated qualitative and suppression/restoration cost elements, and monthly or quarterly frequency that permit the kind of empirical analysis carried out in the aforementioned literature. So, a new approach, one that exhibits high model fitness, has been devised.

Next, in order to better fill in the reader, we proceed with a description of the region and of the 2007 wildfires.

3. Background information

Situated at the edge of southeastern Europe, on the southernmost part of continental Greece, the Peloponnese (i.e., Greek for the "Island of (ancient king) Pelops") is home to 1.0 to 1.1 million people (according to the 2011 and the 2001 *Censuses*, respectively), spans an area of 21.4 thousand square kilometers (8.3 thousand square miles), is joined to the mainland by bridges at two places (one at the isthmus of Corinth, another at the Rion-Antirrion strait), and connected to nearby islands, the mainland, and Italy by ferries operating from several ports (north, south, east and west).

The terrain is dominated by high mountain-ranges, small valleys traversed by rivers, narrow coastal strips[1], and a very jagged coastline that extends for 1.4

1. Specifically: 48.3% of the area is situated at an elevation of over 800 meters (hereinafter referred to as *mountainous*), another 25.3% is below 800 meters featuring altitudinal differences of 300 meters or less (hereinafter referred to as *flat lowland*), while the remaining 26.4% is below 800 meters and features rather large altitudinal differences (hereinafter referred to as *intermediate/hilly terrains*).

thousand kilometers. These natural features greatly fragment the area into a host of tiny places[2] which, for the purpose of our analysis, will be studied at the disaggregated level in terms of 158 districts. Of these districts, the city of Patras (in the prefecture of Achaea) hosts 15.4 to 16.7% of the population (according to the 2001 and the 2011 *Censuses*, respectively); the other administrative (prefectural) seats, namely, Corinth (in Corinthia), Tripolis (in Arcadia), Kalamata (in Messenia), Sparta (in Laconia), Pirgos (in Ilis), Nafplion (in Argolis), and two towns with over 20-25 thousand people each (Aegion in Achaea, Argos in Argolis), host 19.6-21.0% of the population; another 149 smaller districts host over 62% of the population. For the sake of brevity, in the pages that follow, Corinth, Tripolis and Kalamata will be referred to as *districts A*, and the six towns listed after them as *districts B*.

At the time of the fires, Kalamata and Tripolis were linked to Corinth (and, from Corinth, to Greece's capital, Athens) via a newly-built multilane highway, route A7, while the city of Patras and Aegion were linked to Corinth via an older, narrower highway, route A8[3]. Two main roads near Tripolis connected Sparta and Argos-Nafplion to route A8, and two main roads at either end of route A8 linked up Pirgos and the UNESCO world heritage sites of ancient Olympia (in the west) and ancient Epidaurus (in the east). Of these, ancient Olympia was narrowly saved from the wildfires, as will be discussed below.

The wildfires consisted of a series of forest fires which erupted on (a) July 17th-18th 2007 in the north-eastern part of the region (namely, the prefecture of Corinthia), (b) July 23rd in the north (the prefecture of Achaea), and (c) August 24-25th along a belt which, by and large, runs from the north-eastern to the south-western part of the region (across the prefectures of Ilis, Arcadia, Messenia, Laconia). The flames spread and by the time they were put out (early September) had devastated 8% of the Peloponnese: 9% of its forest and bush territories, 8% of its agricultural land and 4% of its other (mostly inhabited) places (WWF, 2007; Gitas *et al.*, 2008; Athanasiou and Xanthopoulos, 2010). See Map 1. At the same time, news of 49 people dead and images of the destruction sparked an outpour of sympathy for those who survived. To address the immediate needs of the latter, the Greek Government (2007) issued an instant relief allowance of 3,000 euro to each family affected, a higher allowance to large families, additional compensation for the immediate replacement of lost crops, animals, household and other belongings, for irreparable injuries, etc., while individuals, corporations, foreign governments also helped with reconstruction projects and donations.

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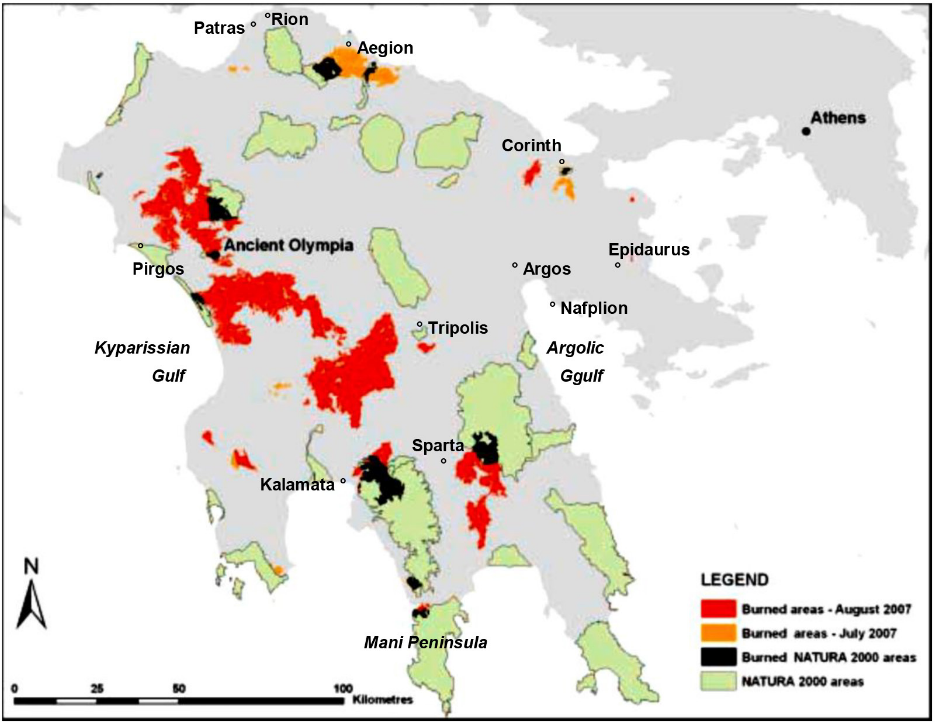
2. The same landscape gave birth to the patchwork of city-states and self-governing tribes of classical antiquity, and a mosaic of jurisdictional cantons in early modern times. Prodromidis (2010) finds very little inter-municipal commuting flows outside the urban centres of Patras, Corinth, Tripolis, Kalamata and their immediate surroundings.
3. The old A8 route was replaced by a newly-build multilane highway ten years later.

Map 1. The extent of the forest fires of July and August 2007 in the Peloponnese



Note: The Natura 2008 areas are breeding and resting sites for rare and threatened species.
Source: Gitas (2008), used with permission.

To put some of these figures in context: (a) In the course of the twenty years that preceded the fire, land used for agriculture had risen from 43% to 46% of the total, at the expense of forest and bush lands, which had shrunk from 11% to 10% and from 44% to 42%, respectively (WWF, 2012). (b) In the years after the fire, both grassland and cropland areas recovered quickly, while areas with widely spaced trees and forests recovered at a much slower pace (Rahman, 2014). (c) The effects on economic activity are not easily discernible at the (fairly aggregated) territorial level at which most statistics are usually collected, since: (i) The labor force and other state-of-the-economy surveys are conducted at a supra-prefectural scale. (ii) Six out of the region's seven prefectures comprise localities that lie in the actual path of the flames, as well as places that do not, while in all but one prefecture GDP figures per capita continued to grow and did not decrease prior to 2009 (i.e., the time that the Greek economy as a whole entered a recession period). See Table 1. (iii) The decline in population figures detected between the *Censuses* of 2001 and 2011, cannot be directly or exclusively attributed to the wildfires. Other prefectures in Greece, not affected by wildfires, experienced steeper reductions compared to the Peloponnese[4]. See Tables 2a and 2b. (iv) According to Greek Revenue Service (GRS) records, in the course of 2001-10, both the number of income-filers and the average level of declared personal income (the product of which comes to the overall amount of nominal personal income) in all seven prefectures increased.

Table 1. The evolution of per capita GDP in current prices in the Peloponnese (change %)

Territorial units	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11*
Achaea pref.	6	8	9	9	2	14	4	1	-5	-1	-9
Argolid pref.	13	11	7	1	6	11	7	3	-1	-7	-10
Arcadia pref.	4	6	11	6	2	14	5	-3	5	-7	-10
Ilis prefecture	14	8	9	1	4	7	8	2	-3	2	-8
Korinthia pr.	8	0	8	1	3	7	6	7	-5	-7	-4
Laconia pref.	8	7	6	6	-1	8	8	1	1	-7	-6
Messenia pr.	8	3	10	4	7	10	7	2	0	-4	-4
Peloponnese	9	7	9	5	3	10	6	2	-3	-2	-8
Greece	7	6	10	8	3	9	7	4	-2	-4	-8

* Provisional data *Source:* Hellenic Statistical Authority (ELSTAT), own calculations.

Table 2a (left). Changes in population figures between 2001 and 2011 in the Peloponnese

Territorial units	Usual residents	
	thousands	%
Achaea pref.	-9	-3
Argolis pref.	-5	-5
Arcadia pref.	-5	-5
Ilis pref.	-24	-13
Corinthia pref.	1	0
Laconia pref.	-4	-4
Messenia pref.	-7	-4
Peloponnese	-53	-5
Greece	-118	-1

Table 2b (right). Changes in population figures between 2001 and 2011 in other Greek prefectures with population drops in excess of 11 thousand people, i.e., 7%

Territorial units	Usual residents	
	thousands	%
Athens (in Attiki)	-164	-6
Pireaus (in Attiki)	-30	-5
Serre (in Central Macedonia)	-18	-9
Fthiotis (in Central Greece)	-11	-7
Arta (in Epiros)	-6	-8
Kilkis (in Central Macedonia)	-6	-7

Source: ELSTAT, own calculations.

4. In the ten-year period between the censuses, the fire-stricken Ilis, in the west (where ancient Olympia is located), experienced a 13% reduction in population (the highest in the country), neighboring Arcadia (in its east), the fire-free Argolis (in the east), and the Peloponnese as a whole experienced a 5% reduction. At the same time, in considerable distance north of the Peloponnese, the prefectures of Arta, Fthiotis (where a minor fire was reported on August 26th), Kilkis and Serre experienced reductions in excess of 7%.

4. Available data

To properly investigate the matter, one needs disaggregated observations. To the extent that the international scholarship, by and large, attributes the effects of large wildfires on (a) people's average wages or incomes, and (b) employment or earner numbers to the size of local population and workforce-related features, merging the GRS and *Census* data provides a solution. The former data contain information on the evolution of the two components of personal income, number of income-filers and average income (i.e., the likely regressands), are annual, solicited at the postal-district level, and are associated with minor policy shifts in personal income taxation rules[5]. The latter data contain information on the terrain (flat/lowland, mountainous, intermediate/hilly), the demographics, the concentration and distribution of the population, as well as the sectoral composition of the workforce (i.e., the likely regressors), are organised in terms of rural and urban municipalities[6], and are updated every ten years.

Matching up the two datasets yields 158 amalgamated spatial units or districts[7]. Of these districts, 69 were damaged, either partially or completely, in the 2007 wildfires. This means that 69 of the 158 observations concern either damaged areas (communities) or damaged and undamaged communities, while the remaining observations concern undamaged communities only. Each community is either urban (containing one or more points with concentrations of 2,000 people or more) or rural (consisting of smaller or no such concentration points), situated either at high or low or intermediate elevation, and features an initial male and female workforce with a specific sectoral composition (for instance, 40 men and 25 women involved in agriculture, 30 men and 10 women involved in manufacturing, and so on, at the time of the 2001 *Census*).

The basic features of the damaged and undamaged districts in terms of (a) their natural settings, initial population densities and working population compositions, as well as (b) their initial working population and income-filing population numbers, and the evolution of their income-filing population numbers and of average incomes over time are provided in Tables 3a and 3b, respectively.

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5. Mainly involving an increase of threshold exemptions in 2004. Ceteris paribus, a rise in income-exemption levels ought to affect a fall in the number of income-filers and declared incomes, and may explain the findings regarding 2004, reported in the second paragraph of Section 7.
6. The city of Patras and the town of Kalamata contain several postal districts. Each of the remaining postal districts consists of rural communities (each with a population of fewer than two thousand inhabitants) and/or urban municipalities.
7. Securing a fair number of observations across space allows for a more thorough empirical examination in terms of explanatory variables within an acceptable range of degrees of freedom (e.g., Tabachnick and Fidell, 1989; Bartlett *et al.*, 2001).

Table 3a. Districts in the Peloponnese, damaged and undamaged by the 2007-fires, in terms of their natural setting features, initial (2001 census) population density, gender and sectoral working population distribution vectors (in shares, %)

	Damaged districts: 69					Undamaged districts: 89				
	Min	Max	Median	Mean	St.Dev.	Min	Max	Median	Mean	St.Dev.
Geography (consists of)										
Flat lowlands	0	100	**77**	**59**	40	0	100	**4**	**28**	38
Hilly country	0	92	**8**	**19**	24	0	100	**11**	**29**	36
Mountainous	0	100	**6**	**23**	34	0	100	**31**	**44**	43
Pop. density										
Urban	0	100	**40**	**36**	36	0	66	**0**	**4**	14
Rural	0	100	**60**	**64**	36	34	100	**100**	**96**	14
Working pop.										
Male	59	76	66	66	3	53	78	66	67	5
Female	24	41	34	34	3	22	46	34	33	5
Agriculture,etc.	2	73	42	42	17	4	82	45	45	17
Fishing, etc.	0	13	0	0	2	0	10	0	1	2
Mining, etc.	0	2	0	0	0	0	3	0	0	0
Manufacturing	0	19	4	6	3	2	19	5	5	3
Electricity, etc.	0	26	1	2	4	0	19	0	1	2
Construction	2	18	8	8	3	2	27	8	9	5
Trade, etc.	3	20	9	9	4	2	17	7	7	3
Hotels, etc.	1	11	4	4	2	1	27	4	5	4
Transport, etc	1	9	4	4	2	1	12	5	5	2
Financ. interm.	0	3	1	1	1	0	3	1	1	1
Real estate, etc.	1	6	3	3	1	0	6	2	2	1
Public admin.	1	12	5	5	2	1	14	5	5	3
Education	0	3	10	4	2	0	3	9	3	2
Health, etc.	0	8	2	2	1	0	7	2	2	1
Other services	0	5	2	2	1	0	9	2	2	1
Household act.	0	4	1	1	1	0	3	1	1	1
Extra-territorial	0	0	0	0	0	0	0	0	0	0
Unknown act.	0	18	5	6	4	1	35	5	6	5
Part damaged in 2007	0.4	100.0	7.8	25.5	31.6					

Note: **Bold** denotes cases in which the two groups on average (median compared to median, mean compared to mean) vary by 3 percentage points or more.

Source: See Table 1.

Table 3b. The 158 districts of the Peloponnese in terms of their initial working population and income-filing population sizes, and the evolution of their income-filing population figures during 2001-10

Number of districts		Initial size (2001) of the working pop. average (1)	income-filing population average (2)	min (3)	max (4)	Five patterns of change in terms of income-filing pop. 2001-4 (5)	2004-7 (6)	2007-10 (7)
1	not damaged	3,630	4,811	4,811	4,811	↓	↓	↓
54	not damaged [i]	1,705	1,781	103	17,130[a]	↑	↓	↓
28	damaged [ii]	4,240	4,598	88	19,241[b]	↑	↓	↓
23	not damaged [iii]	846	855	36	3,865	↑	↓	↑
3	not damaged [iv]	538	750	122	1,409	↑	↓	–
21	damaged [v]	1,023	1,190	84	4,967	↑	↓	↑
5	not damaged	628	620	231	1,558	↑	↑	↓
11	damaged [vi]	709	674	55	2,135	↑	↑	↓
3	not damaged	1,667	1,402	832	2,227	↑	↑	↑
9	damaged	14,816	17,684	496	95,123[c]	↑	↑	↑

Notes: Drops in average incomes were witnessed only in 2001-4, involving, in the cases under item (i) 13 districts, (ii) 7 districts, (iii) 6 districts, (iv) 1 district, (v) 3 districts, (vi) 3 districts.

The largest districts in terms of initial income-filing population figures were as follows: Under item (a) Tripolis and 2nd largest: Sparta (12,845). Under item (b) Argos and 2nd largest: Pirgos (17,661). Under item (c) Patras and 2nd largest: Kalamata (31,392).

Sources: ELSTAT (column 1), GRS (other columns), own calculations.

The numbers suggest that: Between 2004 and 2007 (and/or between 2007 and 2010), most districts with communities that would be (or were) damaged in the 2007 wildfires experienced reductions in their income-filing population figures. However, many more non-damaged districts exhibited the same pattern. One third of damaged districts and one fifth to a quarter of districts that were not damaged experienced reductions in average income levels between 2001 and 2004 (i.e., some time prior to the fires), but not after that. On average, the districts damaged in the fires were more urban and situated at a lower elevation compared to those that were not damaged in the fires; however, their initial working population structure was quite similar in terms of gender composition and sectoral orientation, consisting mostly of men (66-67%), engaging primarily in agriculture (42-45%).

Since this does not say much about the sources of income variation in the two sets of districts over time (before and after the fires), we turn to econometrics through which we estimate/isolate, year after year, the increased or reduced impact of every aspect for which data exist. Basically, we consider and compare the effects of all possible combinations of (a) urban or rural, (b) lowland, mountainous or intermediate (c) male or female, (d) NACE 1.1 sectoral workforce inputs[8], and (e) damaged or undamaged areas. We call these *elements z* for short. The same or similar elements are routinely used as explanatory variables (regressors) in econometric analyses of personal earnings, average household incomes, per capita GDP, median household income growth and the like (e.g., Schofield, 1975; Miles, 1997; Bhatta and Lobo, 2000; Aronson *et al.*, 2001; Prodromidis, 2006; Gebremariam *et al.*, 2012; the sources cited therein).

5. Methodological issues

Understandably, the presence of regressors that do not vary over time limits the ability to carry out typical panel data analyses on either component of personal income in a fixed effects and (more or less) in a random effects setting[9]. In particular, the fixed effects analysis cannot be carried out (consequently, the Hausman test cannot be performed) and the random effects analysis can only be carried out in a very limited form (see Appendix 1). At the same time, the attempt to explain (analyse) the two regressands and their annual changes over time via pooled longitudinal and cross-sectional data in a difference-in-difference mindset, with the aim of estimating (comparing) the autonomous and time-variant effects in the fire-damaged and other areas before and after the 2007 fires, turns out to produce equivalent or inferior fits compared to cases in which the regime-switching event occurs a year or two earlier: in 2005 or 2006 (see Appendix 2). With these limitations and thoughts in mind, and recognising the need to keep an eye on the changing impact of the factors considered, we turn to a series of cross-sectional analyses (regressions) –one for every year for the period under examination– and compare the parameters estimated from one year to the next. Thus, we are able to work out each factor's impact over time in damaged and undamaged communities, and identify shifts before or after the fires. As we shall see in the analysis, all regressions exhibit high levels of econometric model fitness.

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8. The *Nomenclature statistique des Activités économiques dans la Communauté Européenne* 1.1 is the four-level sectoral classification of economic activities that was applicable in the European Union at the time the 2001 census results were published. The categories were: (a) agriculture, hunting and forestry; (b) fishing; (c) mining and quarrying; (d) manufacturing; (e) electricity, gas and water supply; (f) construction; (g) trade (wholesale and retail) and repair of motor vehicles, motorcycles and personal and household goods; (h) hotels and restaurants; (i) transport, storage and communication; (j) financial intermediation; (k) real estate, renting and business activities; (l) public administration, defense, and compulsory social security; (m) education; (n) health and social work; (o) other community, social and personal service activities; (p) activities of households (e.g., domestic staff); (q) extra-territorial organisations and bodies. For the purpose of the analysis, this means 18 sectors plus vague responses.
9. The regressands (i.e., the number of income-filers and average income) are in time-series form, while the regressors (altitudinal features, spatial dummies, the initial population and workforce concentration characteristics) are not.

The initial composition of the working population, in terms of demographic, sectoral, residential (in damaged or undamaged communities) and other characteristics, is provided in Table 4 (starting from the top white part, moving to the right, then the bottom light gray part and moving to the right):

1) 1.21% consisted of (i) men engaging in manufacturing activities and living in (subsequently) damaged urban hilly areas; or engaging in construction activities and living in undamaged urban hilly areas; or engaging in agriculture, hunting, forestry, electricity, gas and water supply activities and living in undamaged rural lowland areas; or engaging in financial intermediation and living in undamaged rural hilly areas; (ii) women engaging in household activities and living in (subsequently) damaged rural hilly areas, or engaging in hotel and restaurant activities and living in undamaged urban lowland areas; and (iii) men and women living in mountainous urban areas: All attached to (or being part of) Patras or the region's other main towns mentioned in Section 3.
2) 40.79% consisted of the remaining population living in the undamaged areas of Patras or the other main towns (*districts A* and *B*).
3) 5.93% consisted of the remaining population living in the damaged areas of Patras or the other main towns.
4) 2.82% consisted of the counterparts of those listed under items (i)-(iii), living in the rest of the Peloponnese; 41.37% consisted of the remaining population living in the undamaged areas of the rest of the Peloponnese; and 7.88% consisted of the remaining population living in the damaged areas of the rest of the Peloponnese. The rest of the Peloponnese comprises: (a) five districts near Patras, Corinth, and between Tripolis and Kalamata (*districts C*, hereinafter)[10], (b) 33 districts forming a belt around Patras and the main towns (*districts D*)[11], (c) eleven districts forming clusters or strings of localities by the south Kyparissian Gulf, the west Argolic Gulf, and on the Mani Peninsula[12], which exhibited differentiated effects compared to other places in the empirical analysis (*districts E*), and (d) the remaining districts.

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10. Namely, Vrachneika (in Achaia), Ancient Corinth, Isthmia (in Corinthia), Megalopolis, Dirachion-Leontation (in Arcadia).
11. These include ancient Epidaurus, Ligourion, Nea Kios, Tolon (in Argolis), Athikia, Kiaton, Likoporia, Perigialion, Pitsa, Sofikon, Velon, Xilokastron, Zevgolation (in Corinthia), Akrata, Diakopton, Kamares, Kalavrita, Kato Achaea, Sageika (in Achaea), Varda (in Ilis and Achaea), Amalias, ancient Olympia, Avdravis, Katakolon, Kilini, Lehena, Vartholomion (in Ilis), Dimitsana, Eleohorion, Isaris, Lagkadia, Stemnitsa, Vitina (in Arcadia).
12. The first involves Zaharo (in Ilis), Dorion, Gargaliani, Kiparissia and Psarion (in Messenia). The second consists of Astros-by-the-sea (in Arcadia). The third involves Areopolis, Gerolimen, Githion, Kotronas and Pirgos-by-Diros (in Laconia).

Table 4. The distribution (in %) of the initial (2001 census) workforce in the Peloponnese across the sectors and types of districts which appear to affect the fitness of the income-filing population and average income functions the most

	male workforce (wf) in					female wf in		male and female wf in			
	Agricul. at RF areas	Constr. at UH areas	Manuf. at UHD areas	Finan. at RH areas	Electic. etc. at RF areas	Hotels etc. at UF ar.	Hholds at UH areas	UM not D areas	UM D areas	elsewhere not D areas	elsewhere D areas
1. Patras	0.01	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	18.58	0.00
2. Towns along route A7 [a]	0.08	0.00	0.16	0.00	0.00	0.08	0.00	0.00	0.00	7.44	5.13
3. Other main towns [b]	0.49	0.00	0.00	0.00	0.01	0.15	0.00	0.00	0.00	14.77	0.80
4. Five districts near 1 and 2[c]	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.58
5. Belt adjacent to 1-4 [d] and three formations [e]	0.89	0.03	0.00	0.01	0.01	0.08	0.00	0.00	0.10	15.88	3.48
6. Other places	1.35	0.12	0.02	0.01	0.03	0.02	0.00	0.15	0.00	24.29	3.81

Notes: R: rural. U: urban. F: flat lowlands. H: hilly/intermediate terrain. M: mountainous terrain. D: damaged in the 2007 fires. A district may consist of R and/or U, F and/or H and/or M, D or other parts.

[a] Districts A (see Section 3). [b] Districts B (see Section 3). [c] Districts C (see fn. 10) .
[d] Districts D (see fn. 11). [e] Districts E (see fn. 12).

Source: See Table 1.

6. Modeling strategy

As already mentioned, the empirical analysis is carried out through a series of cross-sectional analyses due to the nature of the available data. In this, the two components of people's overall personal income, Y, reported across districts, are explained in terms of the factors mentioned at the end of Section 4 (see *elements z*). Besides these factors, the only other piece of information that is both available at the disaggregated level and suited to explain Y, takes the form of categorical (dummy) variables that capture the administrative and transportational nodes discussed in Section 3 or denote the spatial formations mentioned at the end of Section 5 (*element x*, hereinafter).

For the two sets of *elements* to satisfy a basic assumption regarding regressor independence, x and z are made orthogonal to each other. (See Zeller, 1974; Gujarati, 1995.) In essence, instead of regressing Y or its components on arguments x and z, z (the continuous portion) is first regressed on x (the categorical portion), then a z' is predicted, and a *residual* $\zeta = z - z'$, orthogonal (hence, entirely independent) to x, is estimated. Thus, Y or its components may be explained in terms of x and ζ at any given time, *t*, *t+1*, *t+2* etc[13]. In shorthand functional form notation:

$$Y_{t+k} = Y(x_t, \zeta_t) \quad (1)$$

where *t* refers to 2001 and *k* takes values from 0 to 9.

To the extent a district's *Y* is equivalent to the product of its mean, *y*, times the size of the income-declaring population, *n*, it is probably reasonable to study the initial and subsequent levels of *y* and *n* both before and after the fires, in terms of the same explanatory variables:

$$n_{t+k} = n(x_t, \zeta_t), \quad (2)$$
$$y_{t+k} = y(x_t, \zeta_t). \quad (3)$$

Thus, the two components of Y observed over the years will be studied/explained in terms of vectors pertaining to 2001. This means that each of the *n*'s and *y*'s observed in 2001, 2002, and the other years of the period under examination, will be regressed separately on groupings of *x* and *ζ* dating to 2001. In theory, explaining phenomena in terms of earlier data is quite acceptable. Here, the specification (i.e., the grouping of elements *x* and ζ) in each of the two equations will be allowed to vary so as to best fit the data.

For the sake of explaining the respective results of the two expressions in terms of people and euro, rather than in terms of elasticities and semi-elasticities, a simple linear arrangement will be adopted; and, in order to address heteroscedasticity concerns, the econometric analysis is performed within a robust standard errors framework.

In the interest of brevity, only explanatory variables (regressors or characteristics) that improve the econometric goodness of fit the most are taken into account. The other variables or characteristics generally exhibit lesser (similar to one other) effects; so, with negligible loss of information, the following are grouped together: spatial categorical variables with spatial categorical variables, workforce composition variables with workforce composition variables. Consequently, the expression (regression) concerning the size of the income-filing population, *n*, is found to depend very much on ten regressors, and the expression regarding the average level of personal income, *y*, if found to depend on eleven regressors. One regressor (namely, the initial number of men living in undamaged, hilly, urban areas who engaged in construction) is common in both regressions, while the other regressors vary.

13. The technique is employed in a multitude of analyses across disciplines (e.g., Kentor, 2001; Cutright *et al.*, 2006, 2007; Jaeger, 2010; Cohen-Goldberg, 2012; Riley, 2012; Bradford and Stoner, 2014). In this setting, when the empirical analysis is carried out, only workforce regressors are modestly correlated with each other ($|r|<15\%$ in Table 5, $|r|<25\%$ in Table 6). In Table 6, elements x_t correspond to the top four regressors, and element ζ_t to the other regressors. In Table 5, elements x_t correspond to the top three regressors, and element ζ_t to the other regressors. (Due to the presence of high r's between the ultimate and penultimate regressors and the other five workforce regressors considered in Table 5, the ultimate and penultimate regressors are made orthogonal to the other five workforce regressors as well).

It turns out that the factors which are important for 2001 are also important for 2002, 2003, and following years (i.e., both before and after the fires); besides, regression fitness does not change much from year to year: all R^2s are in the 98-99% range, and adjusted R^2s are lower by no more than a decimal. The estimated coefficients and p-values are provided in Tables 5 and 6; however, to the extent the data involve the entire population rather than a sample of districts, the need to turn to p-values and estimate measures of the recovered coefficients' statistical closeness to the parameters observed in the population probably diminishes.

Table 5. Econometric regressions with robust standard errors of each year's number of income-filers in the 158 districts of the Peloponnese, 2001-10

	2001		**2002**		**2003**		**2004**		**2005**	
Explanatory variables	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values
City of Patras	93,711	0.00	95,331	0.00	96,240	0.00	101,467	0.00	100,416	0.00
Main towns	16,711	0.00	17,151	0.00	17,395	0.00	19,257	0.00	18,705	0.00
Other places	1,412	0.00	1,452	0.00	1,457	0.00	1,655	0.00	1,593	0.00
Initial male pop. in										
• Agricult. at RFN	4	0.00	4	0.00	4	0.00	5	0.00	5	0.00
• Constr. at UHN	15	0.00	16	0.00	16	0.00	17	0.00	17	0.00
• Manufact. at UHD	13	0.00	13	0.00	13	0.00	15	0.00	15	0.00
• Financial at RHN	195	0.00	205	0.00	208	0.00	234	0.00	224	0.00
Initial female pop. in										
• Hotels etc. at UFN	49	0.00	51	0.00	52	0.00	57	0.00	56	0.00
Other pop. in										
• Undamaged areas	1	0.00	1	0.00	1	0.00	1	0.00	1	0.00
• Damaged areas	1	0.00	1	0.00	1	0.00	1	0.00	1	0.00
Model fit (R^2)	*99.7%*		*99.7%*		*99.7%*		*99.7%*		*99.7%*	

	2006		**2007**		**2008**		**2009**		**2010**	
Explanatory variables	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values
City of Patras	101,567	0.00	102,470	0.00	103,395	0.00	104,067	0.00	103,645	0.00
Main towns	18,863	0.00	19,119	0.00	19,254	0.00	19,345	0.00	19,265	0.00
Other places	1,594	0.00	1,608	0.00	1,610	0.00	1,613	0.00	1,601	0.00
Initial male pop. in										
• Agricult. at RFN	5	0.00	5	0.00	5	0.00	5	0.00	4	0.00
• Constr. at UHN	17	0.00	17	0.00	17	0.00	17	0.00	17	0.00
• Manufact. at UHD	15	0.00	15	0.00	15	0.00	16	0.00	16	0.00
• Financial at RHN	226	0.00	232	0.00	235	0.00	239	0.00	234	0.00
Initial female pop. in										
• Hotels etc. at UFN	57	0.00	57	0.00	57	0.00	58	0.00	58	0.00
Other pop. in										
• Undamaged areas	1	0.00	1	0.00	1	0.00	1	0.00	1	0.00
• Damaged areas	1	0.00	1	0.00	1	0.00	1	0.00	1	0.00
Model fit (R^2)	*99.7%*		*99.7%*		*99.7%*		*99.7%*		*99.7%*	

Notes: R: rural. U: urban. F: flat lowlands. H: hilly/intermediate terrain. M: mountainous terrain. D: damaged in the 2007 fires. N: not damaged in the 2007 fires. Districts are heterogeneous: with R and/or U, F and/or H and/or M, D or other parts. All parts were considered. The 4th-8th regressors are orthogonal to the top three regressors, and the two bottom regressors are orthogonal to all previous regressors. Since categorical variables were specified for all places, the regressions were estimated without a constant. Ramsey's regression equation specification error test suggests an absence of relevant variables at the 1% error probability level.

Table 6. Econometric regressions with robust standard errors of each year's average income (in euro) in the 158 districts of the Peloponnese, 2001-10

	2001		**2002**		**2003**		**2004**		**2005**	
Explanatory variables	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values
Patras; districts A, C	12,364	0.000	13,228	0.000	13,771	0.000	13,822	0.000	15,181	0.000
Districts B	10,887	0.000	11,535	0.000	11,795	0.000	11,670	0.000	12,937	0.000
Districts D, E	9,429	0.000	9,946	0.000	10,309	0.000	10,294	0.000	11,456	0.000
Other places	7,512	0.000	7,964	0.000	8,173	0.000	7,878	0.000	8,941	0.000
Male pop. in										
• Electr. etc.at RFN	92	0.000	95	0.000	106	0.000	99	0.000	108	0.000
• Constr. at UHN	9	0.000	9	0.000	9	0.000	10	0.000	11	0.000
Female pop. in										
• Households at UFD	247	0.000	265	0.000	285	0.000	317	0.000	343	0.000
Pop. in UMN	-0	0.099	-0	0.099	-0	0.055	-1	0.000	-0	0.001
in UMD	0	0.003	1	0.000	0	0.040	-0	0.009	-0	0.543
elsewhere N	0	0.958	-0	0.996	-0	0.760	0	0.679	-0	0.899
elsewhere D	0	0.181	0	0.350	0	0.614	0	0.650	0	0.912
Model fit (R^2)	*99.1%*		*99.1%*		*99.1%*		*98.9%*		*99.1%*	

	2006		**2007**		**2008**		**2009**		**2010**	
Explanatory variables	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values
Patras; districts A, C	16,170	0.000	17,308	0.000	18,113	0.000	18,684	0.000	20,732	0.000
Districts B	13,791	0.000	14,707	0.000	15,328	0.000	15,677	0.000	18,116	0.000
Districts D, E	12,157	0.000	13,074	0.000	13,503	0.000	13,815	0.000	16,055	0.000
Other places	9,547	0.000	10,268	0.000	10,812	0.000	11,040	0.000	13,729	0.000
Male pop. in										
• Electr. etc. at RFN	117	0.000	121	0.000	119	0.000	124	0.000	111	0.000
• Constr. at UHN	12	0.000	12	0.000	12	0.000	11	0.000	12	0.000
Female pop. in										
• Households at UFD	355	0.000	390	0.000	423	0.000	448	0.000	400	0.000
Pop. in UMN	-0	0.180	-0	0.004	-0	0.101	-0	0.248	-0	0.014
in UMD	0	0.961	-0	0.364	0	0.136	0	0.126	0	0.797
elsewhere N	-0	0.671	-0	0.528	-0	0.428	-0	0.289	-0	0.353
elsewhere D	0	0.999	-0	0.846	-0	0.657	-0	0.528	-0	0.917
Model fit (R^2)	*99.1%*		*99.1%*		*99.1%*		*99.1%*		*99.5%*	

Notes: R: rural. U: urban. F: flat lowlands. H: hilly/intermediate terrain. M: mountainous terrain. D: damaged in the 2007 fires. N: not damaged in the 2007 fires. Districts are heterogeneous: with R and/or U, F and/or H and/or M, D or other parts. All parts were considered. The 5th-11th regressors are orthogonal to the top four regressors. Since categorical variables were specified for all places, the regressions were estimated without a constant. Ramsey's regression equation specification error test suggest the equations have no omitted variables at the 1% error probability level.

7. Empirical findings

It appears that a small number of factors suffices to explain a good part of the overall variation year after year, while there is no inordinate change in the sizes of the estimated coefficients for the years following the fires (2007-08 and 2008-09), particularly in areas damaged by the fires. (See also Table 7: it consolidates the information of Tables 5 and 6.)

Table 7. The results of Tables 5 and 6 in terms of changes detected from year to year, 2001-10

Income-filer numbers	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10
City of Patras	1,620	909	5,227	-1,051	1,151	903	925	672	-422
Main towns	440	244	1,862	-552	158	256	135	91	-80
Other places	40	5	198	-62	1	14	2	3	-12
Initial male pop. in									
• Agricult. at RFN	0	0	1	0	0	0	0	0	-1
• Constr. at UHN	1	0	1	0	0	0	0	0	0
• Manufact. at UHD	0	0	2	0	0	0	0	1	0
• Financial at RHN	10	3	26	-10	2	6	3	4	-5
Initial female pop. in									
• Hotels etc. at UFN	2	1	5	-1	1	0	0	1	0
Other pop. in									
• Undamaged areas	0	0	0	0	0	0	0	0	0
• Damaged areas	0	0	0	0	0	0	0	0	0
Average incomes	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10
Patras; districts A, C	864	543	51	1,359	989	1,138	805	571	2,048
Districts B	648	260	-125	1,267	854	916	621	349	2,439
Districts D, E	517	363	-15	1,162	701	917	429	312	2,240
Other places	452	209	-295	1,063	606	721	544	228	2,689
Initial male pop. in									
• Electr. etc. at RFN	3	11	-7	9	9	4	-2	5	-13
• Constr. at UHN	0	0	1	1	1	0	0	-1	1
Initial female pop. in									
• Households at UFD	18	20	32	26	12	35	33	25	-48
Other pop.									
• in UMN	*0*	*0*	-1	1	*0*	0	*0*	*0*	*0*
• in UMD	1	*-1*	0	*0*	*0*	*0*	*0*	*0*	*0*
• elsewhere N	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
• elsewhere D	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Notes: R: rural. U: urban. F: flat lowlands. H: hilly/intermediate terrain. M: mountainous terrain. D: damaged in the 2007 fires. N: not damaged in the 2007 fires. Shades denote reductions in the coefficients of Tables 5 and 6 (from one year to the next). Italics denote effects associated with p-values > 1% in Tables 5 and 6.

Evidently, the populous and densely populated (costly-to-live-in) areas are associated with higher tax-filer numbers and incomes compared to other places, while Patras, the main towns and smaller communities grew during 2001-04 and 2005-09 in terms of income-filer numbers, and more so (in both periods) the rural areas in the hills that initially possessed a relatively large male workforce involved in financial intermediation and were not damaged in the 2007 wildfires. (Hence, the trend probably pre-existed). In addition, average incomes generally increased over time across the region, though small reductions were generally observed:

1) In 2004 in all places but Patras, the three towns situated along *route A7* (*districts A*), and five neighbouring districts (*districts C*) (This was prior to the fires).
2) In a number of communities that were not damaged in the fires: (a) in 2004, 2008 (negligibly) and 2010 in lowland rural areas that initially possessed a relatively large male workforce involved in electricity-gas-water supply, (b) in 2009 (negligibly) in hilly urban areas that initially possessed a relatively large male workforce involved in construction, and (c) in 2004 (negligibly) in mountainous urban areas that initially possessed a relatively large workforce.
3) In a number of communities that were damaged in the 2007 fires: (a) negligibly in 2003-4 (before the fires) in mountainous urban areas that initially possessed relatively large workforces, and (b) in 2010 in lowland urban areas that initially possessed a relatively large female workforce involved in household activities.

In short, there is no apparent evidence of change in income-filer numbers or average income figures reported in the damaged and undamaged areas that may be attributed to the fires.

8. Conclusions

The article engages in a series of cross-sectional econometric analyses to (a) study the evolution of annual personal income in the Peloponnese, in southern Greece, at the disaggregated level (across 158 districts), year after year from 2001 to 2010, and (b) to comprehend the medium-term economic effects of the 2007 wildfires on income-filer figures and average incomes in the burned areas and in the other (unburned) areas in the region operating under the same climatic, commercial or other general conditions. To the best of our knowledge, the incident has not been empirically examined yet. However, the pooled and panel set analyses do not fare well with the data available, while the difference-in-difference approach may be misleading.

The main limitation is that two components of personal income observed over the years (i.e. the number of income-filers and the average level of declared incomes) may only be studied in terms of altitudinal features and other spatial dummies, as well as population and workforce concentration features that do not vary over time but date to 2001 (i.e., are explained in connection with hard-to-change natural settings and the initial population densities and working population compositions of damaged and undamaged areas). Explaining phenomena in terms of earlier data is acceptable. In addition, to isolate the information and effects contained in the categorical variables from the information and effects contained in the other available explanatory variables, the two sets of regressors are made independent from each other. Thus, each factor's impact over time, especially before and after the fires, in both damaged and undamaged communities, is worked out. Interestingly, all regressions are associated with high econometric fitness; and the factors that turn out as important for 2001 are also important for 2002, 2003, and the following years (i.e., both before and after the 2007 fires).

Consequently, the article finds that a small number of spatial features and initial workforce composition elements explain, by and large, the variation observed in the beginning of the period and throughout the decade. In addition, there is no strong evidence of change in income-filer numbers or average income figures reported in damaged and undamaged areas on account of the fires. So, it seems and that either due to the operation of the economy, or the type of damage caused, or government intervention, or the medium-term nature of the data or other reasons, no inordinate drop or rise in average income figures or income-filer numbers is detected in the fires' aftermath, particularly in the communities damaged by the fires. Indeed, for the most part, the patterns observed predate the fires. For instance, throughout the period under consideration, the main urban centres linked via routes A7 and A8, and neighbouring localities, as well as the urban parts of the lowlands with a relatively large initial female population employed in household activities that were damaged in the 2007 fires, generally exhibited higher levels of average income compared to the rest of the region up to 2009.

Though the findings may hold some useful lessons for territorial development policy interventions, we do not press the analysis beyond 2010. By most macroeconomic accounts, by mid-2009, the international, economic and financial crisis reached Greece, adversely affecting two of the country's largest earners, namely, shipping and tourism (inherently sensitive to the contraction of international activity); and once austerity measures were adopted, the whole country entered into deeper recession, upsetting both threshold exemptions and the economic behavior and reactions of those involved.

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Appendix 1. Panel data analyses with fixed and random effects

As the available natural setting, gender, and sectoral information regarding the 158 districts does not vary over time, neither a fixed effects model nor a random effects model of average income and income-filer numbers with a forest-fire dummy is computable within a panel data analysis framework. So, in order to tell the difference before and after the fires, in both damaged and undamaged areas, the data is split into two, and one analysis is performed for the years before the fires, while the other analysis is performed for the years after the fires. All explanatory information is consolidated in two regressors and a trivariate version of a random effects model is estimated. The Breusch-Pagan Lagrange multiplier test justifies the use of random effects in all four parts of the analysis.

The coefficients obtained in the process are provided in Table A1, and suggest that in the post-fire period the estimated effects associated with the damaged areas are higher than the effects associated with the undamaged areas as compared to the pre-fire period. Though not a definitive proof of a reaction or a shift attributed to the fires, the findings are not incompatible with the argument.

Table A1. Random effects panel analyses with robust standard errors across 158 districts of the Peloponnese during 2001-10

	Figures declared before the fire (2001-06)				Figures declared after the fire (2007-10)			
	Number of income filers		Average income		Number of income filers		Average income	
Explanatory variables	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values	coeffi-cients	p-values
Constant	-320.28	0.00	9,090.09	0.00	-347.32	0.00	12,380.67	0.00
Initial working pop. in D areas	1.30	0.00	0.24	0.00	1.53	0.00	0.27	0.00
Initial working pop. in N areas	1.31	0.00	0.11	0.00	1.37	0.00	0.13	0.00
Overall R^2	*99.2%*		*16.5%*		*99.4%*		*13.6%*	
Wald X^2	*16,968.13*		*52,65*		*18,515.74*		*42.26*	
Prob. > Wald X^2	*0.00 %*		*0.00 %*		*0.00%*		*0.00%*	

Notes: Districts are heterogeneous: each containing parts (areas) damaged (D) and/or undamaged (N) in the 2007 fires. All parts were considered. Though reported, the Wald test is of limited use given that it is based on the population rather than a sample.

Appendix 2. Pooled data analyses focusing on the autonomous and time-variant effects of the fires in damaged and undamaged areas

The average local incomes, income-filer numbers and their annual changes are empirically estimated in the difference-in-difference setting described by Card and Krueger (1994), in order to ascertain the patterns before and after the fires in both damaged and undamaged districts across the Peloponnese, while controlling for natural setting, district-specific, gender and sectoral effects.

The recovered coefficients are provided in Table A2, and suggest the presence, initially (in 2001), of:

- A lesser autonomous and a larger time-variant effect on income filing population figures in the districts damaged during the 2007 fires compared to other districts (see col.1, lines 33-37). From 2007 onwards, a lesser autonomous effect in damaged communities (areas) compared to other communities in both damaged and undamaged districts, and a lesser time-variant effect in damaged districts compared to other districts (col.1, lines 38-43).
- A lesser autonomous and a larger -though decreasing- time-variant effect on average incomes in the districts damaged during the fires compared to other districts (col.2, lines 33-37). From 2007 onwards, a larger (lesser) autonomous effect in damaged communities compared to other communities in the same districts (undamaged districts), and a lesser time-variant effect in the damaged districts compared to other districts (col.2, lines 38-43).
- A larger autonomous and a lesser time-variant effect on the annual change of income filing population figures in the districts damaged during the fires compared to other districts (col.3, lines 33-37). From 2007 onwards, a larger autonomous effect in damaged communities compared to other communities in the same districts (col.3, lines 38-43).
- A lesser autonomous and a larger -though decreasing- time-variant effect on the annual change of average income figures in districts damaged during the 2007 fires compared to other districts (col. 4, lines 33-37). From 2007 onwards, a lesser autonomous effect in damaged communities compared to other communities in the same districts, and a lesser time-variant effect in damaged districts compared to other districts (col.4, lines 38-43).

However, the importance of the fires is tempered by the presence of superior econometric fits in regressions regarding annual changes in the number or income filers (NIF) and average incomes (AI), under slightly earlier regime switches: that is, if the categorical variable associated with the presumed regime switch were moved to 2006 (for NIF) or 2005 (for both NIF and AI). See Table A3.

Table A2. Econometric regressions with robust standard errors on the evolution of the income filing population and of average income in the 158 districts of the Peloponnese during 2001-10

	Explanatory variables	Number of income filers (NIF)		Average income (AI) in euro		Annual change in NIF		Annual change in AI	
		coefficients	p-values	coef.	p-values	coef.	p-values	coef.	p-values
1	Constant	2,595	0.00	6,465	0.00	-61	0.33	917	0.00
	Districts								
2	City of Patras	97,266	0.00			1,049	0.07		
3	Town of Kalamata	31,087	0.00			589	0.11		
4	Other main towns (population centers)	14,214	0.00			194	0.02		
5	Isthmia (in Corinthia)			4,697	0.00			297	0.19
6	Areopolis, Kotronas (in Laconia), Dorion (Messenia)			2,706	0.00			69	0.58
7	Twenty three high income localities[a]			1,861	0.00			64	0.11
8	Other places (reference)								
	Initial working population (WP)								
	Distribution across space (%)								
9	In urban and flatland areas (reference)								
10	In rural areas	-23	0.00	-7	0.00	-0	0.04	-0	0.66
11	In hilly areas	-0	0.71	-1	0.38	-0	0.84	0	0.95
12	In mountainous areas	-8	0.00	-9	0.00	-0	0.20	0	0.71
	Distribution by gender (%)								
13	Females (reference)								
14	Males	5	0.58	-36	0.00	-0	0.53	-3	0.56
	Distribution across sectors (%)								
15	In agriculture-hunting-forestry (reference)								
16	In fishing	45	0.00	97	0.00	0	0.87	15	0.12
17	In mining-quarrying	-328	0.07	639	0.00	-0	0.98	-6	0.93
18	In manufacturing	-55	0.00	140	0.00	-1	0.69	9	0.11
19	In electricity-gas-water supply	17	0.36	137	0.00	-0	0.90	14	0.06
20	In construction	54	0.00	42	0.00	1	0.45	-2	0.64
21	In trade, etc.	157	0.00	-6	0.70	1	0.43	-8	0.26
22	In hotels-restaurants	-46	0.00	54	0.00	-0	0.85	0	0.99
23	In transport-storage-communication	-4	0.86	58	0.00	-0	0.86	-3	0.76
24	In financial intermediation	260	0.00	136	0.00	4	0.57	28	0.32
25	In real estate-renting-business activities	-37	0.29	218	0.00	0	0.94	3	0.85
26	In public admin., etc.	-130	0.00	65	0.00	-2	0.33	-1	0.93
27	In education	69	0.02	237	0.00	1	0.76	14	0.28
28	In health-social work	-58	0.06	71	0.01	3	0.73	6	0.75
29	In other community-social-personal serv.	-96	0.01	133	0.00	-1	0.73	2	0.87
30	In household activities	-255	0.00	245	0.00	-5	0.33	-1	0.95
31	In extra-territorial bodies	3,913	0.05	2,802	0.06	21	0.92	137	0.86
32	In unknown activities	33	0.00	36	0.00	0	0.90	2	0.64
	Districts damaged in the fire								
33	Autonomous component	-85	0.63	-273	0.08	84	0.00	-114	0.08
34	Time from 2001 onwards (in years)	130	0.00	488	0.00	141	0.00	-406	0.00
35	Time squared					-29[b]	0.00	89[c]	0.00
	Other districts								
36	Time from 2001 onwards (in years)	40	0.12	279	0.00	147	0.00	-481	0.00
37	Time squared			16	0.01	-27	0.00	98	0.00
	From 2007 onwards in the damaged areas (DA)								
38	Autonomous component: District dummy × share of WP in DA	-3	0.67	16	0.07	2	0.00	-6	0.00
39	Time component	-2	0.58	-17	0.04	3	0.00	-19	0.00
40	Time component squared			5[d]	0.01			5[e]	0.00
	From 2007 onwards in the other areas								
41	Autonomous component	0	0.98	22	0.00	2	0.00	-5	0.00
42	Time component	-1	0.27	-20	0.00	2	0.00	-21	0.00
43	Time component squared			5[f]	0.00	-0	0.00	5[g]	0.00

Table A2 (Continued)

	Number of income filers (NIF)	Average income (AI) in euro	Annual change in NIF	AI
Observations	1,580	1,580	1,422	1,422
Model fit (R^2)	97.7%	90.2%	22.7%	62.7%

Notes:

[a] Drepanon, Nea Epidaurus (in Argolis), Dervenion, Hiliomodion, Kaliani, Klimention, Pitsa, Vrahation, Xilokastron (in Corinthia), Kalavrita, Kertezi, Sageika (in Achaea), Varda (in Achaea and Ilis), Lehena (in Ilis), Dimitsana, Kosmas, Megalopolis, Tripolis, Vitina (in Arcadia), Dorion, Kiparissia, Psarion (in Messenia), Gerolimen, Pirgos-by-Diros (in Laconia).

[b] Maximum 2.4 years. [c] Minimum at 2.3 years. [d] Minimum at 12.8 years. [e] Minimum at 2.0 years. [f] Minimum at 3.5 years. [g] Minimum at 1.9 years. The maxima and minima are calculated on the basis of the first and second order conditions of the respective functions with respect to time. In each function, the linear or non linear specification for time was considered and decided based on the best fit (adj R^2). Ramsey's regression equation specification error test suggests an absence of relevant of variables at the 1% error probability level in all regressions.

Table A3. The R^2s recovered from the expressions employed in Table A2 under hypothetical, slightly earlier regime switches

Year of presumed regime switch	Number of income filers (NIF)	Average income (AI) in euro	Annual change in NIF	AI
2005	97.7%	89.9%	31.4%	67.5%
2006	97.7%	89.9%	25.4%	60.4%
2007	97.7%	90.2%	22.7%	62.7%