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Evaluating the Impact of Labour Market Reforms in Greece during 2010-2018

Georgios Gatopoulos, Alexandros Louka, Ioannis Polycarpou and Nikolaos Vettas

THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

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Georgios Gatopoulos[1], Alexandros Louka[2], Ioannis Polycarpou[3] and Nikolaos Vettas[4]

ABSTRACT

In view of long-standing weaknesses in Greece's labour markets, several labour market reforms were implemented during the economic adjustment programmes with two objectives. Firstly, support the economy's adjustment through more flexible labour markets and secondly, enhance gains in cost competitiveness. In relation to their objectives, we find evidence that reforms largely fulfilled the second objective and partially the first, albeit left mostly unaddressed some of the long-standing weaknesses, such as low participation rate and high tax wedge. The analysis is backed by two distinct but complementary approaches. From a micro-founded analysis, while the 2014 reduction in social security contributions positively affected incentives for official sector labour participation, those appear to have decreased cumulatively during the overall programme period. From a top-down macroeconomic perspective, findings suggest that Greece's 2012 labour market reforms had a positive impact on reducing Unit Labour Cost (ULC), increasing the use of flexible forms of employment, slowing down unemployment rate dynamics and slightly accelerating employment growth trends. At the same time, it appears that the 2012 reforms did not improve labour participation rates, while they increased average working hours and inequality.

Keywords: Greek crisis, labour market reforms, impact assessment, participation tax rate, generalized synthetic control

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1. Introduction

The Greek labour market had traditionally been facing significant challenges such as low productivity, low participation rate, high unemployment, high tax wedge, low use of flexible employment forms and high share of self-employed. In the context of three consecutive bail out programs, the Greek state legislated and implemented various reforms aiming to restore its fiscal sustainability and external competitiveness. In this context, the most radical structural reforms took place in the labour market and had a two-fold objective. First, to support the economy's adjustment, through higher labour market flexibility in order to cushion the crisis' negative impact on employment and facilitate a faster employment recovery. Second, to pursue gains in cost competitiveness in order to adjust the external imbalances.

This study evaluates the impact of Greek labour market reforms during the bailout programmes (2010-2018) in relation to their objectives and beyond. To this effect, we follow two distinct but complementary methodological approaches. The first is based on micro-founded simulations at the level of households, through which we evaluate the impact of reforms on microeconomic incentives of individuals in relation to entering the formal labour market. The second is based on a top-down macroeconomic perspective at a cross-country level, applying the generalized synthetic control method, which allows to estimate counterfactual paths for selected macroeconomic and social indicators in the absence of labour market reforms.

The current paper is organized as follows. Section 2 presents some stylized facts highlighting the long-standing challenges in the Greek labour market. Section 3 provides a brief overview of main labour market reforms which took place in Greece during the economic adjustment programmes. A literature review in Section 4 provides background information on published empirical analysis on labour markets in Greece and other countries. The micro-founded simulations focusing on labour participation incentives are illustrated in Section 5. Then the following Section 6 presents the econometrics estimations at a cross country level offering insights from a macroeconomic perspective. The conclusions Section 7 highlights the main findings and some of their forward-looking implications.

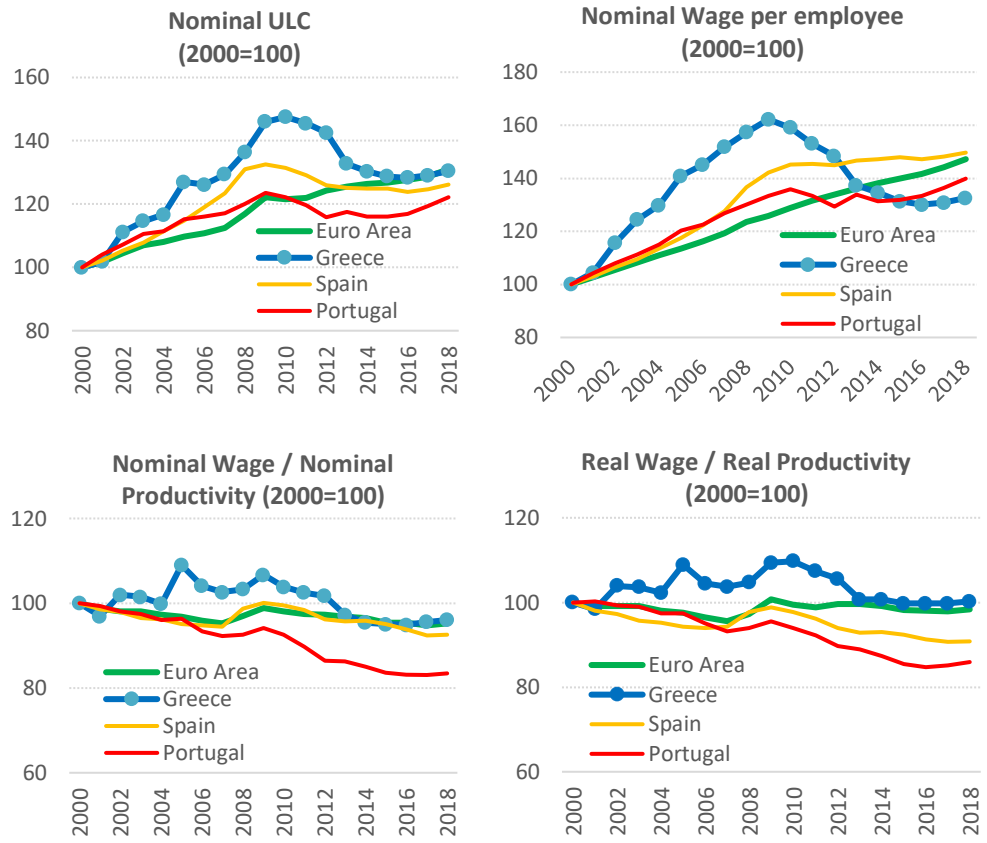
2. Stylized facts of the Greek labour market

During the first decade of the adoption of the euro, the Greek economy's price competitiveness weakened relative to the euro area average, but also relative to other southern euro area peers, such as Spain and Portugal. Greek nominal unit labour costs increased by around 47 percent from 2001 to 2010. In comparison, unit labour costs for the euro area, Portugal and Spain increased by approximately 20, 22 and 31 percent respectively (**Figure 1**). Besides, wages in Greece grew faster than productivity, both in nominal and real terms, while wages grew in line with productivity for the euro area average and productivity

grew faster than wages in the case of other southern euro area peers, such as Spain and Portugal.

This divergence contributed to increasing external imbalances with current account deficits peaking at over 15 percent of GDP in 2008. Labour market reforms that could help realign wages with productivity and restore cost competitiveness were therefore a priority of the economic adjustment programmes. This prioritization was further backed by the absence of other adjustment channels such as the exchange rate.

Figure 1: Unit labour costs, wages and productivity growth in Greece versus the Euro Area



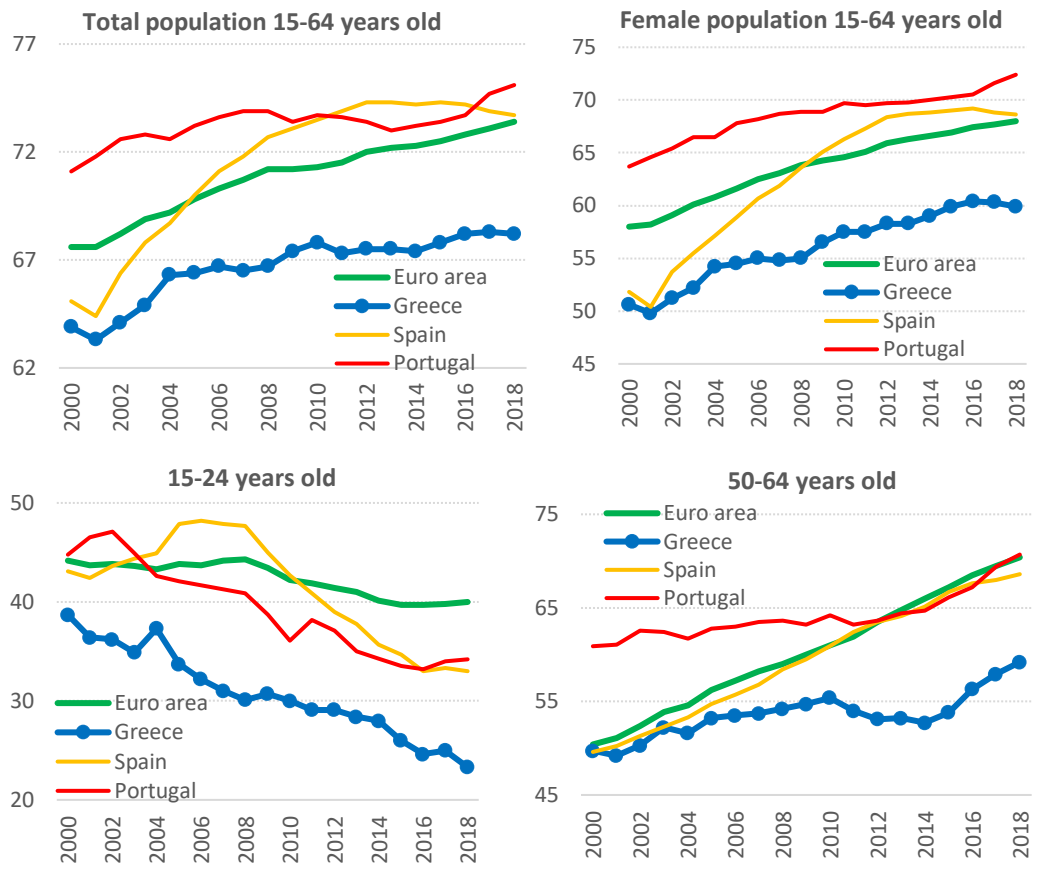
Source: Ameco. Note: Nominal ULC is defined as the ratio of compensation per employee to real GDP per person employed. Wage is defined as gross wage per employee. Productivity is defined as GDP per person employed.

The Greek labour market has traditionally been marked by low participation rates, compared to its European peers, which translates into a high share of working age population not willing to join the labour force (**Figure 2**). Greece's labour force participation rate is low especially among women, around 60% in 2018 compared to 68% for the euro area average, and despite progress during the last couple of decades, Greece has not yet converged with its European peers, as Spain did during the same period[5]. Participation rates are particularly low among

[5] Nicolitsas (2006) explores the factors affecting female labour market participation trends in Greece.

young population 15-24 years old, inter alia due to the high share of tertiary education graduates in Greece, as well as among population aged 50-64 years old, likely affected by the wide use of early retirement schemes up until the programme periods.

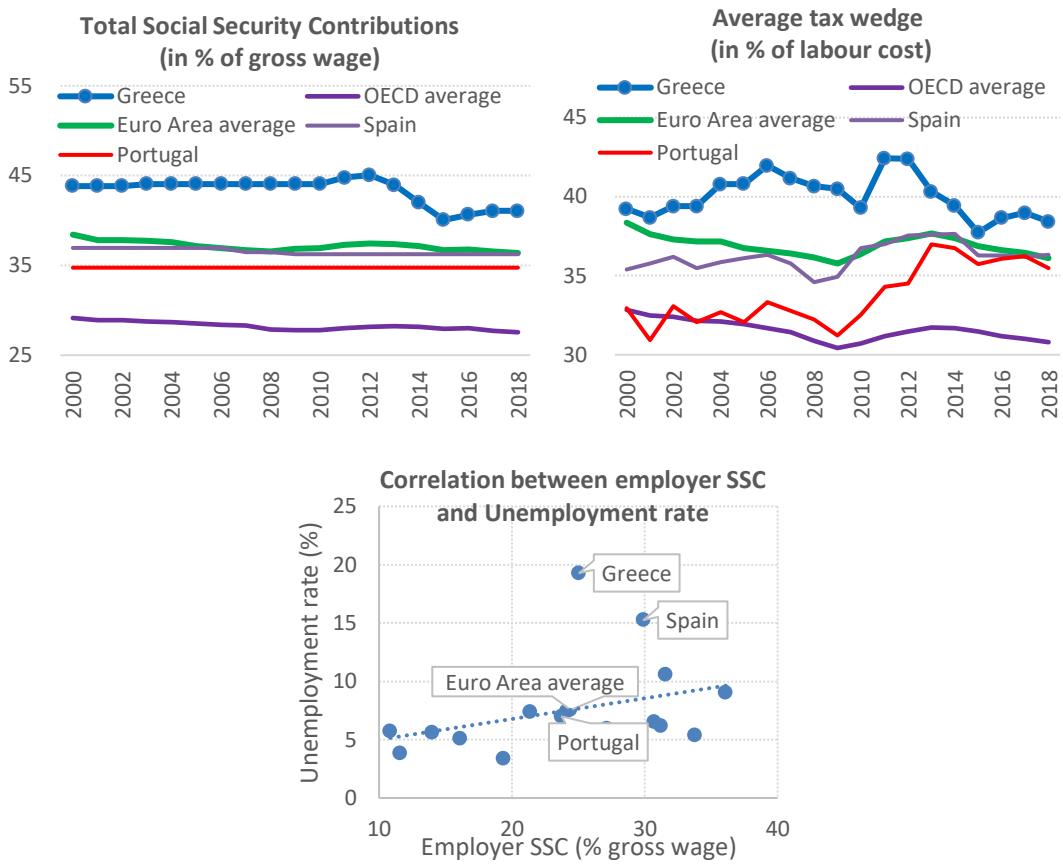
Figure 2: Labour participation rate in Greece compared to the Euro Area



Source: Eurostat. Note: Labour participation is defined as the ratio of Labour Force over Population aged 15-64.

A significant counterincentive for labour force participation is the very high labour taxation. The aggregate tax burden measured either by social security contribution rates or by total tax wedge, has systematically been above common practice in other advanced economies (**Figure 3**). This distorts microeconomic incentives for individuals to enter the official sector labour market and encourages the development of informal labour relations. On a cross-country perspective, it is further observed that the higher the rate of employers' social security contributions, the higher the unemployment rate, at least in the recorded formal labour market. As a result, one of the dimensions of the labour market reforms under the economic adjustment programmes intended to encourage the shift from informal towards the formal labour market, inter alia through lower social security contributions, within the particularly tight fiscal constraints.

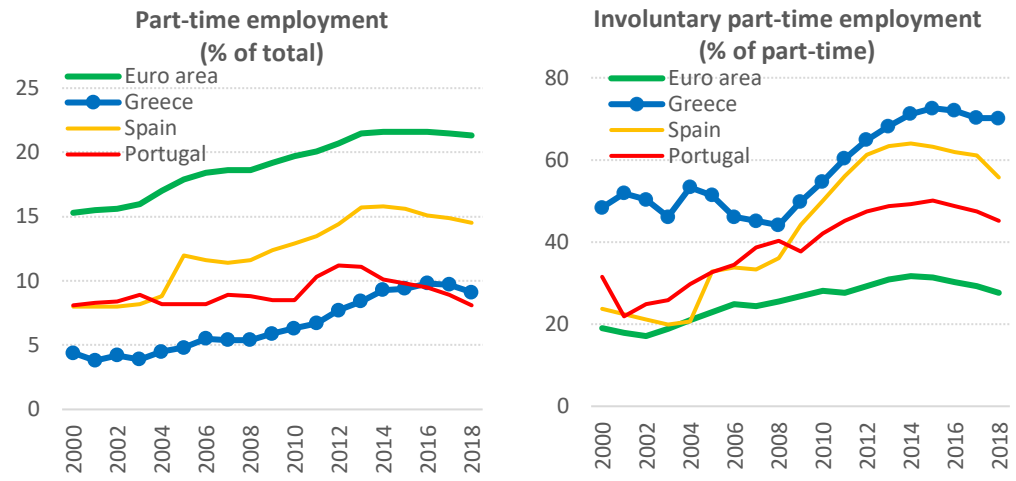
Figure 3: Social security contribution rates and tax wedge in Greece compared to peers



Source: OECD. Note: Tax wedge is measured by the ratio between the amount of taxes paid by a two-earner married couple (one at 100% of average earnings and the other at 67 %) with 2 children and the corresponding total labour cost for the employer.

Furthermore, high degree of employment protection, combined with low degree of use of flexible forms of employment have been common features of the labour markets in southern euro area members. Indicatively, part-time employment in Greece corresponded on average to 5% of total employment during 2000-2010, compared to 18% for the euro area, while the share of involuntary part-time workers is higher than in other EU countries (**Figure 4**).

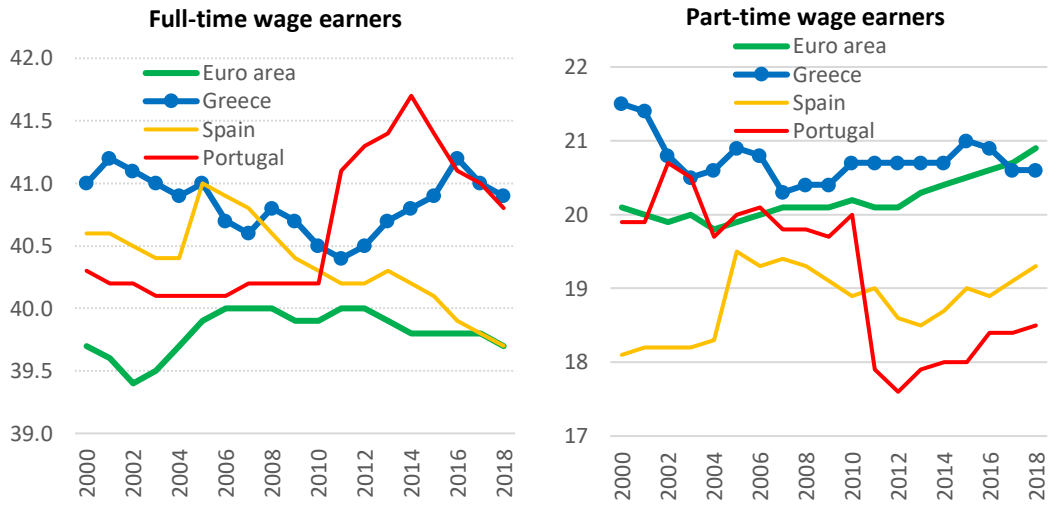
Figure 4. Part time employment in Greece compared to the Euro Area



Source: Eurostat

The average number of working hours for full-time employees in Greece, while higher than in the Euro Area average, had been declining during the pre-crisis expansion phase, contrary to the increasing trend in the Euro area (**Figure 5**). This may relate to regulations increasing the cost of overtime work or of forms of employment beyond the regular work timetable. At the same time, the average number of working hours for part-time employees in Greece have been close to Euro Area average and above the respective hours of southern peers.

Figure 5: Average weekly working hours in Greece compared to Euro Area peers

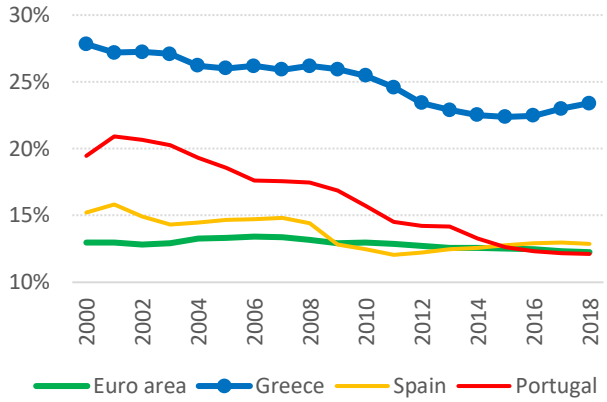


Source: Eurostat

A significant structural feature of the Greek labour market is that almost one in every four labour force members is self-employed, double the respective share in the Euro Area (**Figure**

6). Consequently, the labour market consists of many sole proprietorships and micro enterprises, unlike other countries where the workforce mostly consists of wage earners. The share of self-employed in Greece has slightly declined during the crisis, but it has not eliminated its gap with the Euro Area average, like it did in Portugal.

Figure 6. Total number of self-employed over total labour force in Greece and the Euro Area



Source: Eurostat

3. Overview of labour market reforms in Greece during 2010-2018

In view of the stylized facts of Greece's labour markets, at the onset of the sovereign debt crisis, the economic adjustment programmes included labour market reforms with at least two objectives.

Firstly, to support the adjustment in the economy, through reforms targeting to ease labour market rigidities. The goal was to cushion the negative impact on employment when domestic demand was severely hit by the crisis, as well as to facilitate a faster recovery of employment as soon as the country would return to positive economic growth. More flexible labour market regulations and price adjustments (wage cuts) were preferred to volume adjustments (layoffs), also considering that resources for the welfare state had been highly constrained.

Secondly, to enhance gains in cost competitiveness. In the absence of an exchange rate policy instrument, the competitiveness channel required adjustment in relative prices and nominal wages to correct the large imbalances in Greece's external accounts. The policy of internal devaluation would have side effects on households' purchasing power like the ones of a sharp currency devaluation, in the case the exchange rate instrument had been available. This in turn would have led to higher inflation and thereby lower real wages translating into more expensive imports.

Both objectives aimed to preserve existing jobs, to facilitate the creation of new ones, to enhance the reallocation of factors towards tradable sectors, and to encourage scale

economies. In view of these objectives, a broad range of policy interventions in the labour markets mainly touched upon five dimensions (**Table 1**).

Table 1: Indicative labour market reforms in Greece during 2010-2018

Labour market dimension	Policy rationale	Year	Legal reference
I. Collective bargaining framework	Increase the system's flexibility and decentralization, to facilitate adjustment via wages rather than via volumes	2011, 2012	Laws 4024/2011, 4046/2012
II. National minimum wage	Reduce Greece's minimum wage to lower labour costs, keep the low skilled from being priced out of the formal labour market, introduce new setting mechanism based on tri-partite consultation and evidence-based wage floor setting.	2012	Laws 4046/2012, 4093/2012, 4172/2013, 4254/2014
III. Employment protection	Reduce Greece's exit costs to foster employment.	2012	Laws 4046/2012, 4093/2012
IV. Flexible forms of employment	Facilitate flexible forms of employment to increase labour participation rates and foster job creation.	2011, 2012	Laws 3986/2011, 4093/2012
V. Labour tax wedge	Reduce non-wage costs mainly through employers' social security contributions	2012, 2014	Laws 4093/2012, 4254/2014

The measures pursued included revising the wage setting mechanisms, reducing exit costs and hence making hiring more attractive, introducing more flexible working time, reducing non-wage costs, combating undeclared work and improving active labour market policies. In relation to wage setting, a series of measures concerned the framework of collective bargaining as well as national minimum wage setting, inter alia aiming to remove automatic increases in bonuses and allowances that, over time, decoupled wages from productivity. In parallel, measures aimed to ease employment protection, enhance flexible forms of employment, tackle undeclared labour and lower the tax wedge, albeit within tight fiscal constraints. More specifically, labour reforms during the economic adjustment programmes included the following eight areas of measures.

(1) Collective bargaining framework. Measures implemented in 2011 and 2012 inter alia included (a) the temporary suspension of the extension mechanism of collective agreements, (b) the possibility for firm level collective agreements to prevail over sectoral and occupational agreements (suspension of favourability principle), (c) the restriction of 'after effects' of collective agreements, and (d) the revision of the rules on recourse to arbitration. Institutional reforms aimed at increasing flexibility, decentralization, and

effective representation within collective bargaining. The objective was to put firms in a flexible position to adjust through price rather than through volume (layoffs) and informality.

(2) Minimum wage setting framework. The minimum wage was reduced by 22% (32% for employees up to 25 years old) in February 2012. The setting mechanism was modified in that the statutory minimum wage is set by the government following consultation with social partners and input by stakeholders taking into consideration economic and social criteria. The rationale of the new mechanism was to strengthen evidence-based wage floor setting, as well as to directly involve the government through a tri-partite framework into steering labour market developments as a third party while considering the various objectives expressed by incumbent employees and employers.

(3) Employment protection. The probation period for new hires was extended (2010), the severance payment and notification periods for dismissals were reduced (2012). The rationale was to facilitate firms' increased responsiveness to the economic cycle at the extensive margin, by lowering exit costs to encourage hiring despite the volatile and uncertain crisis environment.

(4) Flexible forms of employment. The use and renewal of fixed-term contracts was facilitated (2011), regulations for part-time shift work and working time arrangements were made more flexible (2010, 2011 and 2012), premia for part-time and overtime work were reduced (2010), the scope of temporary work agencies was broadened in line with other countries (2010 and 2014). The rationale was to facilitate firms' increased responsiveness to the economic cycle at the intensive margin, as well as to enhance labour participation and shift informal labour relations into the formal labour market.

(5) Tax wedge and non-wage labour costs. Employers' social security contribution rates were reduced by 1.1 and 2.9 percentage points in 2012 and 2014 respectively, while employees' contributions were reduced by 1 percentage point in 2014. Besides, bureaucracy on labour arrangements has been reduced, inter alia through abolishing the pre-approvals of overtime work and streamlining other reporting requirements (2012 and 2014). The rationale was to reduce labour costs and strengthen the incentives for employment without negatively affecting take home salary.

(6) Active labour market policies. Both public and EU funds were used to implement short-term public work programmes (2013 onwards), internships with youth voucher schemes, while apprenticeships and vocational training schemes were revisited with an aim to increase their effectiveness. The rationale was to assist job finding and enhance the skillset of the large shares of the population who were either unemployed or inactive.

(7) Undeclared work. Stricter sanctions for undeclared work were imposed (2013), the labour inspectorate initiated a multi-year action plan including risk-based audits, digital systems were put in place to allow checking of both undeclared and under-declared work. The

motivation was to combat the high rates of informal work in Greece which have a negative impact on workers' insurance rights as well as on public finances.

(8) Labour institutions and transparency. The Labour Inspectorate (SEPE) introduced risk based, more targeted audits, the Public Employment Service (OAED) was restructured, the Arbitration Body (OMED) was complemented by an appeal committee, the Supreme Labour Council (ASE) was upgraded in that it obtained a decisive role with regards to the process of collective dismissals. Transparency in relation to monitoring labour market developments and data disclosure were improved, including through the initiation of digital systems such as ERGANI for employment flows, ARTEMIS for undeclared work audits, as well as through the creation of the National Employment Institute (EIEAD).

Overall, within the bailout programmes' set of structural reforms, it is widely perceived that labour market reforms were the most pronounced. Lyberaki et al. (2017) provide an overview of labour market regulation and reforms in Greece. In the context of its post-programme evaluation, ESM (2020) notes that the labour market reforms caused an initial drop in wages, followed by a revival in employment and remuneration in line with productivity gains. Despite the magnitude of policy interventions in the labour market, the unemployment rate in Greece increased significantly during the crisis, peaking at around 27 percent in 2013, while only gradually fading out since then, with a negative impact on productivity, poverty rates and inequality indicators. One explanation offered by policy experts is the inadequate sequencing of reform implementation during the bailouts, i.e. the lack of parallel front-loaded implementation of product market reforms (Meghir et al., 2017). In such turbulent periods, it is of course hard to identify an adequate counter-factual scenario to isolate the effects of labour market reforms. Our work aims to offer further insights towards that direction.

4. Literature review

There is extensive theoretical work in relation to the impact of distinct labour market measures, such as the ones pursued during the programmes. These strands of literature may offer mixed conclusions depending on the prioritized policy objectives, especially on controversial issues such as the minimum wage, the degree of centralization of collective bargaining, or the optimal degree of employment protection.

In the context of collective bargaining, for instance, economic theory on the one hand suggests that broadening the scope of firm-level bargaining is efficient because it allows agreements to account for the particular circumstances of firms in a weaker condition. Empirical findings by Bertola et al. (2010) provide evidence that firms covered by higher-level collective wage agreements were more likely to pursue cost reduction by reducing the number of temporary employees and less likely to reduce wages. They further found that firms bound by higher-level collective agreements were more likely to increase prices

following a cost-push shock. Such a business practice would risk resulting in a damaging spiral of wage and price increases, further eroding competitiveness. Notwithstanding, Boeri (2014) has argued that a two-tier bargaining system may reduce the scope for efficient firm-level bargaining, while there is also critique that fully decentralized systems may hinder collective bargaining. In the case of Greece, Kosma et al. (2017) find that labour reforms effectively facilitated firms to adjust both labour input and wages during the crisis.

According to international practice with respect to the minimum wage setting mechanism, ILO (2014a) notes that such wage setting decisions should be made following tripartite social dialogue and collective bargaining should be informed and evidence based. From a cross-country perspective, ILO (2014b) finds that the state has an active role in setting minimum wages in the majority of ILO member states. Nonetheless, the issue of who holds the ultimate decision-making power (government or social partners) as well as to what extent changes in the minimum wage spillover to the whole wage ladder or affect unemployment remain controversial issues for which empirical evidence is mixed. In the case of Greece, Georgiadis et al. (2018) find that minimum wages are highly correlated with the median wage, but no conclusive evidence for systematic employment effects, while Kanellopoulos (2015) points out a negative relationship between minimum wage and employment. Focusing on the 2012 minimum wage reduction in Greece, Yannelis (2014) supports evidence that hiring increased, while unemployment effects kicked in only above a certain threshold of minimum wage. The IMF (2019) presents evidence that Greek sectors with higher minimum wage share witnessed a higher drop in wages but also a smaller employment reduction. Georgiadis et al. (2020) find no significant impact of the 2012 reform on job separations, implying that changes in employment stemmed from changes in hirings.

In the context of this research project, we focus on empirical literature findings and methodologies aiming to assess the impact of labour market reforms on both microeconomic incentives and the macroeconomic framework. Indicatively for collective bargaining, institutional reforms during the programme aimed at increasing flexibility, decentralization, and effective representation. OECD (2011) argues that the prevalence of sector-level bargaining, the automatic extension of bargaining agreements, and a unilateral recourse to arbitration have contributed to the rise in labour costs and high minimum wages for new entrants to the labour market during the pre-crisis period. Hence, the objective of the reforms was to put firms in a flexible position to align pay with productivity and adjust labour costs through price rather than through volume (layoffs) and informality. Micro level evidence suggests that firm-level agreements signed after the reforms indeed led to downwards adjusting wages. Koukiadaki and Kokkinou (2012) and Ioannou and Papadimitriou (2013) provide evidence that most post-reform firm-level agreements stipulated either wage reductions or adjustments to the levels of the national minimum wage. Christopoulou and Monastiriotis (2016) document that wage adjustments in the private sector have been of at least equal magnitude and speed to the public wage adjustments. At the same time, Daouli

et al. (2017) do not find strong evidence of a negative relationship between wages and regional unemployment except during the early crisis period 2010-2011.

The impact of labour market reforms has been studied in other southern Euro Area peers like Spain and Portugal, which have commonalities with the Greek labour market and which also went through economic adjustment programmes. OECD (2014) use a regression discontinuity in time (RDiT) approach allowing them to compare labour market performance before and after the reforms' date of enactment. They find that labour market reforms contributed to 50 percent of the observed drop in Spanish unit labour costs. OECD (2017) notes that reforms on employment protection had significant positive impact, contrary to the mixed impact of reforms on collective bargaining. Stepanyan and Salas (2020) assess the impact of the Spanish labour market reforms on income distribution and macroeconomic variables such as employment growth, youth unemployment rate and in-work poverty. They find that reforms significantly enhanced employment and income equality, albeit in-work poverty and involuntary part-time work were also negatively affected.

This work aims to build upon the existing literature and shed light on at least two key fronts: (a) evaluate the impact of Greek labour market reforms on microeconomic incentives of individuals to enter the formal labour market, as per Section 5 and (b) estimate the impact of labour market reforms on selected macroeconomic and social indicators, as per Section 6.

5. Microeconomic approach

5.1. Data and methodology

In this section, we estimate the incentives for official sector labour supply, i.e. the probability for a working age person to participate in the labour market. For our calculations we focus on persons who already work to explore possible "unemployment traps" in case they become unemployed. In particular, we simulate the transition from employment to unemployment status and calculate the taxes, contributions and social benefits that the person receives in each state. The analysis concerns the short-term horizon, for as long as the unemployed is eligible for unemployment benefits, in which period we quantify the incentive for employment.[6]

For the purposes of our analysis, we estimate these incentives for labour force participation in three distinct time periods using the respective micro datasets. Such incentives are estimated in the beginning and at the end of the memoranda (2010 and 2018), as well as in 2014. The latter is chosen because we also assess the impact of a reduction of employees' contributions by 1 percentage point which took place in 2014 ("reform") on the incentives for employment, for the whole labour force, as well as distinctly for population groups with

[6] A comprehensive analysis focusing on the long-term labour supply effects and incidence of payroll taxes on earnings in the case of Greece is presented by Saez et al. (2012).

traditionally lower participation rates in the official sector labour market, such as women and young population.

We use micro-data for Greek households from the EU Survey for Income and Living Conditions (EU-SILC) during the crisis years and up until 2018. For the purposes of our methodology, following some filtering criteria described below, a sub-sample of the data from EU-SILC is used as input within a microsimulation framework with the deployment of EUROMOD. This tool applies tax and benefit policy rules which hold within a given year (policy system) and simulates in detail the taxes, benefits, social insurance contributions at both the individual and the household level. It can also compute accurately the respective disposable income for each household when the system rules are applied (Sutherland and Figari, 2013). EUROMOD has been extensively used for simulation of policy reforms (Leventi and Matsaganis, 2013).[7] Using EUROMOD policy parameters for the three distinct years of interest, i.e. 2010, 2014 and 2018, we simulate the components that critically affect labour market participation incentives at the extensive margin, i.e. the decision whether to participate or not. These components are taxes paid, benefits received, social insurance contributions paid, and labour earnings.

The Participation Tax Rate (PTR), as in Immervoll et al. (2007), is a commonly used proxy for the counterincentives for employment which stem from labour taxation, as well as from social benefits. It is easily constructed on the basis of a simple micro-founded model (see Appendix 8.1). PTR accounts for the share of gross remuneration which is paid for taxes and contributions or the share of disposable income which is lost due to foregone social benefits when an unemployed person transitions to employed status. Hence, it is based on the concept of opportunity cost. PTR reflects the net tax burden (taxes plus contributions minus allowances) of a household from a person transitioning between the states of employment and unemployment, expressed as a share of gross remuneration. Given that a welfare system offers income support at the unemployment state, this means that the net tax burden at the unemployment state becomes negative, as taxes paid at the unemployment state are less than benefits received, and as a result PTR is positive for most persons. The more generous the social benefit system at the unemployment state, and the higher the tax wedge at the employment state, the higher the PTR and the lower the economic payoff and hence the incentive for employment. PTR equals zero when counterincentives for employment are at a minimum and equals one when there are maximum counterincentives.

Specifically, we can express PTR for a person i in household h in terms of the household's disposable income:

$$PTR_i = 1 - \frac{Y_h^w - Y_h^{nw}}{E_i}$$

[7] The parameters for the Greek policy system are explained in the 2019 EUROMOD country report: https://www.euromod.ac.uk/sites/default/files/country-reports/year10/Y10_CR_EL_Final.pdf

where E_i represents the gross income of person i when she works, Y_h^w is the household's disposable income when the person i works, while Y_h^{nw} is the household's disposable income when the person i is unemployed.

The above metric requires that counterfactuals will be simulated for each individual in the sample. For the PTR calculations, the taxes, benefits and social insurance contributions of individuals need to be simulated under both employment and unemployment states. EUROMOD will allow us to calculate these quantities for households and individuals. We estimate the PTR for each person in the sample by shifting her status from employment to unemployment, while computing the household's disposable income in both states through a simulation via EUROMOD. This incorporates the impact of the social welfare system when the person changes employment status and reflects the respective counterincentives for labour supply.

Given that the disposable income is measured at the household's level, when calculating the PTR for each person, this needs to reflect the person's transition between the two states (employment and unemployment) while keeping the employment status of other household members unchanged. This is crucial since taxation and benefits likely depend on the status and income at the level of the household. We contain ourselves to presenting the findings on a sample of employed persons only, for whom we simulate their transition to unemployment), because the reverse exercise would require several additional assumptions concerning the imputed wage of unemployed persons in the labour market, the working hours, the specific sector/employer, given that contributions and taxes may depend on all these parameters. Data constraints impede us from studying the transition between unemployment and inactivity, since we can hardly disentangle between active and inactive jobless individuals in our sample. However, analysing the transition between unemployment and employment status allows us to infer some of the incentives applicable to the transition between inactive and active population and hence assess the impact on overall labour participation as discussed in section 5.2.

In the context of PTR calculation, the simulation consists of three steps:

- We estimate the household's disposable income without any change in the employment status of its members.
- For each employed person in the household, sequentially, labour remuneration is equalized to zero and EUROMOD simulates all benefits for which the person would be eligible, including the unemployment benefit. In each simulated case of a person's transition to unemployment, the system estimates the respective household's disposable income.
- In the example of a household with two earners, we first simulate the transition to unemployment for one of the two wage earners, while keeping the labour remuneration of the other household member constant. We estimate the household's respective disposable income as well as the person's PTR. We then repeat the

simulation for the second wage earner member of the household, while again keeping the employment status and labour remuneration of the first household member constant. We estimate again the household's respective disposable income as well as the second person's PTR.

To compute the PTR for currently employed persons, assumptions were made in relation to the eligibility for unemployment benefits as well as on the duration of the benefit. For instance, to define the eligibility, we set the number of contribution months equal to the number of employment months before transiting to unemployment status. These months are then transformed into working days and are compared to the criterion of the last 14 months without accounting for the last two months. We further assume full take-up ratio by all eligible persons, in relation to social benefits.

Besides, PTR can be expressed as the mathematical sum of its components, i.e. net changes in taxes, contributions and benefits when transiting to an unemployment status. The PTR equation can hence be written as a function of its components, in percent of gross remuneration:

$$PTR_i = -\left(\frac{\Delta B_{HH} - \Delta T_{HH} - \Delta S_{HH}}{E_i}\right) = PTR^B + PTR^T + PTR^S$$

where PTR^B refers to the contribution of an increase in benefits, PTR^T refers to net tax reduction and PTR^S corresponds to net reduction of contributions when the person becomes unemployed. Equivalently, at the extensive margin, PTR measures the proportion of gross earnings lost because of higher taxes, higher social insurance contributions and lower benefits when an individual decides to participate in the labour market and becomes employed.

Our analysis of PTR focuses on persons who are already employed. We consider active working age population between 18-65 years old. Students, pensioners, minors and disabled persons are excluded from the simulation analysis. Our sample hence consists of persons who are eligible for unemployment benefits in case they become unemployed. Besides illustrating the incentives for employment which arise from the system of social benefits and taxation, we are particularly interested in assessing the impact of a reduction in social security contribution rates. For this reason, we restrict our sample to wage earners,[8] for whom we can accurately calculate the respective contributions on their income: (a) private sector employees insured with IKA – EFKA; (b) banking sector employees insured with funds such as ETE; (c) civil servants and employees in former state owned entreprises such as OTE and DEI.

On the aforementioned sample of employed persons, for whom descriptive statistics are presented in **Table 2**, we simulate two scenarios with respect to their contribution rates, both on which we calculate the PTR to capture the impact of the 2014 reform:

[8] Self-employed, free lancers and farmers are excluded from the micro-simulation for two reasons, first since the policy reform focused on wage earners' social security contributions and secondly because several additional assumptions would be needed to simulate the potential eligibility for unemployment benefits in each category other than wage earners.

- EU-SILC data 2014 and EUROMOD parameters 2014 including the 1% employees' social security contribution for the wage earners' family allowances account "DLOEM" (scenario before the 2014 reform)
- EU-SILC data 2014 and EUROMOD parameters 2014 excluding the 1% employees' social security contribution for the wage earners' family allowances account "DLOEM" (scenario after the 2014 reform)

The empirical analysis consists of two parts. The first relates to calculating PTR for a representative micro data set of Greek households, as well as presenting its demographics' distribution in two distinct time periods: in 2010, which is the year when the first economic adjustment programme was launched and in 2018, which is the year when the third programme ended. The second part of the analysis relates to estimating the impact from the 2014 reduction of social security contributions (reform) on the average PTR as well as on its demographics' distribution, particularly across income deciles, gender and age group.

Table 2. Descriptive statistics of sample demographics for PTR calculations

	2010		2014		2018	
	Number of persons	% of total	Number of persons	% of total	Number of persons	% of total
Total employed persons	3,342	100%	5,662	100%	9,278	100%
Gender						
Female	1,460	43.7%	2,474	43.7%	3,998	43.1%
Male	1,882	56.3%	3,188	56.3%	5,280	56.9%
Age						
18-30	700	20.9%	865	15.3%	1,342	14.5%
31-50	2,020	60.4%	3,654	64.5%	5,750	62.0%
51-65	622	18.6%	1,143	20.2%	2,186	23.6%
Education level						
Primary or low secondary	636	19.0%	681	12.0%	1,088	11.7%
Secondary	1,193	35.7%	1,945	34.4%	3,288	35.4%
Tertiary	1,513	45.3%	3,036	53.6%	4,902	52.8%

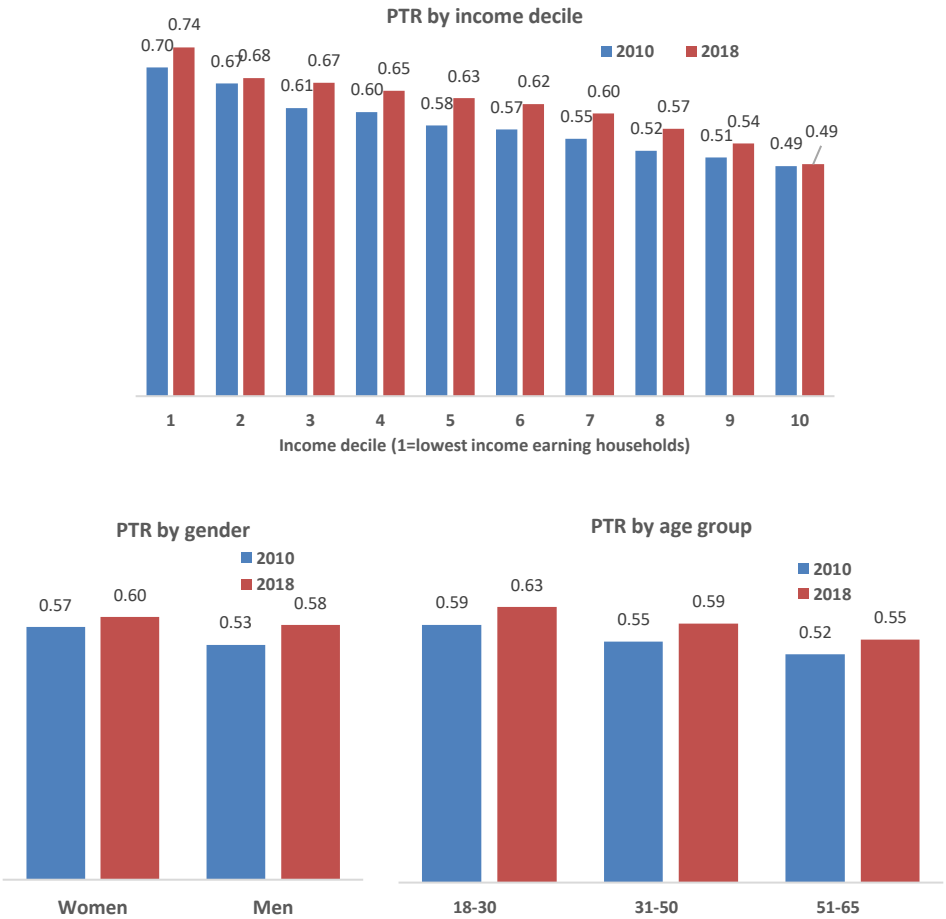
Source: EU-SILC 2010, 2014, 2018, authors' sample selection criteria. Note: our sample is the result of filtering criteria used such as to focus only on employed wage earners and is hence a sub-sample of the EU-SILC database.

5.2. Results

The findings on the descriptive analysis overall suggest that counterincentives for official sector labour participation increased during the bailout programmes, as reflected through the estimated increase of PTR for the average household in Greece between 2010 and 2018. The deterioration of incentives for labour supply has been more pronounced among male and younger population, which is in line with the stylized fact that recorded labour participation decelerated for these demographic groups during 2010-2018 (**Figure 2**). In relation to the simulation analysis on the impact from the 2014 reduction in employees' social security contributions, there is evidence that incentives for official sector labour participation improved following the specific reform, especially for groups such as youth and women, both of whom exhibit relatively low participation rates.

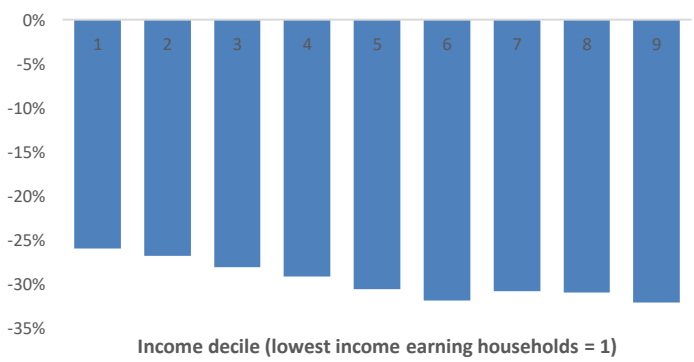
During 2010-2018, we observe an increase of the estimated average PTR across all income deciles, as well as the persisting stylized fact that counterincentives for labour participation are systematically larger for lower income earners, for women and for younger population segments (**Figure 7**). A comprehensive analysis of the causes behind the observed increase of PTR during the programmes lies beyond the scope of the current work. Nonetheless, one can note that the combination of increases in labour taxation due to the need for fiscal consolidation during the Greek sovereign debt crisis as well as the recessionary environment led to a significant drop of households' take-home salary which in turn negatively affects their incentives for official sector labour participation, ceteris paribus. In this context, the negative effects amplified to the extent that the fiscal adjustment relied more on the revenues side rather than expenditures, or on raising tax rates (e.g. special solidarity contribution on labour earnings) rather than broadening the tax base. In all, Greek households' disposable income decile thresholds exhibited a cumulative drop during 2010-2018, which exceeded 25%, which inevitably translates into an increase of PTR, ceteris paribus (**Figure 8**).

Figure 7. Estimated PTR by income decile, gender and age, before and after the bailout programmes



Note: Authors' estimations based on EU-SILC data and EUROMOD parameters for 2010 and 2018

Figure 8. Households' disposable income deciles change during 2010-2018 (in %)

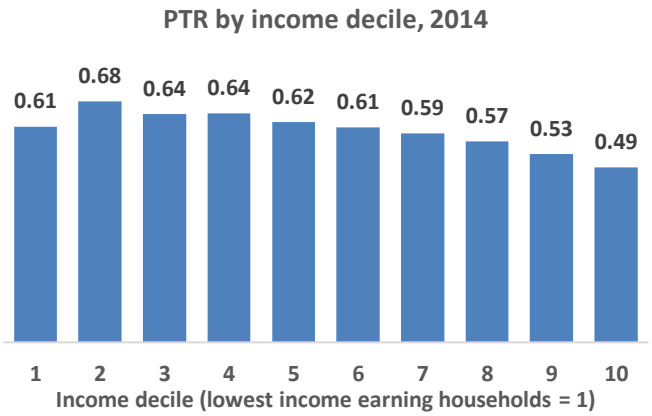


Note: Authors' estimations based on EU-SILC data for 2010 and 2018

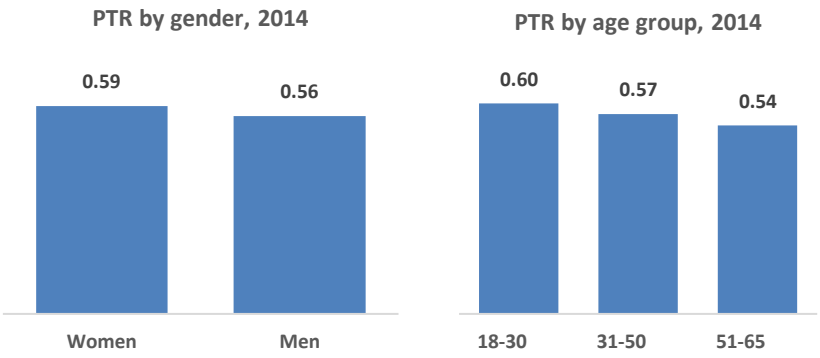
In the objective to reduce labour costs without reducing the employees' take-home salary, in line with the second adjustment programme, Greece reduced the social security contribution rates for employees by 1 percentage point as of July 2014 ("2014 reform").[9] This percentage point was used to collect revenues earmarked for the wage earners' family allowances account (DLOEM). Before the 2014 reform, we confirm the demographics' evidence highlighted in the descriptive section, since counterincentives for labour participation appear to be higher for lower income earning households, for women and for younger population groups (**Figure 9**).

To assess the reform's impact on labour market participation incentives and households' disposable income we estimate PTR across households and illustrate households' income distribution before the reform, using EU-SILC and EUROMOD 2014 micro data set described in the previous section, and then simulate the policy change, ceteris paribus, which allows us to re-estimate PTR and income distribution after the reform. In relation to the distributional impact of the reform, it had a positive impact on households' disposable income, ranging from 0.4% to 1.2%, while it was more pronounced for low-income earners (**Figure 10**).

Figure 9. Estimated PTR by income decile, gender and age, before the 2014 reform

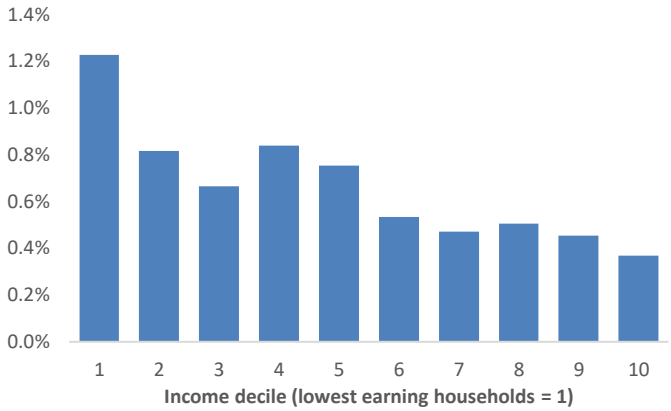


[9] In parallel, employers' social security contributions were reduced by 2.9 percentage points in July 2014. However, this policy change did not necessarily translate into a change of workers' take-home salary, hence we do not include it in our simulation analysis.



Note: Authors' estimations based on EU-SILC data and EUROMOD parameters for 2014

Figure 10. Estimated 2014 reform impact on households' disposable income, by decile (in %)



Note: Authors' estimations based on EU-SILC data and EUROMOD parameters for 2014

The positive impact of the 2014 reform on labour participation incentives is reflected through a drop of the estimated average PTR by circa 0.5 percentage points (**Table 3**). The rationale for this reduction stems from the reduction in contribution rates which increases disposable income in the household's employment state and hence makes official sector employment more attractive compared to the unemployment state.

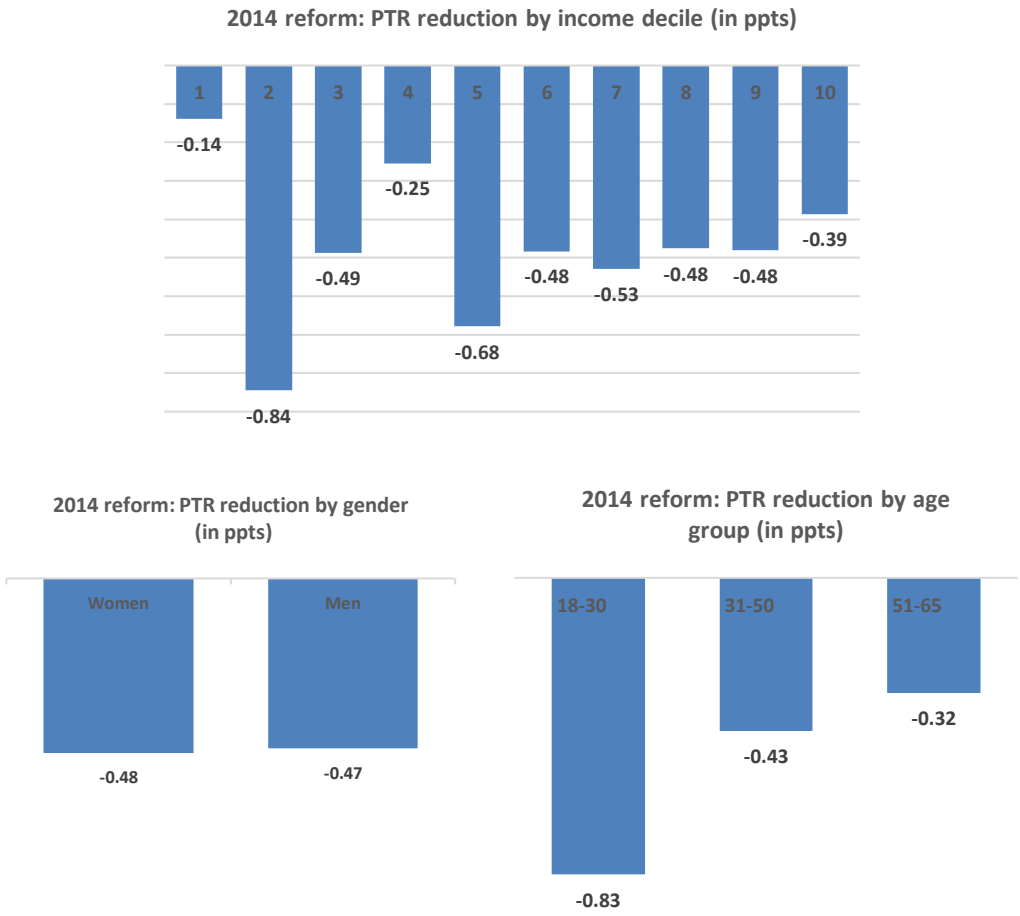
Table 3. PTR distribution before and after the 2014 reform

PTR per income decile	Low 20%	Mean	Upper 20%
PTR (before the 2014 reform)	0.677	0.570	0.565
PTR (after the 2014 reform)	0.668	0.565	0.561

The simulation findings point out that the 2014 reform led to a systematic reduction of the counterincentives for labour across all income deciles. Furthermore, the reduction in PTR was

larger among women and young population segments (**Figure 11**). Therefore, the positive impact on labour market incentives of the 2014 policy reform was higher for population segments which exhibit lower labour participation in the first place.

Figure 11. Estimated PTR reduction stemming from the 2014 reform



Note: Authors' estimations based on EU-SILC data and EUROMOD parameters for 2014

Changes in PTR are directly related to changes in labour participation rates, as shown in Appendix 8.1. Estimating the elasticity between PTR and labour participation is an important avenue for further research. In the case of Greece, IOBE (2019) applied a similar methodology to estimate the impact from a pension reform on labour market participation incentives and estimated an elasticity of around 0.75. If we use this estimate in our analysis, the obtained reduction in PTR by 0.5 ppts would translate into an increase in labour market participation in Greece in 2014 of around 0.4 ppts or 28 thousand persons, ceteris paribus.

6. Macroeconomic approach

6.1. Data and methodology

In relation to the macroeconomic impact of labour market reforms implemented in Greece during the economic adjustment programmes, we explore their impact on variables such as employment growth, unemployment rate, participation rate, use of flexible forms of employment, average working hours, unit labour cost and inequality. To achieve this, we construct appropriate counterfactuals for each variable of interest, that will depict the evolution of each variable in absence of major labour market interventions. Specifically, we use a synthetic control approach similar to Stepanyan and Salas (2020), who analyse the impact of Spain's structural labour market reforms, which took place in 2012. In Greece, the bulk of the reforms was also implemented in 2012, when changes in collective bargaining, minimum wage, employment protection and flexible forms of employment regulations were implemented (Laws 4024/2011, 4046/2012, 4093/2012). We hence consider that year as the turning point in our synthetic control method.

In principle, the synthetic control method requires that the sample be split in two groups: the "treated" country or group of countries in which an implemented policy is to be evaluated and the "non treated" countries. For our analysis of "treated" units, we consider the three programme countries of the southern Euro Area where significant labour market reforms with common features took place around 2012, Greece, Portugal and Spain (GPS). The method foresees the use of an appropriately weighted combination of not treated countries to construct a relevant counterfactual, to which the treated units can be compared to. This requires the use of a combination of other countries to construct a "synthetic" control country which replicates the Greek economic indicator's trend before the economic crisis. Essentially, it is an extension of the difference-in-differences (DID) method, but it allows assigning weights in a more systematic way, by using statistical matching techniques for instance. Thus, it aims to overcome the often violated "parallel trends" assumption required by DID, due to the existence of time-varying unobserved heterogeneity.

Building upon Stepanyan and Salas (2020), who use the synthetic control approach, introduced by Abadie et al. (2010), we employ the generalized synthetic control method proposed by Xu (2017). The latter provides a means of implicitly assigning weights using factor analysis techniques, which are often employed in quantitative finance. Specifically, the counterfactual for each treated unit is constructed using control group variation based on a linear interactive fixed effects model[10] that incorporates unobservable common shocks (factors) and their heterogeneous impacts on cross sections.

For the purposes of our analysis, the main advantages of the method we employ compared to the one in Stepanyan and Salas (2020) is that, firstly, it allows for multiple treated units (countries) and, secondly, the implicit weighting of the control units is easy to implement with

[10] A linear interactive fixed effects model is a fixed effects model augmented with factor variables.

the use of a built-in cross-validation procedure. This procedure does not a priori require selecting appropriate covariates for the matching procedure, and is hence more "data-driven".

To construct our counterfactual scenario, a comparable control group is selected from advanced economies which are both members of the EU and the OECD and did not employ major labour market reforms after the global financial crisis, based on data availability. Countries that have implemented major labour market reforms (e.g. Czech Republic), also following the filtering criteria applied by Stepanyan and Salas (2020), have been excluded from the generalized synthetic control sample. We end up with a control group of 22 countries[11]. For both the treated and control countries, we use annual data from Eurostat and the OECD on total employment growth, unemployment rate, youth unemployment rate, participation rate, part-time and full-time shares of employment, including involuntary part-time work, average working hours, unit labour costs and Gini coefficient.

We choose to use the interactive fixed effects model to capture the co-movements across countries instead of introducing exogenous covariates to explain variations in the variable of interest. Thus, the variability is explained solely by fixed effects and factor variables, which also encompass possible time effects. In this way, we avoid conducting specification searches and potentially introducing endogeneity bias by using inappropriate covariates. By exploiting the variations across our control units and given the choice of the control group, our results are purely data-driven.

The selected approach entails an advantage in that we minimize the risk of mis-specification due to potentially inappropriate exogenous regressors, albeit it introduces some limitations too. For instance, the estimated reform impact may be influenced by other idiosyncratic shocks that occurred simultaneously with the labour market reforms, while the factor variables cannot capture unobserved confounders that are independent across units. In the case of Greece, this appears a rather restrictive assumption given that several other policy shocks took place during 2012, such as the Private Sector Involvement of sovereign debt, significant fiscal policy measures were implemented and a new bailout programme was agreed. To attribute the findings to labour market reforms, we run in parallel estimations for all three programme countries in which labour market reforms took place during 2012. Given that findings exhibit quite similar patterns, one can attribute them to the common policy reforms rather than to country specific shocks. Another limitation of the approach is that, although we allow for heterogeneous responses of countries to common shocks, it is possible that the treated countries are affected differently by common shocks in the post-treatment periods, implying a structural break in the model. Such issues may somewhat distort the imputed counterfactuals.

[11] These are Austria, Belgium, Bulgaria, Croatia, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Romania, Slovakia, Slovenia, Sweden and the UK.

A non-technical description of the employed methodology can be summarized in four steps. In the first step, we use countries in the control group to construct factor variables, that is, time-varying unobserved variables that explain the largest part of the variations among control countries. Then, in the second step, factor loadings (i.e. country-specific coefficients) are estimated for the treated countries using only the pre-treatment periods. In the third step, the number of factors is chosen optimally, so that the error of prediction is minimized in the pre-treatment periods. Finally, in the fourth step, we impute the counterfactuals for the treated countries using the previously determined factors and loadings. The above procedure essentially amounts to an implicit weighting of the control countries to obtain an appropriate counterfactual for each treated country. The Appendix 8.2 contains further technical explanations of the model setup, information about the control group country weights, estimates' confidence intervals and robustness checks from some sensitivity analysis.

6.2. Results

We apply the generalized synthetic control method for each macroeconomic variable of interest separately. The findings overall suggest that Greece's 2012 labour market reforms had a sizable positive impact on reducing ULC, increasing the use of flexible forms of employment and slowing down unemployment rate dynamics. They also had a slight positive impact on the employment growth trend. At the same time, we find that the 2012 reforms did not improve labour force participation rates, while they increased average working hours and inequality. The 2014 reform lowering social security contributions is found to have had a positive impact on labour participation, confirming evidence from the microeconomic approach.

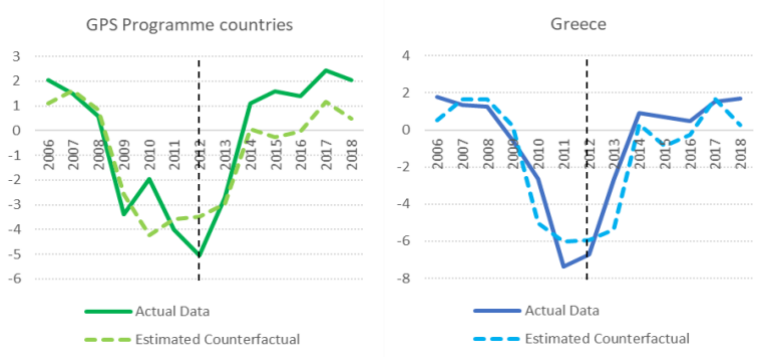
The following pairs of figures present actual data and estimated counterfactuals for the treatment group of countries, i.e. for Greece, Portugal and Spain (GPS) on the left side figure and for Greece alone on the right-side figure. The number of periods used in each case depends on data availability. The counterfactual is estimated using observations from the control countries. The closer the estimated counterfactual is to the actual data in the pre-treatment periods, the more reliable it is expected to be in the post-treatment periods. Given the observations on the control countries, the number of factors and their corresponding coefficients for each treated country are chosen to minimize the distance between the two curves in the pre-treatment periods.

Labour market reforms appear to have had a small positive impact on actual total employment growth trends (solid line) compared to the counterfactual scenario (dotted line) among the GPS programme countries, including Greece (**Figure 12**). Indicatively, actual employment growth in Greece during 2013-2018 is estimated to have been on average around 1.1 ppt higher than in a scenario without the 2012 labour market reforms. This

compares to a positive impact of similar magnitude, around 1.2 ppts for the three GPS programme countries average during the same period.

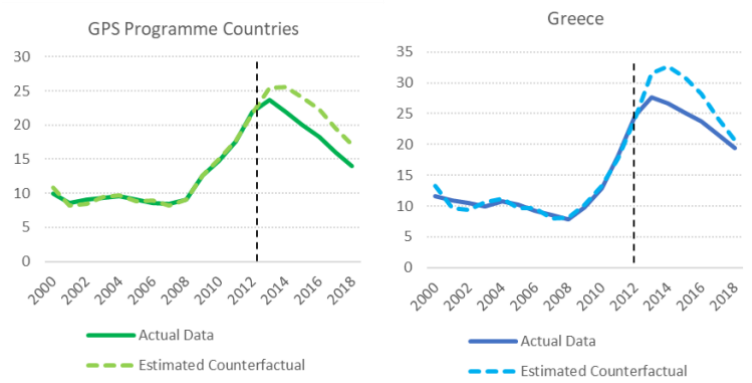
Furthermore, labour market reforms appear to have had a sizable positive impact on easing unemployment dynamics (solid line) compared to the counterfactual scenario (dotted line) among the GPS programme countries, and particularly for Greece (**Figure 13**). Indicatively, actual unemployment rate in Greece during 2013-2018 is estimated to have been on average around 4.0 ppt lower than in a scenario without the 2012 labour market reforms. This compares to a positive impact of somewhat smaller magnitude, around 3.3 ppts for the three GPS programme countries average during the same period. Especially in relation to youth unemployment, the estimated counterfactual scenario portrays an even gloomier path than the one recorded, which can be interpreted as evidence that labour market reforms had a non-negligible positive impact (**Figure 14**). It is noteworthy that the gap between the actual unemployment rate and the estimated counterfactual narrows during 2015-2018. The decreasing effect of reforms on unemployment across time should be interpreted with caution for at least two reasons: firstly, from a methodological perspective, the estimated counterfactual scenario's significance gradually weakens in the medium term and secondly, actual unemployment rate decline may have decelerated during the 2015 financial crisis, as well as affected by changes in the workforce emigration trend or changes in labour participation.

Figure 12. Estimated effect of labour market reforms on employment growth (in ppts)



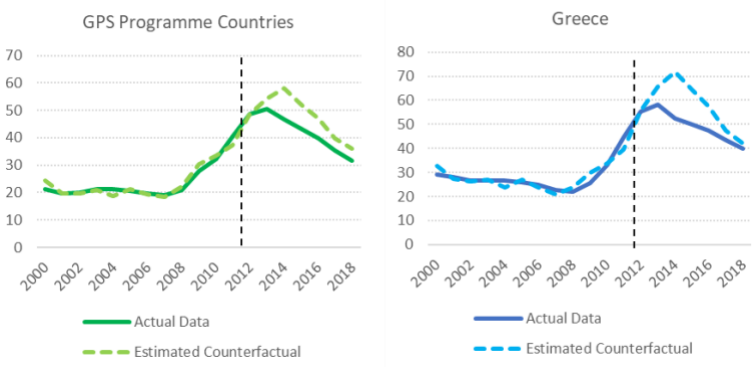
Note: GPS stands for Greece, Portugal and Spain. Total employment is defined in terms of number of persons employed. 2006 is chosen as the starting period to achieve a better a fit in closer to 2012.

Figure 13. Estimated effect of labour market reforms on unemployment rate (in ppts)



Note: GPS stands for Greece, Portugal and Spain. Unemployment rate is defined as the ratio of the number of unemployed over the labour force.

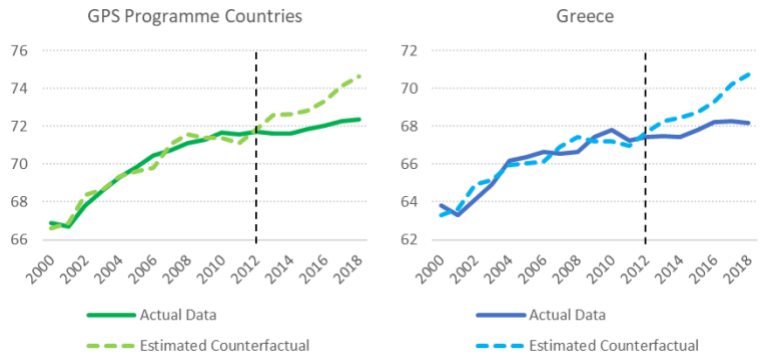
Figure 14: Estimated effect of labour market reforms on youth unemployment rate (in ppts)



Note: GPS stands for Greece, Portugal and Spain. Youth unemployment rate is defined for persons below 25 years old.

Labour market reforms in 2012 do not seem to have improved actual participation in the labour markets. On the contrary, our model estimation highlights that 2012 policy interventions had a negative impact on actual labour participation trends (solid line) compared to the counterfactual scenario (dotted line) among the GPS programme countries, including Greece (**Figure 15**). This can be partly due to parallel fiscal consolidation measures imposed on labour taxation in the programme countries around 2012, which hampers the incentives for official sector labour supply, as illustrated in the microeconomic approach section. Indicatively, in the case of Greece, a special solidarity contribution was imposed on labour income in 2012, which may have affected the estimated impact on participation rates.

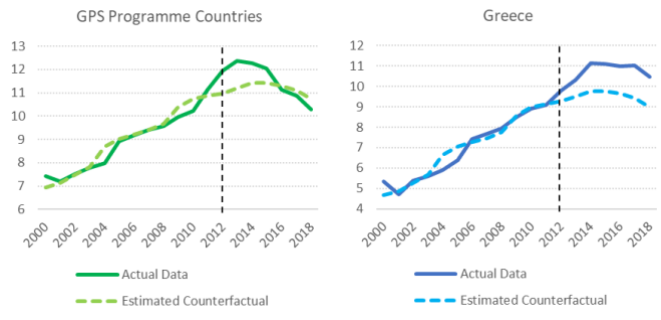
Figure 15: Estimated effect of labour market reforms on participation rate for ages 15-64 (in ppts)



Note: GPS stands for Greece, Portugal and Spain. Participation rate is defined as the ratio of the labour force over working age population 15-64 years old.

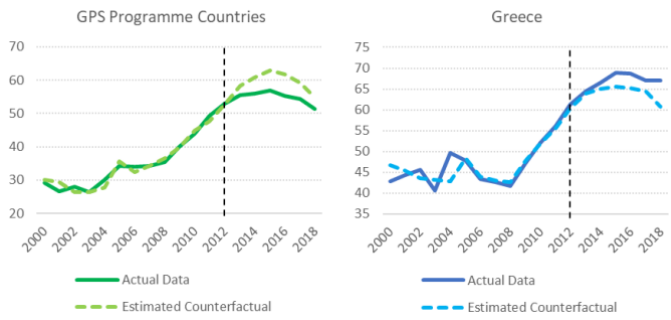
In relation to flexible forms of employment, the 2012 labour market reforms appear to have had a sizable positive impact on the actual use of part-time employment (solid line) compared to the counterfactual scenario (dotted line) among the GPS programme countries, and particularly in Greece (**Figure 16**). Indicatively, actual part-time employment as a share of total employment in Greece during 2013-2018 is estimated to have been on average around 1.3 ppt higher than in a scenario without the 2012 labour market reforms. Nonetheless, the transition towards part-time employment in Greece was often not the outcome of preferences, as the share of involuntary part-timers in part-time employment increased in Greece, contrary to the other two programme countries (**Figure 17**). Furthermore, the average working hours among full-time employed persons in Greece increased significantly following the reforms compared to the estimated counterfactual scenario, as opposed to the trend in other programme countries (**Figure 18**). Besides indicating increased flexibility in working relationships, and possible higher use of overtime work, the significantly higher average working hours observed in Greece may also relate to the large number of self-employed population.

Figure 16: Estimated effect of labour market reforms on the share of part-time employment in total employment (in ppts)



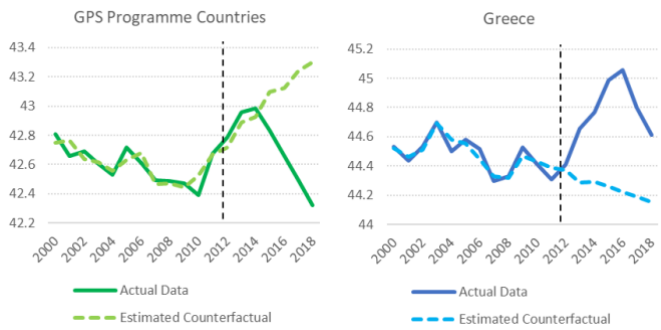
Note: GPS stands for Greece, Portugal and Spain. Total employment is defined in terms of number of persons employed.

Figure 17: Estimated effect of labour market reforms on involuntary part-time employment as a percent of part-time employment (in ppts)



Note: GPS stands for Greece, Portugal and Spain. Employment is defined in terms of number of persons employed.

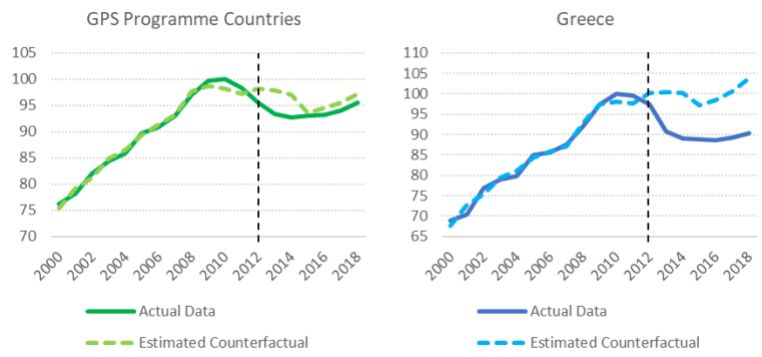
Figure 18: Estimated effect of labour market reforms on average hours worked for full-time employed persons



Note: GPS stands for Greece, Portugal and Spain. Total employment is defined in number of persons employed and includes wage earners and self-employed. The metric reflects average usual weekly hours worked on the main job.

In relation to price competitiveness, the 2012 labour market reforms had a significant positive impact on actual unit labour costs (solid line) compared to the estimated counterfactual scenario (dotted line) among the GPS programme countries, and particularly in the case of Greece (**Figure 19**). Indicatively, the actual ULC in Greece during 2013-2018 is estimated to have been on average around 10.6 ppts lower than in a scenario without the 2012 labour market reforms. This compares to a positive impact of considerably smaller magnitude for the three GPS programme countries average, of around 2.2 ppts during the same period.

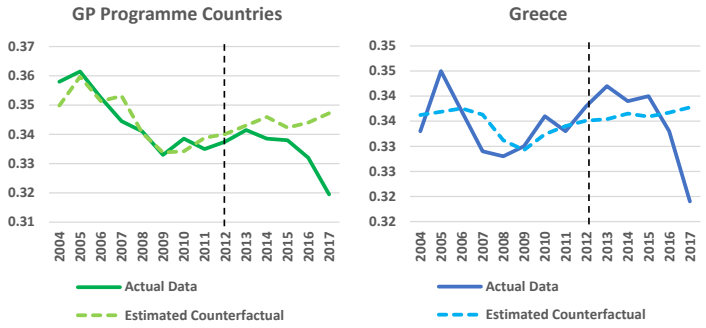
Figure 19: Estimated effect of labour market reforms on unit labour cost (Index 2010=100)



Note: GPS stands for Greece, Portugal and Spain. The Unit Labour Cost metric used (OECD database) relates to the Business Economy and is defined in terms of employment hours.

In the context of introducing more flexible labour market regulations in order to assist the labour market rather adjust through prices (wage cuts) than through volumes (layoffs), this seems to have had a negative impact on equality metrics, particularly during the first years after the reforms. The recorded GINI inequality coefficient (solid line) increased in Greece compared to the estimated counterfactual scenario (dotted line) during the first three years after the reforms, to be followed by a significant drop during 2015-2017 (**Figure 20**). It is noteworthy that peer programme countries did not exhibit such a severe inequality shock following their reform periods, while the results for Spain confirm the findings of Stepanyan and Salas (2020).

Figure 20: Estimated effect of labour market reforms on the GINI coefficient

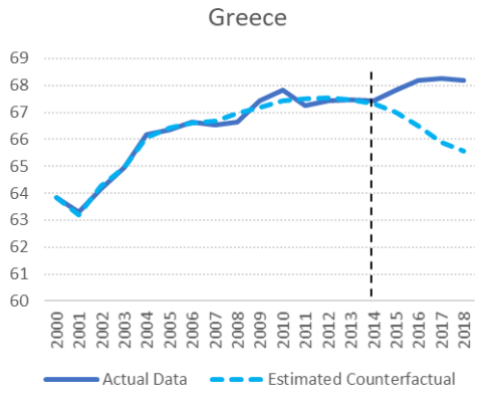


Note: GP stands for Greece and Portugal, since data for Spain is lacking. 2004 is chosen as the starting period to achieve a better a fit in closer to 2012. GINI coefficient compares the cumulative proportions of the population against cumulative proportions of disposable income, post taxes and transfers. It ranges between 0 (perfect equality) and 1 (perfect inequality).

Finally, as complementary to the microeconomic approach, we test the generalized synthetic control method in relation to the impact of the 2014 reduction of social security contributions by 1 ppt for employees and by 2.9 ppts for employers. For this particular application, we adjust our control sample by further filtering out all countries in our sample, which modified their social security contribution rates during the examined time span. This reduces our control group to nine countries.[12] We find that the labour market intervention in 2014 had a positive impact on actual participation in the labour markets. The actual labour force participation trend (solid line) is estimated to exceed the counterfactual scenario (dotted line) for Greece during 2015-2018 by an average of 1.9 ppts per annum (**Figure 21**). This is in line with the evidence from our microeconomic approach in the previous section which estimated a positive impact on individual households' labour participation incentives, which in turn could be translated into an increase of the aggregate participation rate by circa 0.4 ppts in the short-term.

[12] These are Spain, Belgium, Italy, Sweden, Denmark, Slovenia, Portugal, Slovakia and Austria.

Figure 21: Estimated effect of the 2014 reduction of social security contributions on participation rate for ages 15-64 (in ppts)



Note: Participation rate is defined as the ratio of the labour force over working age population 15-64 years old.

7. Conclusions

The Greek labour market had traditionally been facing significant challenges in relation to some of its features such as low productivity, low participation rate, high unemployment, high tax wedge, low use of flexible employment forms and high share of self-employed.

In view of these stylized facts of Greece's labour markets, at the onset of the sovereign debt crisis, the economic adjustment programmes pursued labour market reforms with at least two objectives. First, to support the adjustment in the economy, through reforms targeting to ease labour market rigidities. Their goal was to cushion the negative impact on employment when domestic demand was severely hit by the crisis, as well as to facilitate a faster recovery of employment as soon as the country would return to economic growth. Second, to enhance gains in cost competitiveness to correct the large imbalances in Greece's external accounts. In relation to their objectives, we find evidence that the implemented reforms largely fulfilled the second objective and partially the first objective, albeit left mostly unaddressed other long-standing weaknesses, such as low participation rate and high tax wedge.

Based on a micro-founded analysis, it appears that counterincentives for official sector labour participation increased during the bailout programmes, as reflected through the estimated increase of the participation tax rate for the average household in Greece between 2010 and 2018. The deterioration of incentives for labour supply has been more pronounced among male and younger population. Nonetheless, simulation analysis on a specific labour market measure which reduced employees' social security contributions in 2014 suggests that incentives for official sector labour participation improved, especially for groups such as youth and women, both of whom exhibit relatively low participation rates. A possible explanation for the low levels of labour force participation in the longer-term is that the magnitude of the

2014 policy intervention was limited and its positive effects on labour force participation were more than offset by other fiscal consolidation measures relying on labour income taxation.

From a top-down macroeconomic perspective, through the generalized synthetic control method which allows to construct counterfactual paths for each labour market indicator, empirical findings suggest that Greece's 2012 labour market reforms had a sizable positive impact on reducing ULC, increasing the use of flexible forms of employment and slowing down unemployment rate dynamics. They also seem to have had a slight positive impact on the employment growth trend. At the same time, it appears that the 2012 reforms did not improve labour force participation rates, while they increased average working hours and inequality. The 2014 reform lowering social security contributions is found to have had a positive impact on labour force participation, confirming evidence from the microeconomic approach.

From a forward-looking perspective, there is evidence that further reducing the tax wedge can enhance labour market participation and narrow the respective gap between Greece and its peers. A continuous monitoring of Greek labour market trends is warranted for policy makers to implement informed based labour market measures in the direction of further increasing labour productivity, reducing unemployment and inequality, three additional areas where Greece needs to accelerate its convergence to other advanced European economies.

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Appendix

Appendix 1 - Microeconomic approach – Technical Annex

The analysis of incentives for labour market participation at the extensive margin requires to focus on the persons' decision whether to work or not. Each person chooses between two alternative situations, total disposable income with zero earnings from labour and total disposable income with positive earnings, should she decide to participate in the labour market.

The theoretical foundation for the "participation tax" in labour can be presented through a simple model setup, such as the one by Immervoll et al. (2007). We assume that the utility function has a quasi-linear form:

$$U = c - v(z), v(0) = 0$$

where c is consumption and z represents labour earnings. v is a positive, continuous, increasing, and convex function. U captures utility from consumption and disutility of labour. If we use subscripts w and nw to denote consumption at the states of work and unemployment respectively, then the person will work as long as:

$$c_w - c_{nw} > v(z_w)$$

The working person's consumption is given by:

$$c_w = z_w - T(z_w) + q$$

Where $T(z_w)$ are transfer payments, taxes and contributions paid, while q is the household's income from other sources. The non-working person's consumption is $c_{nw} = -T(0) + q$. The condition for labour market participation can hence be written as:

$$z_w - [T(z_w) - T(0)] - V(z_w) > 0$$

Which can be re-written as follows:

$$(1 - a)z_w - v(z_w) > 0$$

where $a = [T(z_w) - T(0)]/z_w$ is the labour Participation Tax Rate (PTR), which can be interpreted as an index of increasing tax liabilities and decreasing social transfer receipts when the person starts earning positive income from labour.

In the context of a linear probability model, the empirical analogy for the labour market participation condition can be expressed in terms of a probability for participating in the labour market as follows:

$$\Pr(work)_{it} = \alpha + \beta_{ext}(1 - \alpha)z_{w,it} + \varepsilon_{it}$$

Where $\Pr(work)_{it}$ gets a value of 1 if the person is employed under a payment scheme. Hence there is theoretical relationship between PTR and the participation rate which is reflected through the elasticity β_{ext}, i.e. the percentage change in the participation rate resulting from a percentage change in PTR.

Appendix 2 - Macroeconomic approach – Technical Annex

We assume the following functional form:

$$Y_{it} = \delta_{it} D_{it} + \mu_i + \lambda_i' f_t + \varepsilon_{it}$$

where D_{it} equals 1 if country i has been exposed to the treatment prior to time t and 0 otherwise. δ_{it} is the heterogeneous treatment effect on country i at time t.

μ_i: country specific intercept (i.e. fixed effect)

f_t is a $(r \times 1)$ vector of unobserved common factors,

λ_i is a $(r \times 1)$ vector of unknown factor loadings,

ε_{it} represents unobserved idiosyncratic shocks for unit i at time t and has zero mean.

Assumptions: the errors are strictly exogenous, weakly serially dependent, satisfy certain regularity conditions (existence of certain moments), and are cross-sectionally independent and homoscedastic. For details see Xu (2017).

Estimation procedure steps:

1. Estimate an Interactive Fixed Effect model using only the control group data, obtaining the factor variables and factor loadings, for a given choice of the number of factor variables r.
2. Estimate factor loadings for each treated unit by minimizing the mean squared error of the predicted treated outcome in pre-treatment periods.
3. Repeat steps 1-2 for different values of r. Using a leave-one-out-cross-validation procedure, select the optimal number of factors r^*.
4. For the treated units, calculate treated counterfactuals for the post-treatment periods using the factor variables from step 1 and factor loadings from step 2.

If we denote by $Y_{it}(1)$ and $Y_{it}(0)$ the potential outcomes for individual i at time t when $D_{it} = 1$ or $D_{it} = 0$, respectively, then we have $Y_{it}(0) = \lambda_i' f_t + \varepsilon_{it}$ and $Y_{it}(1) = \delta_{it} + \lambda_i' f_t + \varepsilon_{it}$. Therefore, if we use the notation in Xu (2017), the average treatment effect on the treated (ATT) at time t equals:

$$ATT_t = \frac{1}{N_{tr}} \sum_{i \in \mathcal{T}} \delta_{it}, \qquad t > T_0$$

where N_{tr} denotes the number of treated units, T_0 denotes the point in time before the treatment occurs, and $\mathcal{T}$ denotes the set of countries that belong in the treatment group, respectively.

Confidence intervals:

The set of figures below illustrate the estimated ATT for Greece, together with its 95% confidence intervals for each one of the macroeconomic variables explored. We note that confidence intervals are relatively wide, in line with related literature, due to the aggregate

nature of the data set variables in terms of time and cross-sectional variation, e.g. as Xu (2017) points out in cases where the number of units in the control group is smaller than 40.

Figure 22. Estimated ATT on employment growth (in ppts)

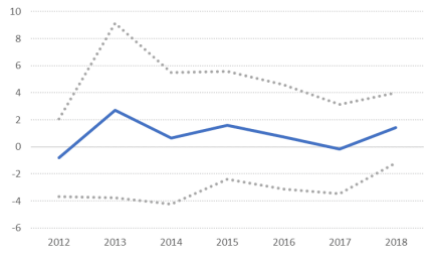


Figure 23. Estimated ATT on unemployment rate (in ppts)

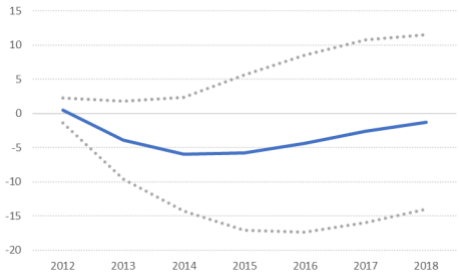


Figure 24: Estimated ATT on youth unemployment rate (in ppts)

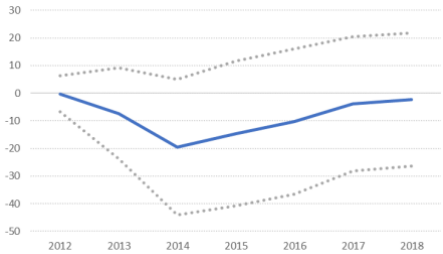


Figure 25: Estimated ATT on participation rate for ages 15-64 (in ppts)

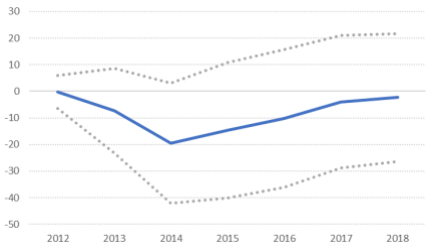


Figure 26: Estimated ATT on the share of part-time employment in total employment (in ppts)

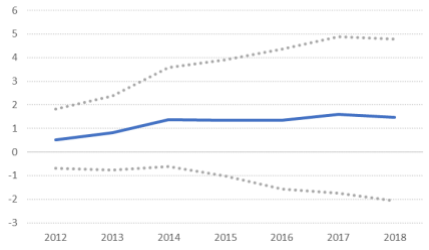


Figure 27: Estimated ATT on involuntary part-time employment as a percent of part-time employment (in ppts)

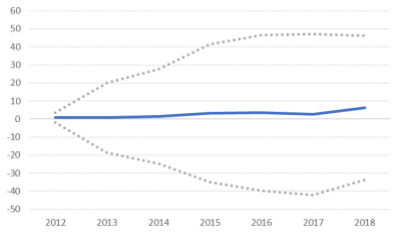


Figure 28: Estimated ATT on average hours worked for full-time employed persons

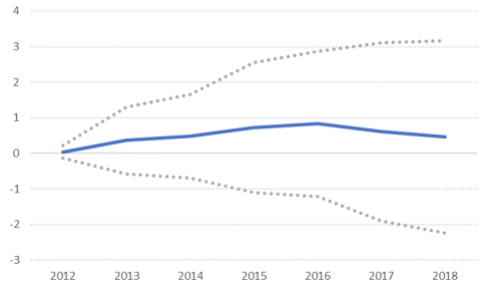


Figure 29: Estimated ATT on the unit labour cost (Index 2010=100)

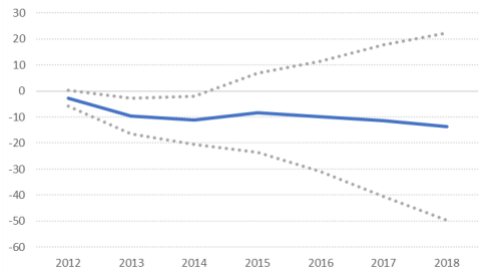


Figure 30: Estimated ATT on the GINI coefficient

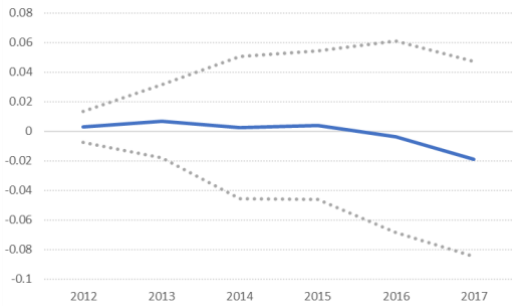
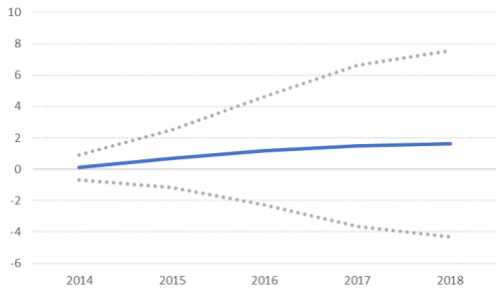


Figure 31: Estimated ATT after 2014 on participation rate for ages 15-64 (in ppts)



Control group weights:

Table 4 below presents the estimated weights for each unit of the control group for Greece. These can be inferred by combining the estimated factor variables (Estimation Step 1) – that are a weighted average of each country in the control group – with the assigned factor loadings for the case of Greece (Estimation Step 2). Notice that there can be negative values for the weights and there is no restriction on the sum of weights.

Table 4. Estimated weights for the control group units in each dependent variable estimation

Country	Employment Growth	Unemployment Rate	Youth Unemployment Rate	Participation rate for ages 15-64	Share of part-time employment in total employment	Involuntary part-time employment as a percent	Average hours worked for full-time employed	Unit labour cost	GINI coefficient	Participation rate after 2014
Austria	-0.06	0.01	-0.18	-1.63	0.62	-0.13	0.58	0.71	-1.31	0.50
Belgium	0.02	0.05	-0.02	0.11	-0.03	0.20	0.56	0.98	-1.23	0.37
Bulgaria	0.27	-	-	-	-0.06	0.67	-1.85	1.77	8.70	-
Germany	-0.04	-0.13	-0.15	-0.68	0.30	-1.17	-0.08	0.83	0.53	-0.18
Denmark	-0.09	-0.09	-0.22	2.46	0.36	0.26	4.02	0.54	-	-0.62
Spain	-	-	-	-	-	-	-	-	-	1.94
Estonia	-	-	-	-	-	-	-	0.00	-	-
Finland	-0.16	0.18	0.16	1.06	0.23	0.51	0.99	1.50	-0.21	-0.37
France	-0.09	0.13	0.10	-0.14	0.04	-0.09	2.50	0.74	-	-0.21
UK	-0.16	-0.23	-0.33	0.65	0.10	0.08	0.38	0.46	-2.77	-0.19
Croatia	0.62	-	-	-	-0.05	0.52	0.09	0.77	-	-
Hungary	-	-	-	-	-	-	-	0.78	6.83	-
Ireland	-0.48	-0.65	-0.66	-0.23	0.46	1.16	0.80	-0.29	-0.86	0.45
Italy	0.00	0.36	0.67	1.88	0.52	0.49	-0.11	0.79	2.57	0.08
Lithuania	-	-	-	-	-	-	-	-1.03	1.83	-
Luxemburg	0.01	0.08	0.04	-1.98	0.18	0.17	4.46	1.45	-	-0.26
Latvia	-1.45	-0.53	-0.36	-2.01	-0.07	0.79	1.24	-2.65	-4.44	-0.62
Netherlands	0.08	0.07	-0.19	-1.12	0.38	0.01	-0.27	0.80	-	0.38
Poland	-	-	-	-	-	-	-	0.66	-4.16	-
Portugal	-	-	-	-	-	-	-	-	-	0.11
Romania	-0.11	-	-	-	-0.20	0.24	1.03	0.92	1.50	
Slovakia	-0.01	0.48	0.78	1.75	0.26	-0.24	-1.32	0.54	-3.16	-0.70
Slovenia	0.24	0.19	0.44	2.12	0.31	0.34	-0.21	0.96	1.37	-0.02
Sweden	-0.23	-0.13	-0.48	-0.73	0.02	-0.15	0.10	0.78	-	-0.15

Note: Countries with no weight had not been included in the respective estimation specification due to missing data.

Sensitivity analysis

We have proceeded with two types of sensitivity analysis.

- In the first type, we rerun our estimations on each dependent variable, while removing each time the country in the control group which had the highest weight (in absolute value) in our initial estimation.
- In the second type of new sensitivity analysis, we rerun our estimations on each dependent variable, while removing each time both Latvia and Ireland from the control group. The rationale of this second test relates to the fact that both Latvia and Ireland went through IMF/EU financial support programmes during 2008-2012 and 2011-2013 respectively. Hence there is merit in testing the case whereby these two countries may not be appropriate to be included as control group countries. On the other hand, we decide to include them in the initial estimations for two reasons: (a) because the magnitude and scope of labour market reforms in these two countries

were of smaller scale and different timing compared to the ones in Portugal and Spain and (b) because we follow existing empirical work (Stepanyan and Salas, 2020) has scrutinized the choice of the control group for Spain's labour market reforms in 2012 through filtering criteria which led to the decision to include both Latvia and Ireland in their control group.

Overall, the new estimations through both sensitivity tests led to counterfactual estimates which do not vary substantially from the ones shown in this paper, hence not reported here, confirming that the initial empirical findings are rather robust. The empirical estimations of both sensitivity tests are available by the authors upon request.

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