CONVERGENCE THROUGH CRISIS? THE IMPACT OF THE CRISIS ON WAGE RETURNS ACROSS THE GREEK REGIONS

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Abstract - *The macroeconomic and social dimension of the Greek crisis has put to second-stage attention to its spatial manifestation and consequences. Partly because of this, the literature thus far does not seem to reach agreement about the 'regional footprint' of the crisis, i.e., whether it contributed to magnifying (Monastiriotis, 2011) or narrowing (Psycharis et al, 2014) regional disparities. In this paper we tackle one particular aspect of this question, examining whether the crisis led to convergence in the way the country's regional labour markets reward different labour characteristics – thus increasing 'spatial fairness' (defined as 'equal returns to equal characteristics, irrespective of location'). Descriptive evidence from aggregate data suggests that regional wages show signs of accelerated convergence during the crisis. To look underneath this aggregate picture, we derive region-specific shadow prices of worker and job characteristics from Mincerian wage equations and analyse their evolution following the T&I approach of Duranton and Monastiriotis (2002). Our results show that the crisis coincided with a notable acceleration of pre-existing tendencies for convergence in the returns to most characteristics. Underneath this aggregate pattern of 'convergence through crisis', however, we find significant heterogeneity, implying that regional responses to the crisis have been far from uniform.*

Key words **-** REGIONAL DISPARITIES, CRISIS, CONVERGENCE, WAGE RETURNS, GREECE

JEL classification **-** C23, J24, J31, R12, R23

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1. INTRODUCTION

The presence, and persistence, of regional disparities is an issue that has been at the core of regional science since its very beginnings. Research into this issue has flourished over the years and large bodies of literature exist today that examine various facets of this issue, for example the role of agglomeration and production activity, the role of local capacities and indigenous drivers to growth, the role of demand-side factors and cumulative causation forces, the role of national and regional policy, and so forth. Somewhat surprisingly, the literature has much less to say about the evolution of regional disparities in times of crisis and in relation to external shocks. Some literature exists concerning the pro-cyclicality of regional disparities (Petrakos and al, 2005) or about the impact of external developments (globalisation, trade liberalisation – Resmini, 2003; Rodríguez-Pose, 2006). But studies that address how regional disparities evolve in times of national recessions/crises are few and far between (see, for example, Blazek and Netrdová, 2012) .

Also limited is the attention in the contemporary literature on whether the evolution of disparities is related to compositional issues [1] (e.g., differences/changes in production structures, labour quality, etc) or instead to issues of functioning (e.g., production linkages within local economic systems or valuation of / demand for skills in each local economy). With regard to the latter, in a seminal contribution Duranton and Monastiriotis (2002) showed for the case of the UK that regional wage disparities are mainly driven by differences in the characteristics of the regional workforce (composition) and that observed trends of aggregate divergence (in regional wages) mask underlying trends of regional convergence in the returns (valuation) to worker and workplace characteristics across space – thus implying a process of increasing sorting across regions on the basis of these characteristics. Although numerous studies exist that examine the returns to various worker and other characteristics at the regional level, generally very few offer a systematic examination of their differences and their evolution.[2]

This paper takes up this issue and examines it for a particularly intriguing case, that of Greece in the pre-crisis period and during the recent (and ongoing) crisis. Following the eruption of the global financial crisis and the unveiling of significant fiscal imbalances in the country, Greece entered a deep crisis which destabilised it politically and pushed its economy to a deep and prolonged recession. As recent analyses have shown (Monastiriotis, 2011; Monastiriotis and Martelli, 2013; Psycharis et al, 2014), the crisis had a variable impact across the

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[1] There is a long tradition in regional science employing shift-share analysis to examine issues of function-versus-composition (see Houston, 1967, Herzog and Olsen, 1977; vis-à-vis Bellini et al, 2013 and Blien et al, 2014), but this approach is less popular in the contemporary literature and in any case has rarely been employed to study issues relating directly to labour market processes.
[2] Some recent studies have looked at aspects of this at the national and supra-national levels (see, inter alia, Simon, 2012; Christofides and Michael, 2013; and Montenegro and Patrinos, 2013).

Greek regions, although unemployment increased everywhere (and economic activity declined everywhere) quite substantially. Still, regional adjustment to the crisis has not been uniform and some regions managed to contain the effects of the crisis more successfully than others (Monastiriotis and Martelli, 2013). Largely anecdotal evidence suggests that this has in part been due to migration flows – and thus to compositional changes in the local workforce. However, the extent to which the crisis has led to more uniformity, or instead to further divergence, across regions in terms of labour market functioning – and in particular in terms of the valuation of workforce characteristics – remains largely unknown.

To examine this issue we use individual level data derived from successive waves of the Greek Labour Force Survey. We estimate a large set of (extended) Mincerian wage equations for each of the 15 Greek regions[3] covering the period 2000-2012, i.e., from Greece's accession into the Eurozone to the year representing the height of the crisis. We use the derived elasticities (returns to characteristics) to implement a comparative analysis of the evolution of returns across regions before and during the crisis and examine the trends for convergence and divergence separately for the composition of workforce characteristics and for their returns. Our analysis reveals that the crisis has accelerated the pre-existing trend of convergence in the returns to key labour force characteristics across regions, thus leading on-the-aggregate to more equality in the valuation of these characteristics across the regional economies of the country. This assigns an element of 'spatial fairness' in the developments concerning (the determination of) regional wages in the country, with similar individuals (in terms of both personal and job-related characteristics) attaining increasingly similar wages irrespective of their location. Underneath this pattern of 'convergence through crisis', however, we find evidence of substantial regional heterogeneity, both in the distribution of returns and in the paths that these have followed for different (groups of) regions during the crisis.

The structure of the paper is as follows. In the next section we review the sparse literature on regional disparities in Greece and present some descriptive evidence on the evolution of regional wages and regional wage disparities in the country prior and during the crisis. Section 3 discusses our empirical strategy, including the estimating model and the method for examining regional convergence using the "trends and intercepts" approach of Duranton and Monastiriotis (2002). Section 4 presents our empirical findings concerning the evolution of regional disparities in the returns to individual and job characteristics before and during the crisis, making also some remarks about the evolution of dispari-

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[3] Our sample comprises the 13 NUTS2 regions of Greece, with a separate distinction for the two main metropolitan areas of Athens and Thessaloniki, as delineated by Hellenic Statistics, the statistical service of Greece. Unfortunately, the Greek LFS does not provide more spatial detail to allow an analysis at the sub-regional level (e.g., local labour market areas – see Prodromides, 2010 and Kallioras et al, 2012). For a list of the Greek NUTS2 regions and a map showing their administrative boundaries see http://en.wikipedia.org/wiki/NUTS_of_Greece or the EUROSTAT portal at: epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/introduction.

ties in terms of the regional composition of these characteristics. Finally, the last section concludes with a summary of the results and a short discussion about the pressures on regional disparities in times of economic crises.

2. REGIONAL WAGE DISPARITIES AND PATTERNS OF CONVERGENCE IN GREECE

There are very few studies examining the geographical distribution of wages in Greece and the extent of regional disparities in labour market outcomes more generally in the country. A number of studies have examined the issue of regional income disparities following the neoclassical convergence literature and thus examining the extent of beta-convergence in labour productivity or per capita GDP. One of the first studies to do so (Siriopoulos and Asteriou, 1998) found evidence of conditional-only club convergence, with regions in the north and the south of the country converging to their own steady states, suggesting that overall the country is characterised by duality (north – south) and rather permanent differences in regional incomes. In contrast, Petrakos and Saratsis (2000) found significant evidence of beta-convergence, showing also that regional disparities in Greece appear to be pro-cyclical, i.e. rising in periods of expansion and declining in recessions. Strong evidence of beta-convergence has also been found subsequently by Tsionas (2002), Michelis et al (2004), Christopoulos and Tsionas (2004), Benos and Karagiannis (2008), and Lolos (2009).

Evidence concerning regional disparities in wages comes only indirectly, from studies examining the structure of wages (and returns to workforce characteristics) in the country.[4] For example, Christopoulou and Monastiriotis (2014a) find significant regional effects in their analysis of private and public sector wages in Greece prior to the crisis, suggesting sizeable differentials in net wages even after controlling for a large set of individual and job characteristics.[5] A similar result is implied by the study of Livanos and Pouliakas (2009) – although estimates on this are not reported directly. As is well documented (Bank of Greece, 2012; Koukiadaki and Kretsos, 2012; Monastiriotis, 2013; Daouli et al, 2013; Christopoulou and Monastiriotis, 2014b), the crisis led to a substantial decline in average wages in the country, by well over 20%. However, no study exists to date that examines in any sufficient depth – and systematically – how these changes have played out across the regions of Greece. Given this absence of systematic evidence on the geographical impact of the crisis and on the regional distribution of wages in Greece more generally (including its temporal evolution pre-crisis), a first step into our analysis is the descriptive examination of the picture of regional wage disparities. To perform this, we use data on

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[4] A number of policy reports by the Institute for Employment of the General Confederation of Greek Labour occasionally document the extent of regional wage disparities in Greece, but they offer no systematic evidence on their evolution or indeed about the drivers of the observed differences.
[5] Similar regional differences have been reported in the literature with regard to unemployment (Livanos, 2007; Rodokanakis, 2010; Lolos and Papapetrou, 2011; Monastiriotis and Martelli, 2013).

monthly average wages derived from the spring waves of the Labour Force Survey of Greece for the years 2000-2012.[6]

As shown in Figure 1, nominal wages in Greece have been growing quite fast during the period from the country's accession to EMU until the eruption of the sovereign debt crisis – while with the crisis they declined substantially, reaching in 2012 levels broadly seen in 2007. The evolution seems to be broadly similar across regions – although stability seems to be much lower at the beginning and end of the period under consideration.

For most of the period, the regions of the North Aegean, South Aegean, Western Greece and Athens exhibit the highest nominal wages; while regions such as Central Macedonia (excluding Thessaloniki), Ionian and Thessaly are more often than not at the bottom. In 2006, average nominal wages ranged between 6.6968 log-points (I.e., euros expressed in natural logarithms – corresponding to €810) in Central Macedonia and 6.9164 log-points (€1,009) in the North Aegean – a max-to-min ratio of 124.5%. By 2012 this ratio had dropped to 119%, with wages ranging from €805 in the Ionian to €958 in the North Aegean. From simple inspection of Figure 1, regional disparities in average nominal wages do not appear to have been on the rise – neither prior to, nor during, the crisis. This is corroborated by a simple sigma-convergence analysis[7], as depicted in Figure 2.

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[6] The LFS is a quarterly household survey covering information on a range of personal, household and labour market characteristics, including age, gender, marital status, education, region of residence, occupation and sector of work, regular monthly wages (excluding bonuses and overtime pay and reported in wage bundles which typically have a 100 euro range). Each wave contains 30,000 working age individuals, of which around two-fifths are wage earners. The survey includes both full-time and part-time employees but excludes the self-employed for whom incomes from employment are not reported. As this is a household survey, the data also capture the wages of salary-earners working in the informal economy. Information on wages contained in the survey is residence-based and thus individuals' wages are assigned to regions on the basis of where each individual lives. In the Greek context, where cross-regional commuting flows are minimal, this is generally not a problem; while in the case of the Athens labour market area, which extends beyond the administrative boundaries of the capital, it helps assign correctly observed wage outcomes to the relevant regional economy.

[7] This is essentially an analysis of the evolution of the standard deviation of the regional nominal wage distribution. To avoid the effect of inflation and scale effects, which tend to push towards a higher variance over time, we standardise the standard deviation by the mean of the distribution, thus deriving the corresponding coefficient of variation. By using this standardisation, we essentially deflate all wages and thus regional disparities are expressed in real terms. We do not weight our regional data by the regional population shares (as in Petrakos and Artelaris, 2009) as we are interested in the extent of disparity across the regional economies and not across the population residing in these. The small sample size (15 regions) and our focus here on the issue of convergence do not lend themselves to the use of other indices of inequality (e.g., Theil index, Gini coefficient, etc).

Figure 1. Regional nominal wages across the Greek regions
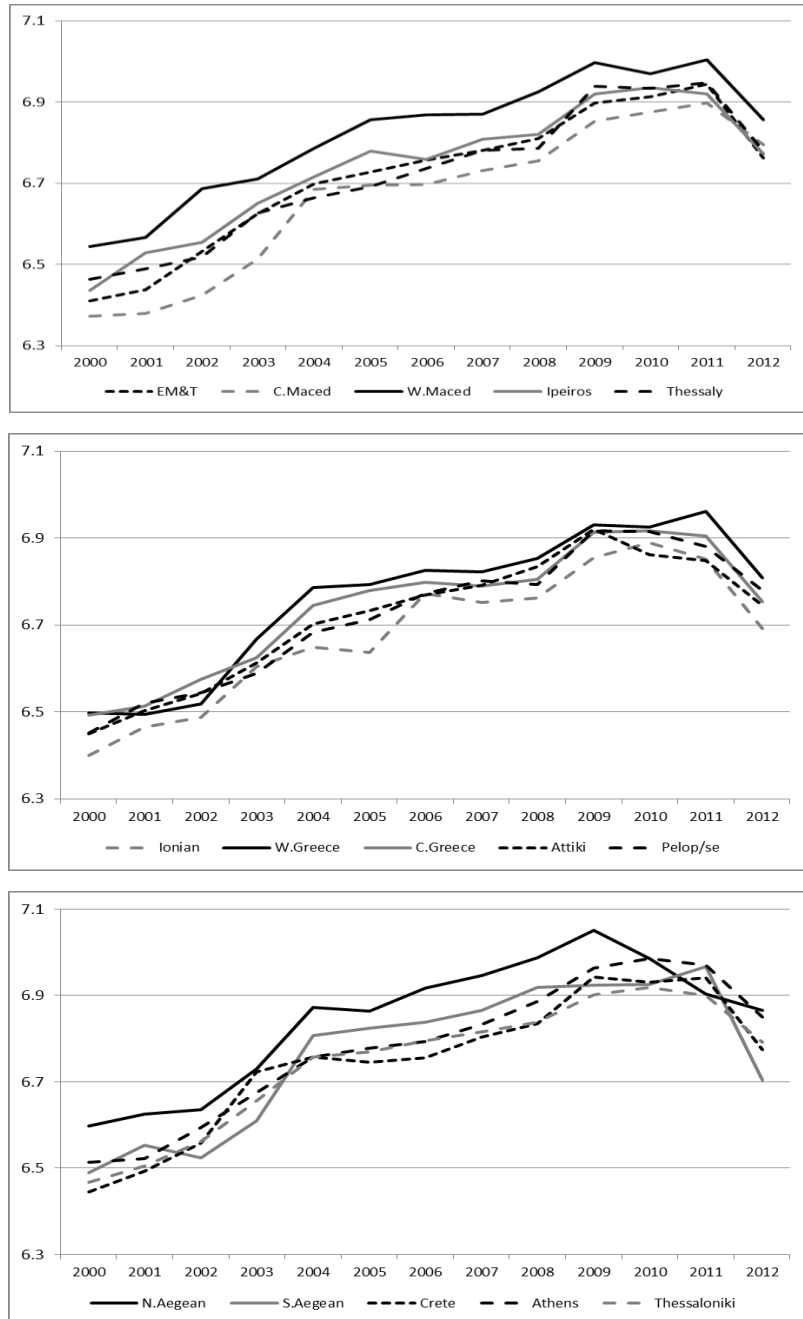
Source: Greek Labour Force Survey. Author's calculations.

As can be seen, in the pre-crisis period the coefficient of variation has been largely oscillating around a constant value, albeit with widening fluctuations as we move closer to the crisis. Some evidence of (sigma) convergence appears in 2005-2009 but with a large spike in 2008. From there, as we enter the crisis[8], we see a rather disparate evolution: a sharp decline in 2009-2010 but a subsequent rebound in 2011 and 2012. The overall trend (based on a second-order polynomial) is of declining disparities, with the drop starting near 2004 and intensifying dramatically with the crisis. But the evolution between 2009 and 2012 gives a much less conclusive picture about the evolution of regional disparities in the more recent period.

**Figure 2. Regional wage disparities across the Greek regions**
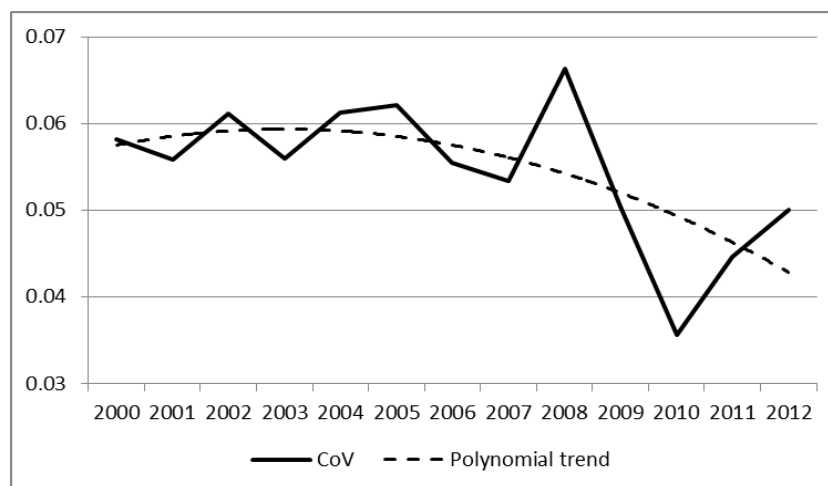
As a means for shedding more light onto this, we move on to examine the extent of beta-convergence in the country, separately for the pre-crisis and crisis periods (Figure 3) noting, however, that the sample size (15 observations) does not allow us to derive strong conclusions in a statistical sense. Evidently, the pre-crisis period is one of relative heterogeneity with no evidence of convergence. In contrast, the crisis period depicts a picture of convergence, with low-wage regions having generally slower declines in wages in the 2009-2012 period. On a close inspection, however, the picture is less clear. Removal of only two outliers (Central Macedonia, in the north-west of the graph; and North Aegean, in the south-east of the graph) suffices to turn the fitted relationship into a positive one, thus signaling divergence. Thus, the relationship appears to be neither particularly strong nor particularly robust.

This is in a way the graphical depiction of the ambiguity that surrounds the evolution of regional disparities in Greece during the recent crisis. The evidence, even at the simple level of descriptive analysis presented here, seems to

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[8] Note that, as the sovereign debt crisis did not start until late in the autumn of 2009, the first crisis year in our data is essentially the year 2010.

be rather inconclusive: on the whole, regional wage evolutions seem to have been in the direction of declining disparities, consistent with the view of regional disparities as predominantly pro-cyclical; however, for sub-groups of regions (e.g., excluding outliers in Figure 3) and for specific years even inside the crisis (e.g., for 2011-2012 in Figure 2), there is as much evidence of regional divergence as there is for regional convergence.

Figure 3. Beta-convergence before and during the crisis
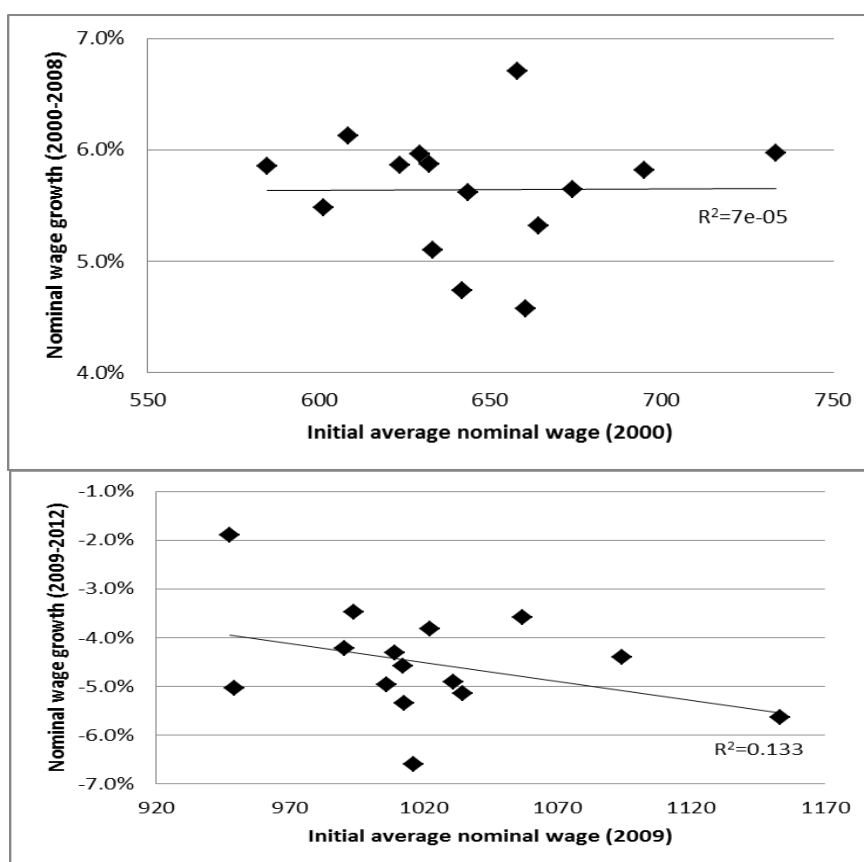
A possible explanation for this ambiguity is that, possibly, our observed wages conflate two different tendencies in the Greek regional labour markets: on the one hand a compositional movement, having to do with selective (e.g., skilled) migration and changing skill-compositions for the unemployed (i.e., employment sorting); on the other hand, a price-based movement, concerning the (shadow) prices of marketable labour force characteristics (education, experience, etc). We examine this more closely in the analysis that follows.

3. EMPIRICAL APPROACH AND METHODOLOGICAL ISSUES

To perform our analysis we estimate a large number of extended Mincerian wage equations[9], one for each year and region in our sample (15 regions, 13 years). The estimating equation makes an individual's hourly nominal wage (in logs) a function of various personal, household, and labour market characteristics, so that the derived estimates reflect the shadow prices of these characteristics and thus their contribution to the wage attained by each individual. Specifically,

$$\ln(w_{irt}) = \alpha_{rt} + b_{rt}^G G_{irt} + b_{rt}^N N_{irt} + b_{rt}^E E_{irt} + b_{rt}^X X_{irt} + b_{rt}^M M_{irt} + b_{rt}^D D_{irt} + b_{rt}^P P_{irt} + b_{rt}^T T_{irt} + b_{rt}^F F_{irt} + b_{rt}^S S_{irt} + \varepsilon_{irt} \qquad (1)$$

where *i*, *r* and *t* index individuals, regions and time (years), respectively, and the right-hand-side variables are as follows: *G* is a gender dummy, equal to one if the individual is a woman; *N* is a nationality dummy, equal to one if the individual has been born abroad; *E* is years of schooling (education); *X* is years of post-education labour market experience[10]; *M* is a dummy for marital status (one if married/cohabiting); *D* is the number of under-aged dependants in the household; *P* and *T* are dummies for part-time and temporary employment, respectively; *F* is a dummy taking the value of one if the individual is employed in a small firm; *S* is a vector of sectoral dummies; and *ε* is an error term. Given the fact that we estimate this regression separately for each region and year, the coefficients *b* give the shadow price of the various characteristics in each location at each point in time; while α is essentially a time-varying regional fixed effect capturing 'baseline' wages (net of workforce and job characteristics) in each region-year.

As our interest is not directly on the contribution of these characteristics to individual and regional wages, but rather on the evolution of their (shadow) prices over time and across space, we do not report the estimates from these wage regressions.[11] Instead, to analyse the evolution and spatial differentiation of the valuation of the various worker and workplace characteristics we rely on an approach first developed by Duranton and Monastiriotis (2002), for a similar analysis for the case of the UK. The approach is as follows. Based on the estimated coefficients from the wage regressions we build a panel (cross-regional time-series) dataset of returns to characteristics (shadow prices). We then use the time-series dimension of this dataset to regress, for each region separately, the shadow prices of each characteristic on a simple linear time-trend. This

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[9] See (Mincer, 1974) for the origins of this approach. The approach of human-capital wage equations is a literature standard with thousands of applications internationally (see Heckman et al, 2003; Hendricks, 2004; and Lemieux, 2006).

[10] In the regressions we include additionally a quadratic term of this variable, as is common in the wage regressions literature (see Heckman et al., 2003).

[11] We ran 195 regressions which produced over 3,500 coefficients. The full results can be made available upon request. Generally, our regional regressions performed very well, with the median R-square at 0.453 (ranging between 0.38 in the Ionian Islands region and 0.49 in Thessaly) and over 60% of the estimated coefficients being significant at the 0.01 level.

gives us an estimate of the annual rate of change of the shadow price of each characteristic in each region, in a similar fashion as with the calculation of a simple annualised growth rate.[12] Additionally, the intercepts from these regressions give us an estimate of the level of the shadow price of each characteristic in each region at the start of the period (base year), thus approximating, in beta-convergence terms, the 'initial level' of each shadow price. With these pieces of information (trend and intercept) we move on to produce a number of scatterplots (the so-called "Trend & Intercept plots"), one for each characteristic of interest, and derive the corresponding fitted regression line. The latter gives us an estimate of the direction and speed in the evolution of regional disparities for the returns of each characteristic.

In algebraic form the analysis is as follows. For each shadow-price estimate, b^k (with $k=\{G,N,E,\ldots,S\}$ in eq.1), we estimate

$$b_{rt}^k = a_{rt}^k + \gamma_{rt}^k t_t + u_{rt}^k \tag{2}$$

separately for each region $r=\{1,2,\ldots,15\}$. We then use the cross-section of estimates a_{rt}^k and γ_{rt}^k to fit the following model, again for each parameter k separately:

$$\gamma_r^k = \delta_0^k + \delta_1^k a_r^k + \varepsilon_r^k \tag{3}$$

This set of estimates is presented in the scatterplots of the T&I analysis. This analysis resembles closely that of the (unconditional) beta-convergence, but with some important differences. As with beta-convergence, the sign of the slope of the fitted line (coefficient δ_1^k in eq.3) indicates convergence (negative slope) or divergence (upward slope); while its size is a measure of the speed of convergence or divergence. Unlike the beta-convergence approach, however, the T&I analysis captures the overall trend in the evolution of disparities and not the difference between two specific points in time; while in the T&I analysis the estimated trend is linear (and not asymptotic as in beta-convergence) – which seems more appropriate when evaluating movements in (shadow) prices than in unbounded real economic aggregates (such as labour productivity, for example).

To examine in particular how regional differences in the returns to worker and workplace characteristics evolved prior and during the crisis, we apply this analysis separately for two sub-periods – the pre-crisis period, covering the year since Greece's admission to EMU until the last year before the eruption of the crisis in Greece; and the crisis period, from the eruption of the crisis until 2012, which represents the height of the crisis in the country. We present the T&I

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[12] The advantage of this approach, vis-à-vis the ad hoc calculation of a growth rate, is that it avoids the problem of relying solely on the start- and end-period data points. Given that the (shadow) prices used in this analysis are estimates, deriving from the wage regressions, and they are not directly observed, relying solely on a couple of data points may introduce too much noise in our analysis. Instead, the estimation of the annual rate of change on the basis of a linear trend makes equal use of all available data points.

plots jointly for the two sub-periods and discuss, for each characteristic, the differences observed in the context of the crisis, focusing mainly on the slope (δ_1 in eq.3) and fit of the underlying relationships. We also look comparatively at a shorter pre-crisis period (2005-2008), starting at the year after Greece hosted the 2004 Summer Olympics, and compare it to the period of the early 2000s (2000-2004) as well as to the crisis period (2009-2012).[13] To facilitate the discussion, and also bring out the analytical relevance of our results, we group the price effects of these variables into five categories, each corresponding to a particular facet of the factors underlying wage determination in the extended Mincerian model. The first category concerns shadow prices usually associated to labour market discrimination (female and foreign-born penalties). The second is related to marketable characteristics of the individual which affect productivity (returns to education and experience). The third concerns household characteristics (returns to marital status and to the number of dependants), which could be capturing either labour supply or institutional influences on wage determination (e.g., reservation wages or legally binding wage supplements). Our fourth category comprises the wage penalties associated to part-time and temporary employment, thus corresponding to characteristics related to the 'employment relationship'; while the last category groups together two employer characteristics (size and location).

For completeness, we also replicate this analysis for the regional composition of characteristics – in addition to the analysis of shadow prices, as discussed above. This in turn allows us to examine comparatively the extent to which overall (aggregate) convergence-divergence patterns are driven predominantly by trend-changes in the composition of characteristics in each region versus similar changes in the valuation (shadow prices) of these characteristics across space. Last, we implement additionally an analysis of sigma-convergence for the estimated shadow prices, which we consider as supplementary to our T&I analysis. Unlike the T&I analysis (or the traditional beta-convergence analysis), which examines the tendency of regional values to revert to a common mean, the sigma analysis examines the evolution of the spread of the distribution of these regional values over time. Thus, it allows us to get a comparative picture of whether any tendencies of convergence, in T&I terms, coincided with an actual narrowing of the cross-regional distributions of shadow prices or instead have been related more to less permanent movements around a common mean. We present and discuss the results from all these pieces of analysis in the next section.

4. EMPIRICAL RESULTS

As mentioned already, the main task of our empirical analysis is to examine the size and relative evolution of the shadow prices of a number of individual and job-related characteristics, which we group along five analytical categories capturing aspects of (i) labour market discrimination; and of the valuation of (ii) productivity-enhancing skills, (iii) household characteristics, (iv) different

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[13] The corresponding T&I plots are reported in Appendix A. We make selective reference to these in the text.

forms of employment contracts, and (v) workplace-related characteristics. The summary results from the T&I analysis for all variables feeding into these five categories are presented in Table 1.

As can be seen, all shadow prices exhibit evidence of convergence, both prior to and during the crisis. Convergence, however, is much slower in the pre-crisis period (ranging for example between -0.06 for the temping penalty, which is not statistically significant, to -0.23 for the marital status premium) and seems to have speeded up significantly during the course of the crisis. In that latter period, each and every estimated slope coefficient is more negative and statistically more significant than before and all but two are over twice as large as those observed in the pre-crisis period. On this evidence, it is clear that the crisis has coincided with the emergence of a trend towards narrowing regional disparities in the returns to individual and workplace characteristics. By implication, the crisis period seems to be also a period where the valuation of characteristics became more homogenous across space and thus less disparate for similar individuals, irrespective of their location. [14] We explore this further by looking in more detail at the individual cases of the various characteristics used in our analysis.

**Table 1. Trend-and-intercept analysis - summary results**

Category and variable	Pre-crisis		Crisis	
	Slope (δ_1)	Fit (R^2)	Slope (δ_1)	Fit (R^2)
Discrimination				
Female penalty	-0.107***	0.512	-0.359***	0.616
Foreign-born penalty	-0.178***	0.675	-0.326**	0.396
Skills				
Education premium	-0.118*	0.199	-0.288***	0.440
Experience premium	-0.153***	0.793	-0.393**	0.376
Household				
Marital status premium	-0.234***	0.773	-0.402***	0.431
Dependants premium	-0.168***	0.783	-0.418**	0.341
Employment relationship				
Part-time penalty	-0.119***	0.796	-0.372***	0.680
Temping penalty	-0.069	0.155	-0.242***	0.590
Workplace characteristics				
Small-firm penalty	-0.062	0.136	-0.183***	0.573
Regional fixed-effect	-0.151***	0.469	-0.358***	0.584

*Note: The table reports slope coefficients and the overall fit (R-squared) from simple linear OLS regressions of the estimated trend-change of each shadow price on the corresponding estimate for the 'initial value' (intercept), as depicted in eq.3. *, ** and *** show significance at the 10%, 5% and 1% level, respectively.*

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[14] The implication is that there is an element of increased labour market "fairness" that emerges with the crisis. We pick up on this point later in our discussion (section 5).

Starting with the discrimination variables (Figure 4), a first observation is that the speed of cross-regional convergence in the female penalty more than tripled over the period, while the increase in the speed of convergence for the foreign-born penalty was much more moderate. Importantly, in the case of the foreign-born penalty the fit of the regression line is significantly diminished, suggesting that the convergence process has been rather less homogenous across space. Indeed, as can be seen, there are two notable outliers which influence the trend for convergence (the Ionian and North Aegean island regions); while even besides these regions individual-region outcomes are rather diverse – with the South Aegean and Athens for example experiencing similar trend-changes in the foreign-born penalty (vertical axis) despite their substantially different starting positions (horizontal axis). Similar heterogeneity is observed for the case of the female penalty, with the clustering of data-points suggesting probably some sort of club-formation.

Figure 4. T-I analysis: discrimination variables
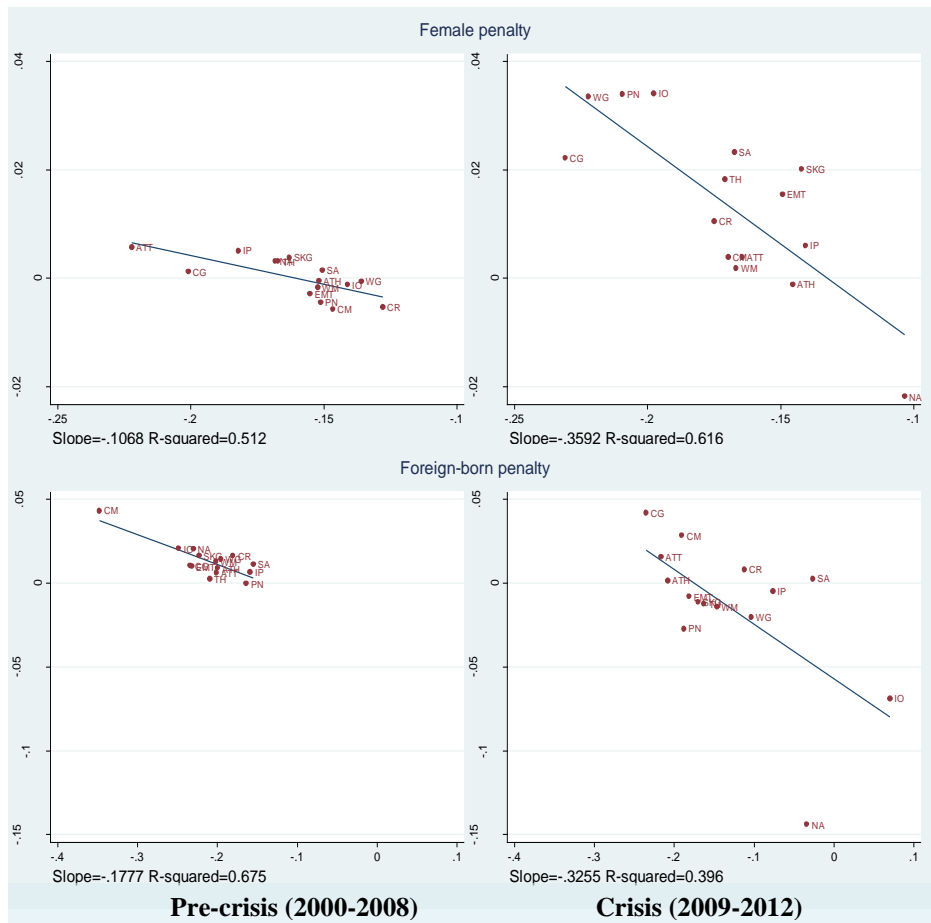
Importantly, however, when examining developments separately for the two sub-periods of the pre-crisis era (Appendix A), we find that convergence in the returns to discrimination-related characteristics was equally strong (female penalty) or stronger (foreign-born penalty) also in the period immediately preceding the crisis (2005-2008). Thus, the evidence of Figure 4 may in fact over-state the (presumed) impact of the crisis on the spatial distribution of the female and foreign-born penalties. This is consistent with the results from the sigma analysis (Appendix C), where there is little evidence of a systematic narrowing of regional disparities in the size of the two penalties. In any case, it should be noted that for almost all regions both penalties have been declining over time[15], suggesting that discrimination and 'pricing' based on pre-determined characteristics is increasingly becoming less prevalent nationally and less heterogeneous across space.

Figure 5. T-I analysis of convergence: skills-related variables
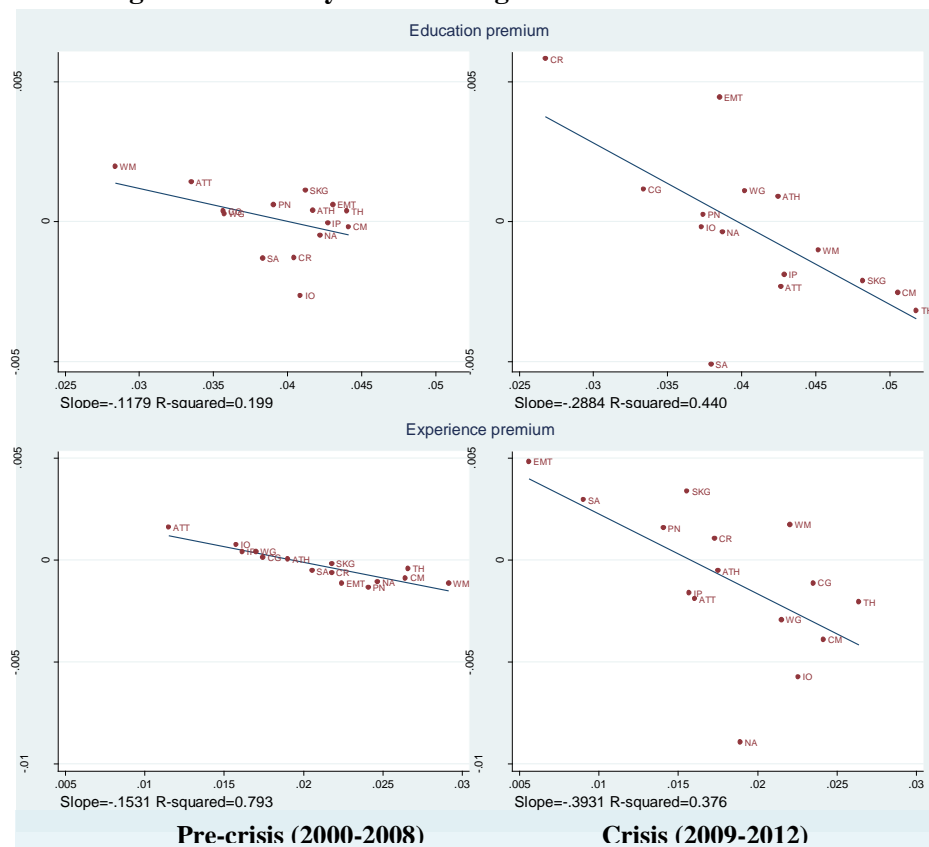
In Figure 5 we depict the T&I analysis for the skills-related variables. Again, the evidence is of intensified convergence in the returns to both education and

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[15] Most regions have positive trend-values (Figure 4 and Appendix A).

experience. Compared to the 2005-2008 sub-period (Appendix A), the crisis constitutes a period of 'return to convergence' for the returns to education, as in the former period convergence in these seemed to have stalled – although convergence in the returns to labour market experience seems in fact to have slowed down relative to 2005-2008. Again, the Ionian and North Aegean island regions appear as notable outliers; while some clusters of divergence (in the returns to experience) can clearly be identified (for example, a cluster comprising Central Greece, Western Greece, Thessaly, Central Macedonia, the Ionian islands and the North Aegean which seems to follow an upward-sloping pattern). This is consistent with the results from the sigma analysis (Appendix C) which suggests an absolute widening of disparities in the case of the returns to labour market experience during the crisis period. Interestingly, these evolutions were concurrent with a slow but intensifying convergence across regions in their composition of skill-related characteristics (Appendix B). This suggests that the crisis did not instigate processes of spatial sorting (e.g., selective migration of high-education individuals to high-education regions): if anything, we observe convergence in compositions, especially in the case of labour market experience.[16] By the same token, the speedier convergence in the returns to education signals a more equal valuation of formal qualifications across space, although for the majority of the regions this is combined with a trend towards declining returns (see the top-right panel of Fig.5).

As was also shown in Table 1, the results for the returns to household variables (Figure 6) are not drastically different. In both cases (marital status and number of dependants), cross-regional convergence in the associated premia accelerates with the crisis, although the fit of the regression line – and thus the extent to which the aggregate pattern of convergence describes more or less equally all regions – subsides significantly. The same applies broadly in the case of the regional compositions of these characteristics (Appendix B), although there the speed of convergence is much slower and individual regional evolutions are even more heterogeneous (especially in the case of the number of dependants). As our wage regressions control for differences in regional sectoral compositions (vector S in eq.1), it would appear that these evolutions have less to do with policy developments (e.g., universal cuts in the legislated wage supplements for spouses and children, which were originally of different relative importance to different regions due to their different sectoral compositions – see Monastiriotis, 2011) and more with changes across regions in terms of the structure and intensity of labour demand and supply.

Of more interest are perhaps the results about the part-time and temping penalties (Figure 7), as they relate to variables describing the 'employment relationship'. Here, too, penalties appear to converge faster in the crisis

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[16] It seems, however, that this does not reflect any significant trend in equilibrating migration. Rather, the effect is driven by a universal rise in age-sorting, with less experienced (younger) individuals experiencing worse wage outcomes (see Christopoulou and Monastiriotis, 2014b).

period[17], albeit again with some heterogeneity across space (note the cases of Crete for the part-time penalty and of Central Macedonia and South Aegean for the temping penalty). The extent of part-timing also converged fast across regions during the crisis; while rates of temporary employment have in fact become more disparate across space in the same period (Appendix B). These evolutions in terms of composition reflect to an extent the very different nature of these two forms of flexible labour use in the Greek case. Temping, which is used extensively in the country, increased only in (three of the four) regions that specialise most in this form of flexible employment (the three island regions of Crete, Ionian and South Aegean); while it actually declined in all but one of the other regions. Temping, it seems, has not been a particular source of adjustment for most of the country during the crisis. Instead, part-timing, which stands at extremely low levels in Greece by international standards, has increased in all regions but one – and faster so in the regions that used to rely less heavily on this form of flexible employment.
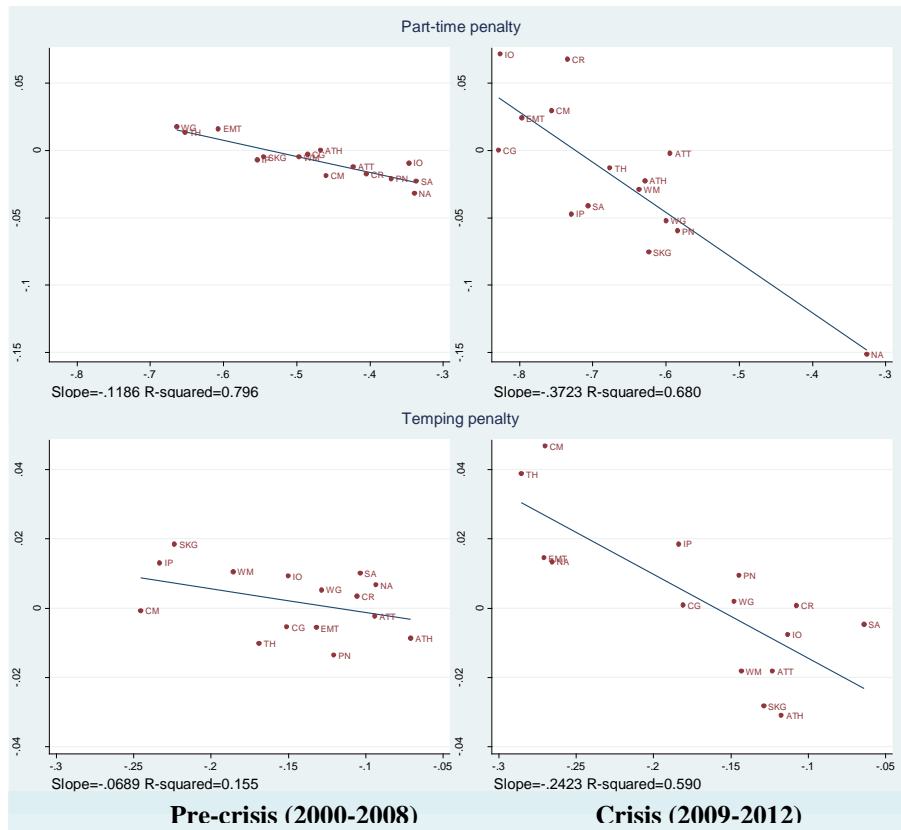
Figure 6. T-I analysis of convergence: household variables
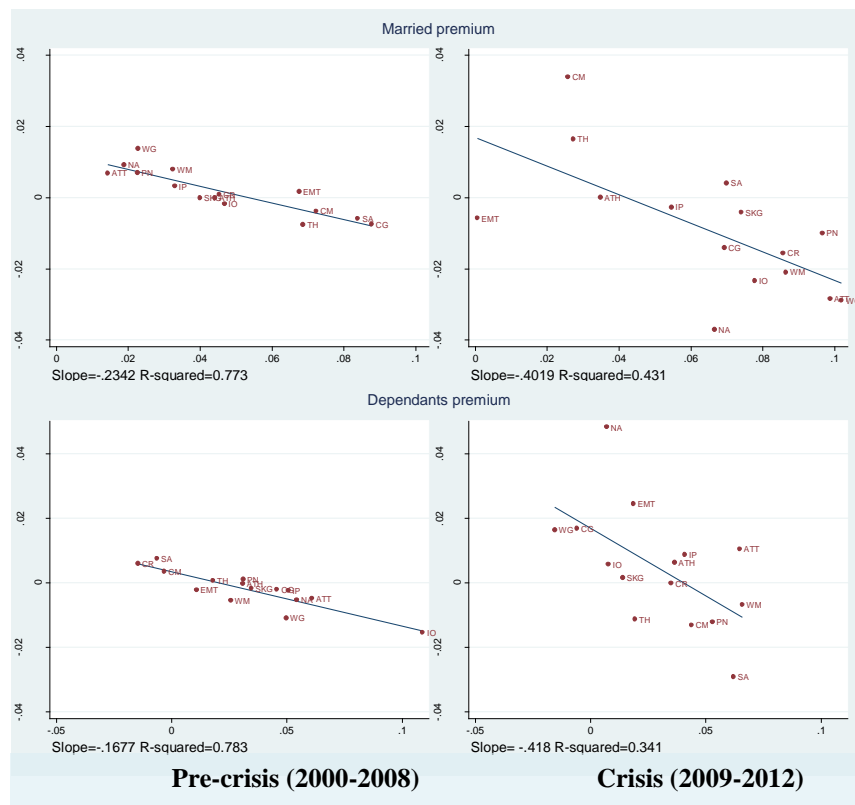
Figure 7. T-I analysis of convergence: employment relation variables

Pre-crisis (2000-2008)   Crisis (2009-2012)

Returning to Fig.7, importantly, the observed trends in the two penalties do not show a uniform type of adjustment across regions, despite the overall evidence of convergence. For regions such as Crete, Ionian, Central Macedonia and East Macedonia & Thrace, the part-time penalty declined during the crisis; while for the majority of the other regions the part-time penalty went up – with North Aegean at the extreme having a trend-change of some 15% per year. Similarly, the temping penalty followed an increasing trend in Central Macedonia, Thessaly, East Macedonia & Thrace, Ipeiros, Peloponesse and the North Aegean; but it declined in most other regions and most emphatically in the two metropolitan regions of Athens and Thessaloniki – where this penalty was at the start of the period relatively moderate.

Figure 8 presents the T&I results for the shadow prices of the 'workplace' variables. As can be seen in the top panel, the small-firm penalty declined in most regions during the crisis and exhibited speedier cross-regional convergence relative to the pre-crisis period (but not relative to 2005-2008). Interestingly, this penalty increased in the region of the North Aegean (a remote and relatively poor region near Turkey) and in the metropolitan region of

Thessaloniki (a much more accessible and developed area at the north of Greece) – suggesting that developments with regard to this shadow price are not driven by a unique set of influences (e.g., accessibility problems). Small-firm employment also declined in most regions (including, albeit only moderately, in Thessaloniki and the North Aegean) and converged across space (Appendix B), showing to an extent the disproportionate difficulties faced by small firms during the crisis – especially in regions such as Central Macedonia, East Macedonia & Thrace, Ipeiros, South Aegean and Crete.

Figure 8. T-I analysis of convergence: workplace variables
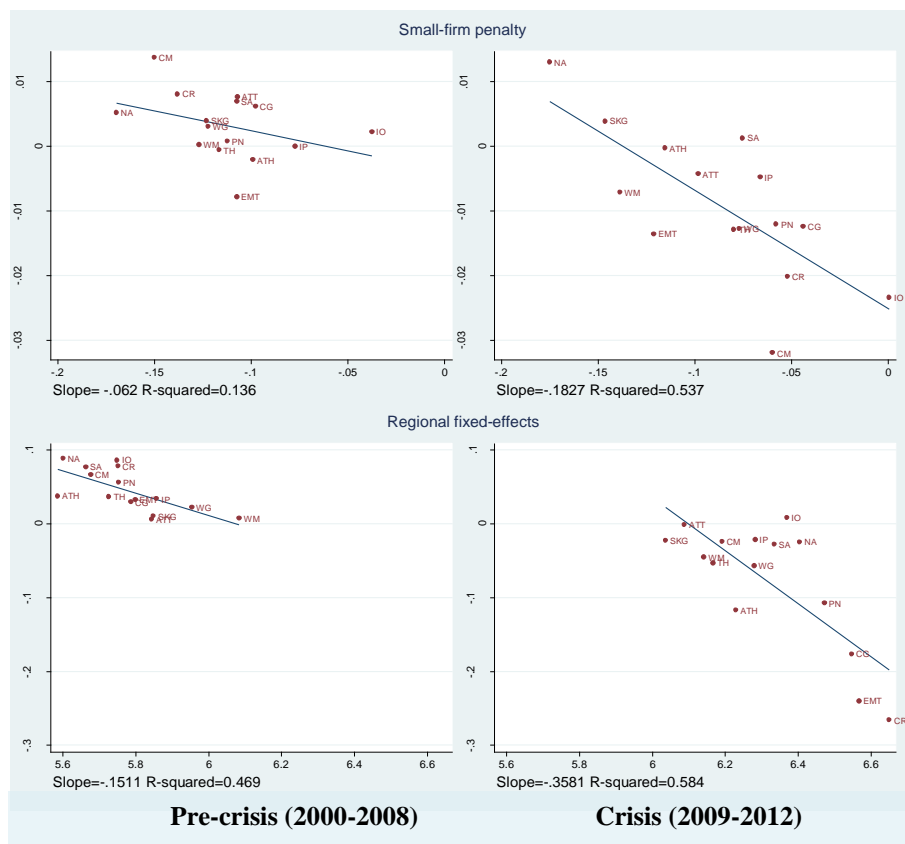
Last – but by no means least – among our variables (shadow prices) of interest is the one concerning the regional fixed effcets. As briefly mentioned earlier, these fixed effects capture the 'baseline' wages prevailing in each region – i.e., the regional wage levels net of the influences of composition (distribution of characteristics) and valuation (distribution of the returns to characteristics). In this sense, they reflect the wider demand and supply conditions in each of the regions, besides the prevailing regional distributions of skills and personal attributes or of job characteristics. As is shown in the bottom panel of Fig.8, at the start of the crisis these baseline wages were substantially larger than in the

pre-crisis period (see the differences along the horizontal axis between the two graphs). At the same time, however, baseline wages followed a negative trend in almost all regions during the crisis (in the right-hand-side graph all regions but one are below the zero-mark on the vertical axis). Generally, the decline has been much more substantial in those regions that enjoyed at the start of the crisis the highest baseline wages, thus leading to a strong convergence coefficienct in the T&I analysis (slope=0.358). There is however subsantial heterogeneity in this result.[18] For a large number of regions, the trend-declines in baseline wages were rather moderate (between 0-10%) and, it appears, largely unrelated to the initial levels (intercepts) at the start of the period. In fact, the finding of convergence is almost entirely driven by four or five regions (Crete, East Macedonia & Thrace, Central Greece, Athens and, less so, the Peloponesse) , which experienced trend-decline rates of between 10-30%.

This finding raises again the issue of the substantial heterogeneity that seems to characterise the Greek regions not only in terms of structures (e.g., composition of characteristics) and outcomes (e.g., wages and returns to characteristics) but also in terms of the evolution of these structures and outcomes, both in absolute terms and relative to other regions, and both prior to and – especially – during the crisis. We move to a discussion of this issue, informed by the findings presented here, in the next section.

5. CONCLUSIONS

The starting point in our analysis has been the underlying question about how the crisis in Greece may have affected regional disparities and regional outcomes more generally and in the labour market in particular. Casual inspection of aggregate patterns in regional wage data suggests a subsiding of regional disparities during the crisis – consistent with the limited evidence in the literature about the pro-cyclicality of regional disparities (Petrakos et al, 2005). At closer inspection, however, the evidence of convergence appears less robust – with evidence for both temporal and spatial heterogeneity around the presumed aggregate trend (see our discussion vis-à-vis Figures 2 and 3). Adding to this, are questions about labour market functioning, concerning especially the question as to how (regional) labour markets adjust in times of crisis. Are tendencies of convergence driven for example by equalisation in regional prices – or are they rather driven predominantly by compositional changes (e.g., via cross-regional migration)?

Our approach to examining these questions follows the logic of the analysis of beta- and sigma-convergence. But in our empirical analysis we applied a slightly different methodology, estimating the average growth (trend) and initial level (intercept) of the shadow prices that constitute the variables of our interest through a regression analysis rather than calculating them directly from the data. This has the advantage of avoiding problems related to the definition of

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[18] Note also the evidence from the sigma-convergence analysis which shows a fast narrowing of disparities in the early phase of the crisis but a substantial reversal of this trend in 2012 (Figure C.2.).

the start- and end-points for the analysis and reducing the econometric noise that unavoidably exists in our shadow prices, which are themselves estimated through a number of first-stage Mincerian wage equations.

On a first reading of our results, it appears evident that the crisis has seen a notable acceleration of the process of cross-regional convergence in the returns to individual and job-related characteristics – with the logical implication that the observed trend of aggregate convergence is at least in part driven by a process of 'price equalisation'. This is an important finding, both as a general empirical observation and in relation to our understanding of the consequences of the crisis in Greece: it implies that the valuation of labour market characteristics became more homogeneous across space during the crisis – and thus that the functioning of the Greek regional labour markets also became more similar. It also implies that in a way the valuation of labour became spatially 'fairer', in the sense that there is a trend for similar individuals (with similar characteristics and working under similar conditions) to be paid more equally across the different regions. Importantly, this 'spatial fairness' has not been found to be combined with a process of spatial sorting[19] (i.e., the separation of different types of jobs and/or workers across different locations) – which would in turn imply a competing move towards spatial 'unfairness', in the form of increased segregation. To the contrary, most characteristics examined in this paper show, too, continuing cross-regional convergence during the crisis.

On the other hand, the sigma-convergence analysis shows a rather different picture: evidence of convergence is present only for one of the shadow prices examined here (the temping penalty), while for many the evidence points instead to divergence (especially for the experience premium). Overall, however, there seems to be much volatility in the behaviour of the measures of disparity used in the sigma-convergence analysis, with no clear overall trend either prior or during the crisis. This applies not only to the shadow prices associated to individual and job characteristics, but also to the regional wages (both actual and 'baseline') at large.

Habitually, evidence of beta-convergence without sigma-convergence is taken to signal a process of 'overshooting', whereby the catching-up regions overtake the former leaders – so that the overall spread of the corresponding distribution changes little.[20] The evidence gathered from our more detailed analysis of the T&I plots suggests a set of rather different, and more nuanced, explanations. For the discrimination penalties, the prima-facie evidence of convergence is underlined by two important developments: one the one hand, a process of cross-regional convergence that pre-dated the crisis; on the other hand, a pro-

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[19] In their application of the T&I analysis in the case of the UK regions, Duranton and Monastiriotis (2002) found strong evidence of spatial sorting, which explained the presence of 'aggregate divergence' (divergence in actual regional wages) despite the underlying trend for 'disaggregate convergence' (convergence in the returns to characteristics).

[20] See Young et al. (2008) for a discussion of other explanations for this discrepancy between beta- and sigma-convergence.

cess of across-the-board reduction in these penalties recently, presumably as the corresponding rewards (for males and natives) were squeezed by the crisis. This is an interesting finding that may extend well beyond the experience of the Greek case.

A similar squeeze is observed, for the majority of regions, for the case of the skills-related premia – implying possibly a job-competition or bumping-down process in these regions, whereby more educated or experienced workers 'crowd-out' from lower-paid jobs less qualified and younger ones[21] (to avoid falling into unemployment), leading to an ad hoc reduction in their private returns to education and experience. In the case of the returns to education this is combined with evidence of cross-regional convergence (returns falling faster in regions that had higher returns initially); whereas for the returns to experience there is some evidence of within-group divergence, which results in an explosive trend in sigma-divergence terms.

The penalties associated to the 'employment relationship' variables also show evidence of cross-regional equalisation, albeit with rather heterogeneous underlying developments in terms of labour market adjustment – with some regions experiencing increasing and other regions experiencing declining penalties; and with evidence showing the extent of temporary (part-time) employment to decline (increase) in most regions and to diverge (converge) across space. In a similar fashion, the estimated regional fixed effects (capturing 'baseline' wages) also exhibit evidence of convergence, but with much heterogeneity both temporally and across space. Temporally, the evidence of convergence from the T&I analysis is corroborated by the sigma-convergence analysis only for the period 2009-2011: in 2012, there is an exceptionally large peak in the dispersion of the distribution of regional baseline wages, which is not captured by the T&I analysis. Spatially, the evidence for convergence seems to be driven by only a sub-group of regions, which experienced rather sizeable declines in baseline wages (over 10% and up to 30% per year), while for the majority of regions the declines were more moderate and cross-regional differences remained rather stable. This implies perhaps important differences across space in demand pressures (and wage adjustments) during the crisis.[22]

To conclude, our analysis helped unveil a number of important facets of intra- and inter-regional wage adjustments in Greece during the crisis. On the whole, regional wage disparities seem to have declined, although more recently a trend for divergence may be (re-)emerging. Regional convergence is present, albeit not for all cases and not always equally strongly, both in the case of re-

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[21] This is also consistent with the evidence of nation-wide (for all regions) increases in the average levels of education and labour market experience observed in our data, as depicted in the relevant graphs in Appendix B. Note, however, that nationally the returns to education on the whole increased during this period, driven mainly by developments in Athens and in the private sector in particular (see Christopoulou and Monastiriotis, 2014b).

[22] This is consistent with the evidence presented, for the case of unemployment, in Monastiriotis and Martelli (2013).

turns to characteristics (shadow prices) and in the case of the distribution of these characteristics (composition). Thus, the crisis does not seem to have instigated either processes of spatial sorting or processes of divergence in the valuation of worker and workplace characteristics. In that sense, perhaps rather surprisingly, there is a clear element of 'spatial fairness' that comes with the crisis in Greece. But underneath these aggregate patterns and trends is some notable variation and heterogeneity in terms of the processes and dynamics that underpin labour market adjustment, both within and across regions, in the country.

This conclusion has important implications for policy. Despite the known problems of functioning and institutional quality of the Greek labour market (or maybe because of these), the particular forms of adjustment that prevailed in the different regional economies of the country do not seem to have accentuated existing regional imbalances. Thus, within-region price adjustments have produced a more homogenous environment of wage returns while quantity adjustments (employment sorting within regions or migration across/outside regions) have also produced a less unequal landscape in terms of the composition of workforce characteristics. Although, however, on the face of it this may seem as suggesting a limited scope for regional policy, underlying our results is a large number of disparate regional evolutions (for example, the rise in the returns to education in East Macedonia & Thrace, showing increased skills-based wage sorting, and the decline in these returns in South Aegean, showing instead a more intensified job-sorting by skills) which undoubtedly call for a more careful and case-specific (place-based) regional policy that will understand the labour market weaknesses and particular needs of different areas and devise measures and policies to address them accordingly.

Last, a final note should be made about the contribution of the paper more generally, besides its relevance to labour market and regional policy questions for Greece. As was noted in the Introduction, studies on the geography and regional-temporal evolution of wage returns are rather scant in the literature and usually they offer simple descriptions of patterns but no systematic analyses of these. The T&I approach employed here, although not novel, offers a very useful guide for the systematic analysis of wage returns, and of shadow prices more generally, in a spatio-temporal framework. Especially for the case of Greece, for which no prior study of the regional distribution of wage returns exists, the implementation of this approach offers a unique insight into the working of the country's regional labour markets and their adjustment in times of crisis. But the range and informational value of our results also show the relevance of this approach more widely for the literature of labour market research within the fields of regional science and quantitative economic geography / geographical economics. The comparative study of shadow prices within a micro-econometric framework is certainly on the ascent in the literature and the T&I approach is, as we believe is manifested from our own analysis in this paper, a very useful tool in this regard.
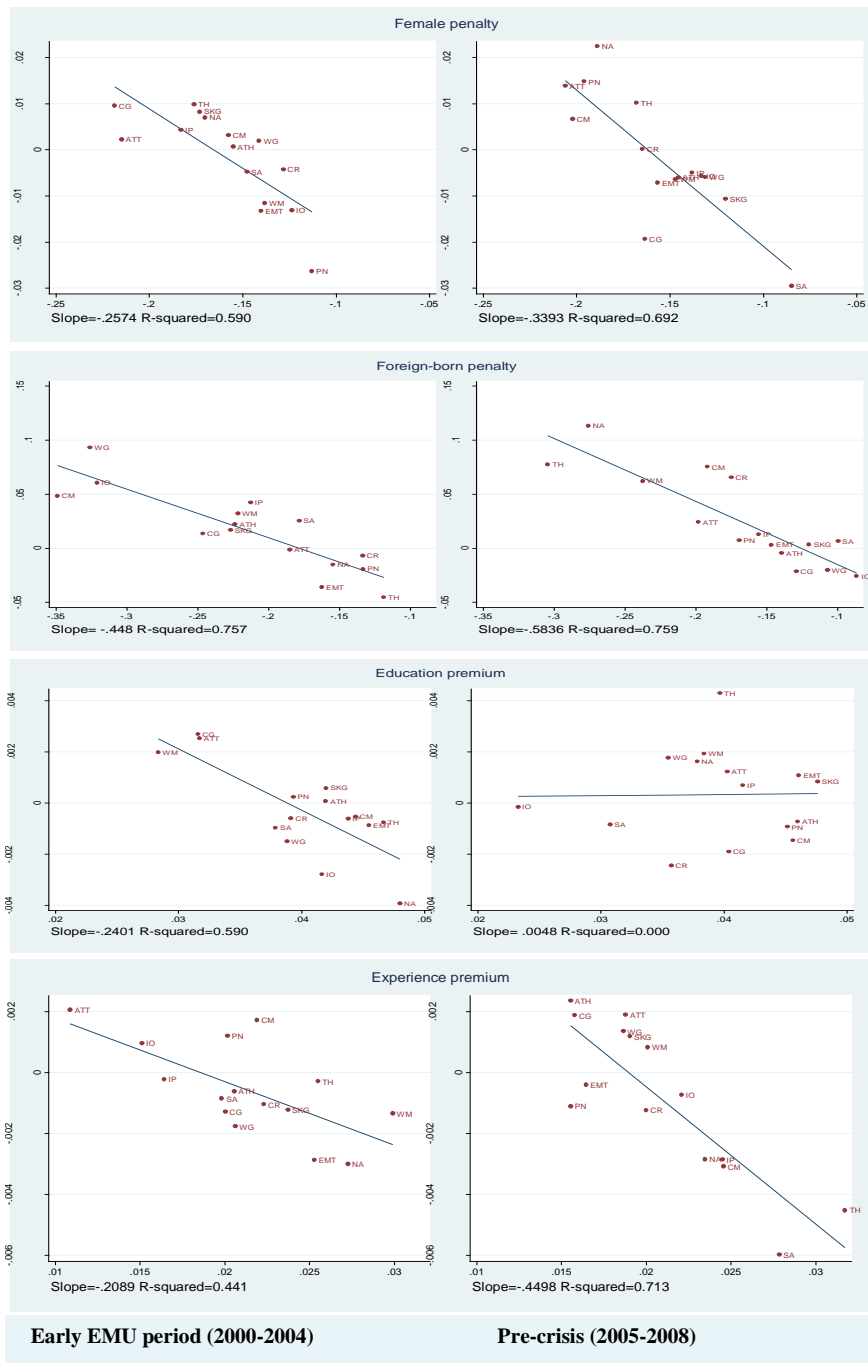
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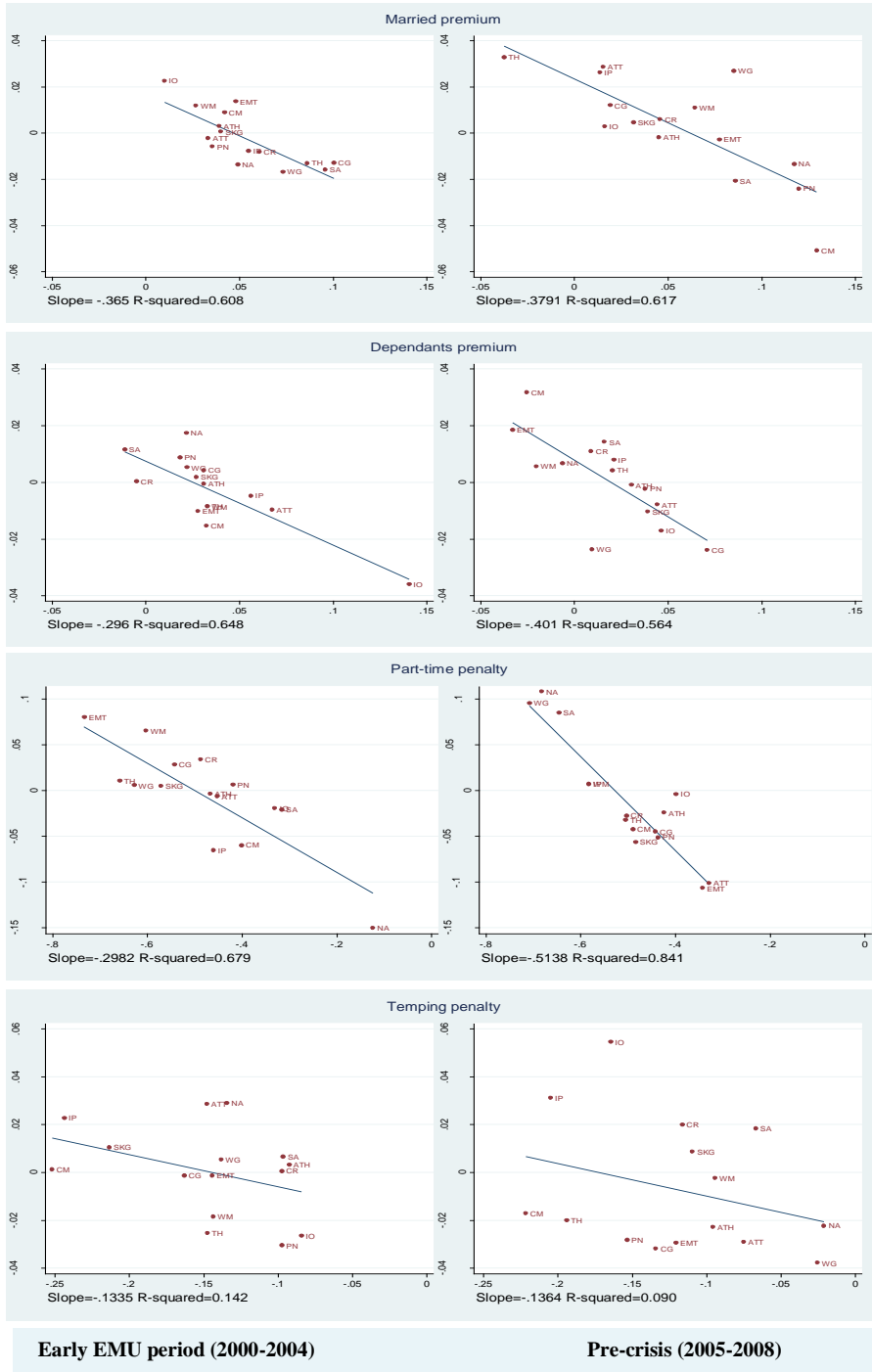
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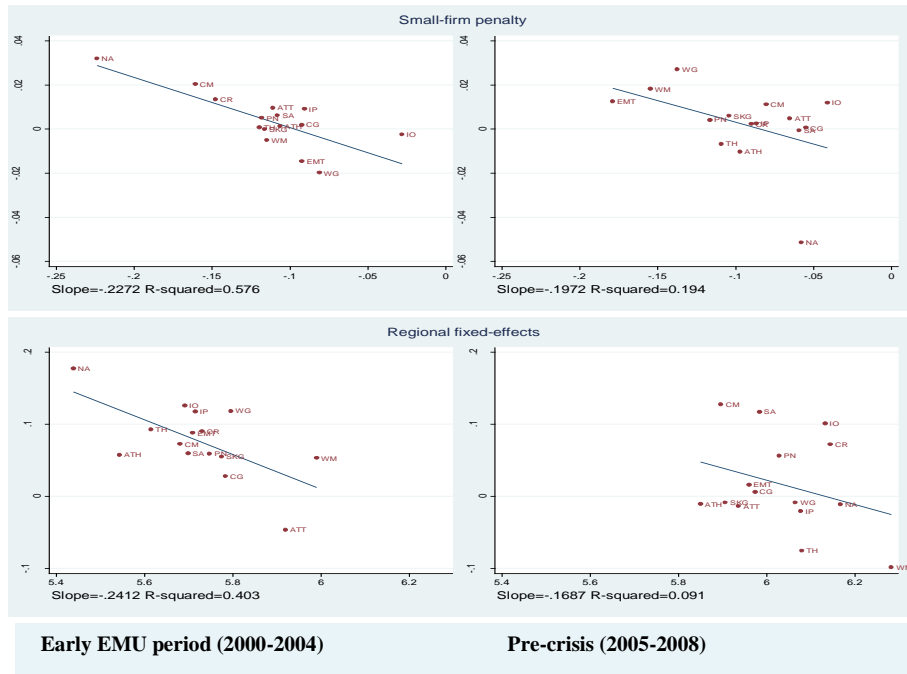
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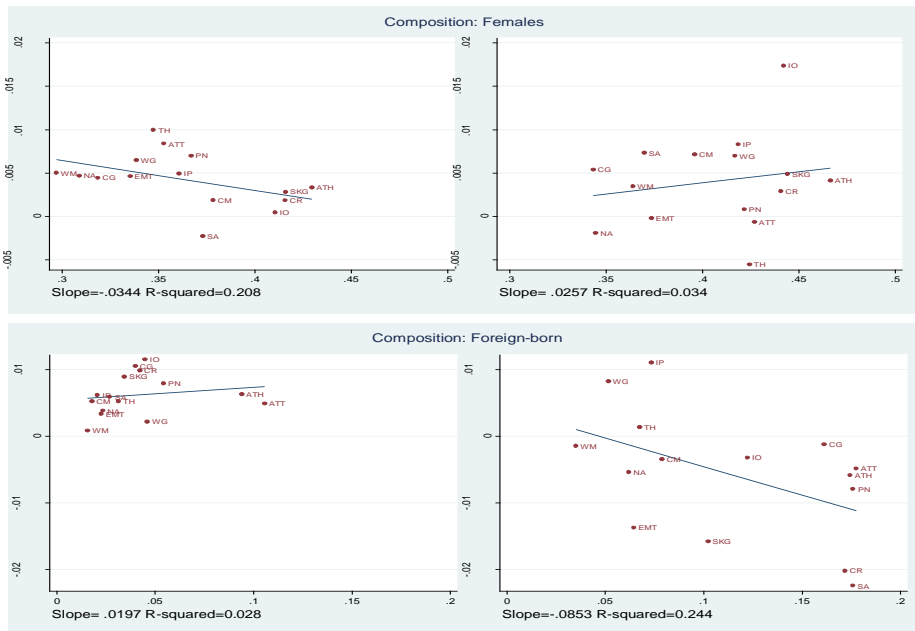
Appendix A: T-I analysis for the pre-crisis sub-periods
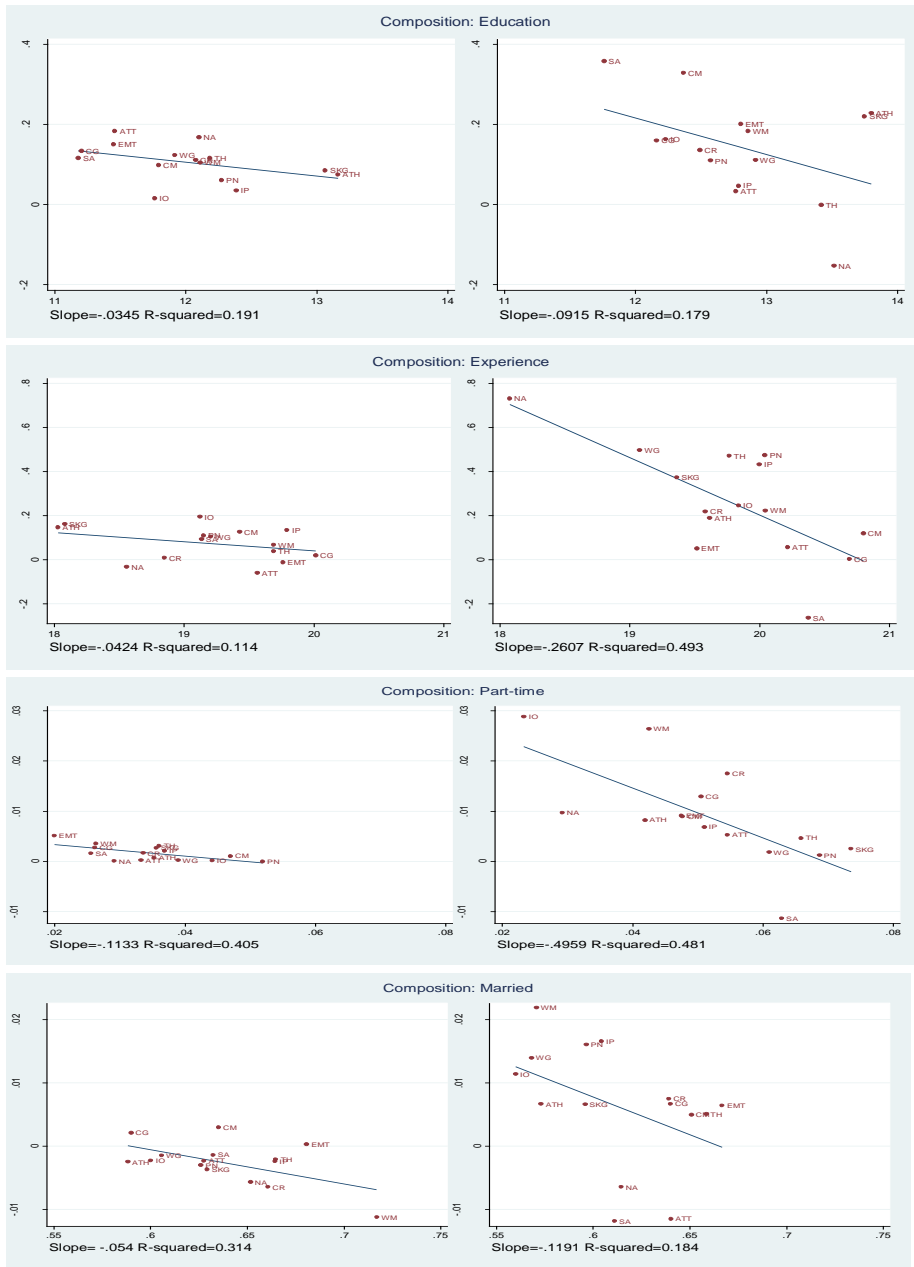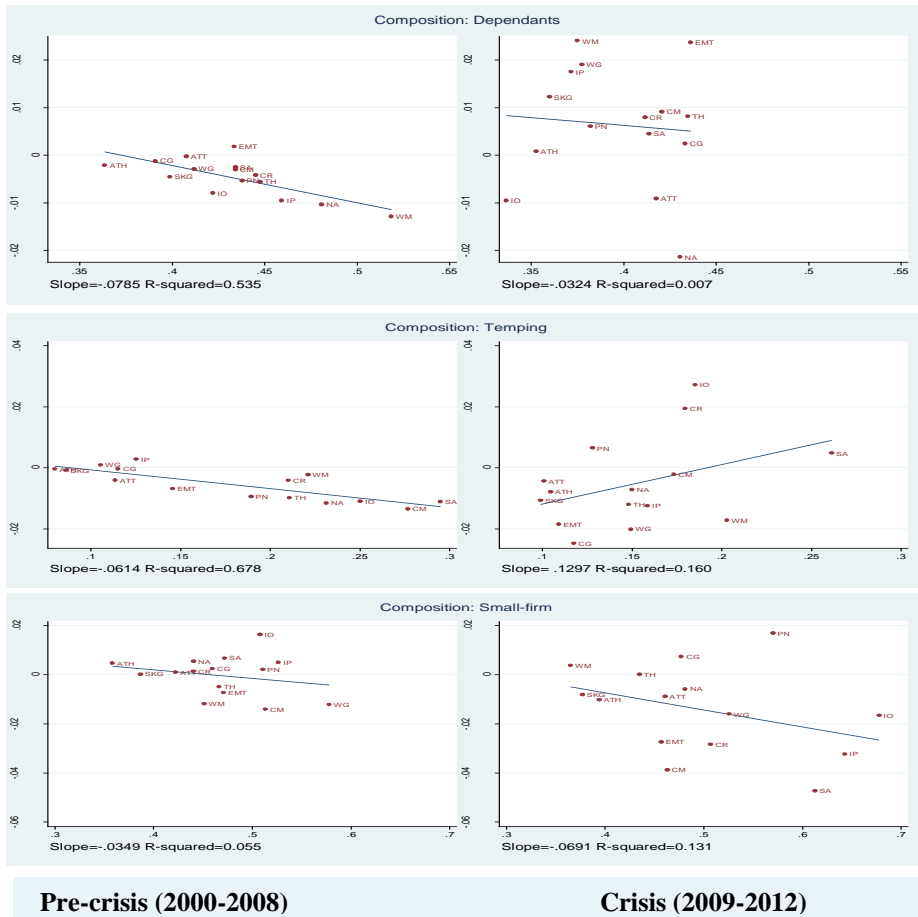## (2000-2004 vs 2004-2008)

Early EMU period (2000-2004)   **Pre-crisis (2005-2008)**

Early EMU period (2000-2004)   Pre-crisis (2005-2008)

Early EMU period (2000-2004)   **Pre-crisis (2005-2008)**

Appendix B: T-I analysis for characteristics (2000-2008 vs 2009-2012)

Composition: Education

Slope=-.0345 R-squared=0.191   Slope=-.0915 R-squared=0.179

Composition: Experience

Slope=-.0424 R-squared=0.114   Slope=-.2607 R-squared=0.493

Composition: Part-time

Slope=-.1133 R-squared=0.405   Slope=-.4959 R-squared=0.481

Composition: Married

Slope= -.054 R-squared=0.314   Slope=-.1191 R-squared=0.184

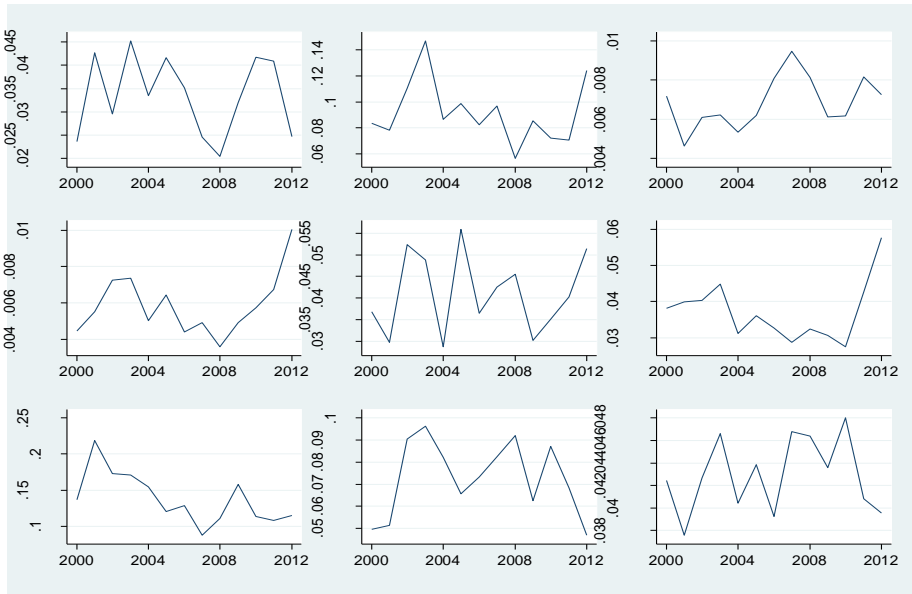**Pre-crisis (2000-2008)**   **Crisis (2009-2012)**

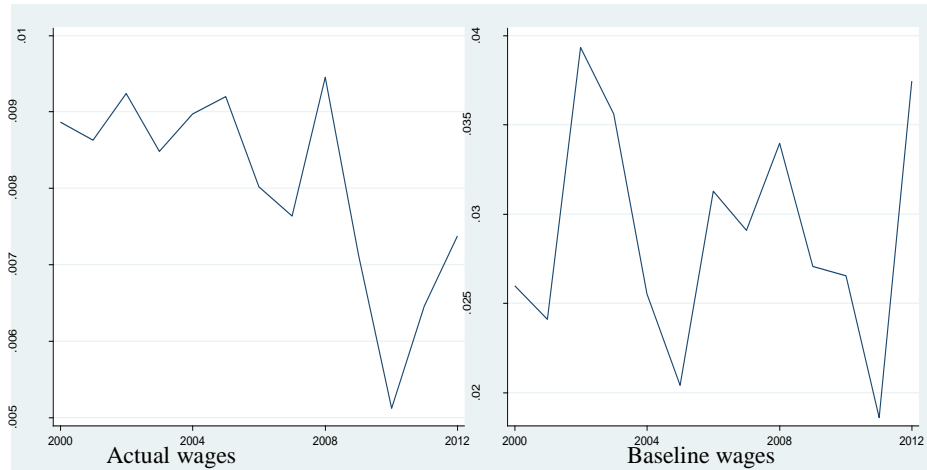**Pre-crisis (2000-2008)**   **Crisis (2009-2012)**

Appendix C: Sigma-convergence analysis for prices and wages

C.1: Sigma-convergence analysis for returns to characteristics

C.2: Sigma-convergence analysis for actual and baseline wages

LA CONVERGENCE DES SALAIRES DURANT LA CRISE GRECQUE : UNE ANALYSE AU NIVEAU RÉGIONAL

Résumé - *L'analyse sociale et macroéconomique de la crise grecque a mis au second plan ses conséquences au plan régional. Cet article se focalise sur cet aspect de la crise en étudiant plus particulièrement les disparités régionales de salaires et leur convergence. Une équation mincérienne est utilisée pour analyser l'évolution des salaires régionaux en suivant la méthodologie développée par Duranton et Monastiriotis (2002). Les résultats montrent une amplification avec la crise de la tendance à la convergence des salaires qui avait débutée avant 2008. Derrière cette tendance, il apparaît que les réponses des marchés du travail régionaux face à la crise ont été fort hétérogènes.*

Mots-clés - AVANTAGES SALARIAUX, DISPARITÉS RÉGIONALES, GRÈCE, CONVERGENCE, CRISE