The Minimum Wage and Employment Dynamics: Evidence from an Age Based Reform in Greece*

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Abstract

This paper analyzes the employment effects and dynamics of the minimum wage using an age-based reform in Greece. In 2012 the minimum wage was reduced differentially for workers above and below the age of 25. Administrative labor force data, graphical evidence and a difference-in-difference approach are used to identify a negative effect on employment. The bulk of this effect is substitution from older workers to younger workers, however there is also a significant disemployment effect. Identifying elasticities of substitution and comparing younger to older workers yields an employment elasticity of between -.28 and -.46 for young workers. The result is present in several outcome variables including unemployment, full time employment, and hours worked and is robust to a number of specification and falsification tests. The employment effects of the reform are seen primarily through a reduced rate of new hires for workers with a higher minimum wage, with no effect on job destructions. Consistent with the predictions of the jobs ladder model, the group subject to the higher wage is less likely to transition to another job, or seek employment while on the job.

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1 Introduction

One of the questions most studied by labor economists for the past century has been the effects of statutory minimum wages on employment. Studies have found negative, no or even positive effects of the minimum wage on employment. Recently a new strand of studies has begun to examine the effect of the minimum wage on employment dynamics– accessions and separations. Empirical evidence regarding the effect of the minimum wage on employment dynamics is particularly important given the ambiguous implications of many search models due to the opposing effects of reducing employers' labor demand while simultaneously increasing workers' search incentives. This paper uses a policy change to identify the effects of minimum wages on employment, accessions and separations.

This paper makes three main contributions. First, a natural experiment is used to show that a higher minimum wage reduces employment for adult workers. This wage cut allows the identification of the elasticity of employment with respect to wages for low wage workers, as well as identification of scale and substitution effects.[1] Most of the employment effect is through a substitution channel. Second, the paper analyzes employment dynamics. Empirical evidence supports the effects of the reform as being entirely through a reduction in new hires as opposed to an increase in separations. Moreover, higher wages reduce on the job search activity. Third, the findings are rationalized through a search model with on-the-job transitions which predicts that the disemployment effects of the minimum wage should be strongest during a large recession such as the one coinciding with the reform.

In February 2012, the Greek cabinet approved large minimum wage cuts so that Greece could comply with the International Monetary Fund (2013) structural adjustment program and qualify for loan tranche disbursements. Effective on March 1, 2012 the monthly minimum wage was cut from €751 by 22% to €586 for workers aged 25 and above and by 32% to €511 for workers below the age of 25. The lower minimum wage for young workers was justified with the aim of promoting the entry of younger workers into the labor market to combat high Greek youth unemployment. This differential cut in the minimum wage can be exploited to identify the effects of the minimum wage

[1] It is arguable that the scale elasticity is the more policy relevant parameter, as most minimum wage reforms affect all workers. However, the total employment effect is still of interest given that many countries have age-specific minimum wages or industry specific minimum wages stemming from collective bargaining agreements.

on unemployment, controlling effectively for spatial heterogeneity. Several countries have age-conditioned minimum wages (Larrain and Poblete (2007)) with lower minimums for teenagers. Studies such as Pereira (2003) have used these in similar research designs comparing teenagers and adults. The Greek reform differs from these as the cutoff for the reform is the age of 25, so individuals above and below the cutoff have finished schooling and are likely to face similar labor market conditions. This allows for precise identification of the employment effects of the minimum wage as the results are not confounded by spatial heterogeneity or differing labor market shocks for age groups. Greece is also an interesting country to study as it has a very high relative minimum, which is likely to bind. The vast majority of prior studies have focused on the US and the UK, which have low minimum to average wage ratios, and hence may not have binding minimum wages. In 2011 Greece had the highest ratio of the minimum to the average wage in the OECD, while the US had one of the lowest (Eurostat (2012)).

The identifying assumption for the research design employed is that individuals above and below the age of 25 would have trended similarly in the absence of the minimum wage reform. The common trends assumption is supported by the institutional background of the Greek labor market as well as graphical evidence. First, workers between the ages of 22 and 27 are in similar stages of their lives being new entrants to the labor force and thus are subject to the same cyclical shocks. Second, as there is a sharp cutoff in terms of the minimum wage at the age of 25 that is not related to other benefits or labor market regulations, other labor market reforms should affect each group identically. Third, and most important, graphical evidence indicates that for key empirical outcomes, the two groups trended similarly prior to the reform.

This study joins a large existing literature on the employment effects of the minimum wage, as well as a burgeoning literature on the effect of the minimum wage on employment flows. The first minimum wage legislation was passed in New Zealand in 1898, and was introduced nationally in the United States at 25 cents an hour in 1938 as part of the Fair Labor Standards Act. From inception, the minimum wage in the US was politically and legally controversial. Economists have focused primarily on the employment effects of a minimum wage, and the debate has continued for nearly a century. Early competitive models such as Stigler (1946) argued that the competitive nature of low wage industries would cause minimum wage legislation to reduce employment. Institutionalists such as Lester (1947) dismissed competitive models as inconsistent with business

practices.

By the early 1980s, economists appeared to reach a consensus that the minimum wage reduced employment (Brown, Gilroy, and Kohen (1982)). However, this consensus was short lived as new methods began to enter the toolkit of applied microeconomists. Several studies such as Addison, Blackburn, and Cotti (2009), Card and Krueger (1992), Katz and Krueger (1992), Card and Krueger (1994), Dickens, Machin, and Manning (1999) and Manning and Machin (1996), employing different methods found that minimum wages had no or even positive effects on employment, consistent with a monopsony model.[2] However, other studies such as Machin and Wilson (2004), Machin, Manning, and Rahman (2003), Neumark and Wascher (1992), Neumark and Wascher (2000), Pereira (2003), Sabia (2009) and Sabia, Burkhauser, and Hansen (2012) found similar disemployment effects to those in the earlier literature. Aaronson (2001), Aaronson and French (2007), Aaronson, French, and MacDonald (2008) and Matsudaira (2013) have found price effects consistent with competitive models that predict reductions in employment following a minimum wage hike. More recently a new strand of empirical literature has emerged such as Brochu and Green (forthcoming), Meer and West (2012) and Portugal and Cardoso (2006) which builds upon the Mortensen-Pissarides framework and search models of Hornstein, Krusell, and Violante (2011), Flinn (2006) and Lang and Kahn (1998).[3] Rather than focusing solely on the employment effects of the minimum wage, this literature analyzes employment dynamics– accessions and separations.

Neumark and Wascher (2007) and Card and Krueger (1992) provide summaries of the recent literature on the effects of minimum wages on employment, which remains a controversial topic among economists. Most existing modern studies use panel data and exploit variation between different states in raising their minimum wages. However, there is significant debate regarding the validity of states as controls for each other given different labor market conditions across geographic areas and spatial heterogeneity. In this paper, a policy change is exploited that assigns

[2] See Ashenfelter, Farber, and Ransom (2010)

[3] Other studies have focused on the response of spending and debt to the minimum wage (Aaronson, Agarwal, and French (2012)), the interplay between cooperation and the minimum wage (Aghion, Algan, and Cahuc (2011)) and the effects of the minimum wage on poverty (Sen, Rybczynski, and Waal (2011)), the effects of the minimum wage on the wage distribution (Dickens and Manning (2004) and Neumark, Schweitzer, and Wascher (2003)), the long run employment effects of the minimum wage (Neumark and Nizalova (2007)), and teen traffic fatalities (Adams, Blackburn, and Cotti (2012)). Gorry (2013) presents a search model with experience which predicts larger effects of minimum wages on younger and inexperienced workers.

different minimum wages to different workers *in the same country*.

The paper is organized as follows. Section 2 discusses the Greek policy reform and outlines the difference-in-difference approach used in this paper to identify the effects of the minimum wage reform on employment outcomes. Section 3 describes the data source used, the Hellenic Labor Force Survey and describes the analysis sample used. Section 4 presents the main results regarding employment outcomes as well as accessions and separations, and presents implications from a search model with on-the-job transitions that rationalize the results. The section also discusses how to identify the scale and substitution effects. Section 5 concludes the paper and describes avenues for further research.

2 Identifying the Effects of the Minimum Wage

2.1 The Minimum Wage in Greece

On February 29, 2012 the monthly net minimum wage for all workers in Greece was €751. The next day, March 1, 2012 the minimum wage fell differentially for workers above and below the age of 25.[4] For workers 25 and above, the minimum wage was cut by 22% to €586 and for workers under the age of 25 the minimum wage was lowered by a larger amount, 32% to €511.[5] Panel A of figure 1 depicts the nominal minimum wage schedule in Greece between 2009 and 2013 for individuals between the ages of 22 and 27. The minimum wage reform was instituted to comply with Greece's structural adjustment program under the supervision of the International Monetary Fund.[6] Young employees who are hired at the lower minimum wage can be paid at the lower minimum wage for three years regardless of their age. The explicit aim of the reform was to increase Greek competitiveness by allowing employers to lower wages.

The minimum wage in Greece is governed by the National Collective General Agreement (NCGA). The Greek Labour Force Survey indicates over 12% of Greek workers earned at or below the minimum wage in the first quarter of 2010.[7] Nearly 29% of new hires earn the minimum wage.

[4] Age or cohort based policy thresholds are relatively common in Greece. Saez, Matsaganis, and Tsakloglou (2012) use a cohort based reform to examine payroll tax incidence.

[5] As a worker ages past the threshold, a workers minimum wage can be reset through a seniority allowance after three years of employment.

[6] See the International Monetary Fund (2013).

[7] This is substantially higher than the fraction of employees earning the minimum wage in the US and the major-

The minimum was very likely to be binding in Greece before the 2012 reform. In comparison to average wages in the country, Greece had one of the highest minimum wages in the EU in years preceding 2012. Greece also had much higher nominal minimum wages than competitors in Southeastern Europe. In fact, Greece raised the minimum wage in 2008 at the onset of the Greek economic crisis. As the recession deepened in Greece in 2008 and onwards, the level of the minimum wage became increasingly binding as average wages fell in Greece.

During the time period in which the minimum wage reform took place, there was substantial uncertainty regarding whether the reform had enough support to pass in Parliament. In section 4.3 falsification tests will be presented which suggest that the reform was not anticipated. Regardless, given the uncertainty surrounding the political situation in Greece at the time, it is very unlikely that the minimum wage reform was anticipated by Greek employers.[8] The Greek government coalition had collapsed in late 2011, and a caretaker government was in place under Lukas Papademos, a former European Central Bank Vice President. New elections were originally scheduled for February, 2012 but were pushed back to May, 2012. The modification of the NCGA to reduce the minimum wage differentially by age group was the result of tense negotiations between successive Greek governments, labor unions, the European Union and the IMF. On the 8th of February, amid riots in Athens, the reform failed to muster enough support in parliament. Eventually it passed on the 12th of February 2012. While the minimum wage reform was passed as part of a large austerity package, the identification assumption of a common trend is not violated. There were no other items in the austerity bill that would have differentially affected workers above and below the age threshold of 25.

Panel A of figure 1 shows the nominal minimum monthly wage schedule between the first quarter of 2009 and the third quarter of 2013. Panels C and D of the same figure show the observed 25th percentile of monthly wages. Panel C shows the 25th percentile monthly wage in each quarter, while panel D normalizes the wages to 100 in the first period. The blue line with triangular marks is the monthly wage for workers under 25, and the solid red line with squares is the monthly wage for workers 25 and above. Panel A of figure 2 shows the impact of the minimum wage reform on

ity of European countries, however lower than the rate in some European countries like France and Bulgaria. See European Foundation for the Improvement of Living and Working Conditions (2007).

[8]There was great uncertainty in Greece at the time, JP Morgan put the probability of a Greek exit from the Euro at 20-50% during this period.

monthly wages for individuals above and below the cutoff threshold. The graphical evidence is consistent with the reform being enforced. The figure plots the mean log monthly wage by each age group using the Greek Labor Force Survey for workers between the ages of 22 and 27, with a 95% confidence interval. Each series is normalized to 100 in the first quarter of 2011. The two wage series track each other closely in 2010 and 2011. There is a slow downward trend in wages over time as the Greek crisis progresses. When the minimum wage reform goes into effect in the first quarter of 2012, which is marked by the dashed red line with squares, there is a drop in monthly wages for workers under the age of 25 and an even sharper drop in monthly wages for workers aged 25 and above. These observed patterns are consistent with the nature of the reform, which induced a larger cut in minimum wages for workers aged 25 and above. As will be discussed later, the same observed wage trends in figure 2 following the reform are robust to the inclusion of controls in a difference-in-difference framework.

2.2 Empirical Strategy

The 2012 Greek minimum wage reform, and the differential impact on workers above and below the age of 25 are used to examine a number of outcome variables including employment status, accessions and separations. The identifying assumption for the research design employed is that individuals above and below the age of 25 would have trended similarly in the absence of the minimum wage reform. Visual evidence is presented, and then regression estimates identify the effect of changes in minimum wages on the outcomes. The following basic difference-in-difference regression specification, or a fixed effect modification of the specification, is used to determine the effect of the reform:

$$y_{it} = \beta_0 + \beta_1 \mathbb{1}[t > Q1, 2012]_t * \mathbb{1}[Age \geq 25]_{it} + \beta_2 \mathbb{1}[t > Q1, 2012]_t$$

$$+ \beta_3 \mathbb{1}[Age \geq 25]_{it} + \gamma X'_{it} + \epsilon_{it} \tag{1}$$

where y_{it} is the outcome variable of interest for individual worker i at time t, which can be,

for example, an indicator of whether an individual is unemployed, an indicator of whether an individual is employed full time, or an indicator of whether an individual has entered a new job or suffered a separation in the past quarter. $\mathbb{1}[t > Q1, 2012]_t$ is an indicator of whether the time period is after the reform and $\mathbb{1}[Age \geq 25]_{it}$ is an indicator of whether an individual is 25 or above and subject to the smaller minimum wage cut. X_{it} is a vector of controls including gender, immigrant status, educational attainment, employment type and sector. The coefficient of interest is β_1, which represents the mean difference in the outcome variable stemming from the difference in the minimum wage between the two groups. The coefficient $\beta_1 = (\bar{y}_{Post,\geq 25} - \bar{y}_{Post,<25}) - (\bar{y}_{Pre,\geq 25} - \bar{y}_{Pre,<25})$ represents the differential effect of the reform, namely a 10% difference in the minimum wage, on the outcome variable y_{it} indexed by individual i in quarter t. In all specifications the standard errors are clustered at the individual level to address potential serial correlation.

To identify the effects of the minimum wage reform on the outcome variables, one must assume that individuals above and below the reform threshold would have trended similarly in the absence of the reform.[9] This assumption should be satisfied because of the age groups to which the sample is restricted. There are no other sharp cutoffs in Greek law at the age of 25 that would affect the two groups differentially. Young workers just above and below the age of 25 are generally newer entrants competing in the same labor market and who are subject to the same shocks. Later in this section graphical evidence will be provided that supports the assumption that the employment of young workers just above and below the age of 25 trended similarly prior to the minimum wage reform.

It is important to note that common shocks are not a threat to the differences in differences identification. Greece was in a recession during the period in question, and there were several other reforms which would have affected employment outcomes during this period. However, these shocks would not violate the common trends assumption as workers who are 24 and 25 were affected identically. The main analysis also includes quarterly time fixed effects to control for any macro shocks that would have affected individuals. It is also worthwhile to note that the common trends assumption does not require the levels of outcomes to be similar; the groups may still share common trends as they share common labor market shocks.

[9] Formally, the identifying assumption is $\mathbb{E}[\epsilon_{it}|X'_{it}] = 0$.

If the common trends assumption holds, before the reform we should see the series for outcome variables track each other closely. Figures 1 and 2 present graphical evidence that this is indeed the case for wages and unemployment. Each figure plots the mean log monthly wage by each age group using the Greek Labor Force Survey for workers between the ages of 22 and 27, with a 95% confidence interval. The blue line with triangular marks is the mean outcomes variable for workers under 25, and the solid red line with square marks is the mean outcome variable for workers 25 and above. All of the series track each other closely in 2010 and 2011 before the reform takes place, lending credence to our identification strategy.

Figure 4 provides more graphical evidence that the common trends assumption holds. Each panel in figure 4 plots a fixed effects specification of the main difference-in-difference specification, in which the treatment indicator is interacted with an indicator for each time period. Figure 4 plots the coefficients from the resulting fixed effects specification and a 95% confidence interval. In panel A the dependent variable y_{it} is wages, in panel B the dependent variable is an indicator of whether an individual is unemployed, in panel C the dependent variable is log weekly hours, and in panel D the dependent variable is an indicator of whether an individual is employed full time. In each case, the treatment effect is not significantly different from zero before the reform took place suggesting no significant differences in the outcome variables between the groups before the minimum wage reform took place. As in the previous figures, the results in figure 4 are consistent with the common trends assumption.

3 Data

3.1 Greek Labor Force Survey

The main source of data used comes from the Hellenic Statistical Authority's Greek Labor Force Survey, which is the main administrative source used for official Greek statistical releases regarding the labor market. The data provide comprehensive information on the Greek labor market during the time period in question. The Greek Labor Force Survey has produced annual estimates of Greek labor force data since 1981, and from 1998 the survey has been a continuous quarterly survey. Like other European labor force surveys, the Greek survey is a large household sample

survey consisting of 32,600 households each quarter.[10] Participation in the survey is compulsory.[11] Households are randomly selected using the 2001 decennial census, and stay in the sample for six quarters. Each period one sixth of the sample is replaced. The survey collects data on employment status as well as demographic and job characteristics and educational attainment. The Greek Labor Force Survey defines individuals as unemployed if they are between the ages of 15 and 74, were without work in the week surveyed, were available for and seeking work or had found a job that starts within the next three months.

The key advantage of the Greek Labor Force Survey sample, as opposed to aggregate or firm level data, is that the age of individual workers is observed. This allows individuals to be split into two groups, those workers at and above 25 who are affected with by the smaller minimum wage cut, and those workers below 25 who are affected by the larger minimum wage cut. As was discussed in the previous section, the identification strategy requires observing the age of workers. A second advantage of the data is the repeated panel nature of the data, which allows analysis of labor market dynamics. The third benefit of the data is the rich set of demographic and labor market history controls, as well as the large sample size of the data– 32,600 households each quarter corresponding to roughly 68,000 individuals in each quarter.

3.2 Analysis Sample

This paper focuses on individuals between the ages of 22 and 27. The main analysis sample consists of an unbalanced panel of individuals from the Greek Labor Force Survey. The unbalanced panel includes an individual's quarter year t survey response. The quarter immediately before the reform took place is excluded in order to minimize the effects of potential anticipation of the reform, which could attenuate the results. The main results are robust to including the period immediately before the reform took place, the fourth quarter of 2011.[12] As the panel is a random survey of the Greek population, the composition of the panel does not change significantly over

[10] This corresponds to a sampling rate of about .85%. The Greek survey is harmonized with European legislation, specifically Council Regulation No. 577/98. See Eurostat (2012) and International Labor Organization (2010) for further information.

[11] However, penalties for refusal are light, so the actual response rate is 92%.

[12] The main results are also robust to excluding individuals who are self-employed or employed by a family member. Individuals who are self-employed or employed as family workers are unlikely to be affected by the minimum wage reform.These individuals are later used in a placebo test. Appendix table A1 presents results in which the sample is excluded. The main results are robust to the inclusion or exclusion of self-employed and family workers.

time.

Table 1 presents summary statistics of the two groups. The main sample consists of 45,880 individual quarter observations. The mean unemployment rate is 28.6% in the sample period, but is increasing steadily in the first quarter of 2009 to the third quarter of 2013 from 19.9% to 38.4%. This increase is depicted in panel B of figure 2. Demographic characteristics such as age, gender, immigrant status, education and employment sector do not vary substantially between the two groups. This is not surprising as both groups consist of 20 year olds who are in similar stages of their lives, facing common economic conditions and competing in the same labor market. It is important to emphasize that the identifying assumption in this study *is not* random assignment, rather the identifying assumption is that individuals above and below the age of 25 would have trended similarly in the absence of the minimum wage reform. The similar composition of the two groups makes it credible that the two groups faced similar labor market conditions and macroeconomic shocks.

4 Results

4.1 Main Results

This section will present the main results of the study, namely that a relative increase in the minimum wage decreases employment for workers above the age of 25 in comparison to workers below the age of 25, who had a larger minimum wage cut. This effect occurred entirely through younger workers being hired at a faster rate than older workers. This result is consistent with the Stigler (1946) competitive model and the predictions of a search model with job-to-job transitions and search frictions. First visual evidence is presented, and then regression estimates are used to identify the effect of the minimum wage reform on outcomes.

Panel B of figure 1 presents illustrative results from aggregated Eurostat data on monthly unemployment in Greece between September 2011 and September 2012. The red dashed line indicates February 2012, when the policy change is announced. The blue line is the mean unemployment rate for workers under 25, and the red line is mean unemployment rate for workers 25 and above, normalized to 100 in September 2011. The two series track each other very closely before the minimum wage reform. Following the minimum wage reform, the unemployment rate spikes for

older workers consistent with the predictions of a classical competitive model of the minimum wage and employment.

The information given above is mainly suggestive, as the aggregated Eurostat data contain all workers above 25 to the age of 75, and do not include any controls. To obtain direct causal evidence of the effect of the minimum wage reform on employment in Greece, the Greek Labor Force Survey is used and a difference-in-difference strategy is employed. The identifying assumption for this strategy is the common trends assumption, which is likely to hold for similar workers close in age. The sample is restricted to individuals between the ages of 22 and 27, who have generally similar observable attributes. Table 1 provides descriptive statistics for the two groups in the sample, those 25 and above and those below the age of 25. The two groups have quite similar observable demographic characteristics before and after the reform, lending credence to the assumption that the composition of the survey did not change before and after the reform.

Panel A of figure 2, as well as panels A, C and D of figure 1 show the evolution of mean log wages between 2009 and 2013. There is a downward trend, which is to be expected as Greece is suffering a severe recession during the time period studied. Panel A of figure 2 indicates that the reform was enforced, and that mean wages did drop following the February 2012 minimum wage reform. The figure plots log wages for employed workers in the sample between the first quarter of 2009 and the third quarter of 2013. The mean log wage is normalized to 100 in the first quarter of 2011. The red dashed line indicates the first quarter of 2012, when the policy change in announced. After the policy change takes effect in the first quarter of 2012, reported wages for workers in the sample see a sharp reduction. As would be expected given the differential reduction in the minimum wage, wages decrease at a steeper rate for workers below the age of 25 who received the larger wage cut.

Panels C and D of figure 1 indicate that the effects of the reform were much more pronounced for low wage earners who would be affected by the minimum wage reform. Panel C plots the 25th percentile of wages. The 25th percentile of wages of younger workers is at the minimum wage of €750 before the reform. Following the minimum wage cut, the 25th percentile of wages quickly drops to the new minimum wage. The 25th percentile of wages for older workers is above the nominal minimum wage before the reform, which indicates that these workers have accumulated some skills with experience and are not new entrants to the labor market. Following the minimum

wage reform, the 25th percentile of wages drops for workers above the age of 25. The drop is not as fast or as large as the drop for younger workers subject to the larger minimum wage cut, which is consistent with the nominal minimum wage schedule. The behavior of wages before and after the reform is consistent with the nominal minimum wage schedule, and the reform being enforced.

Panel B of figure 2 presents evidence that the differential minimum wage treatment affected employment patterns. Individuals who had a relatively smaller minimum wage cut following the reform, and hence a higher minimum wage, suffered higher unemployment compared with individuals with a lower minimum wage following the reform. The figure plots the unemployment rate for individuals in the sample between the first quarter of 2009 and the third quarter of 2013. The red dashed line indicates the first quarter of 2012, when the policy change in announced. The two series track each other very closely until the first quarter of 2012, when the unemployment rate for workers below the age of 25 levels off for several quarters before again continuing to climb. This suggests that the differential minimum wage treatment had a disemployment effect on workers above the age of 25.

Figure 3 shows a similar effect to figure 2. Following the reform, unemployment dropped for workers under the age of 25 relative to unemployment for workers 25 and above. Each dot represents mean unemployment by age group for the ages 22-27, with the mean of unemployment in each quarter year normalized to 100. The hollow dots show the mean unemployment rate in the last year of the sample, the fourth quarter of 2012, when the reform was in effect. The diamonds show the mean unemployment rate immediately before the reform was enacted, in the third quarter of 2011. The figure confirms the basic pattern indicated in the previous figure, unemployment rising at a greater rate for those workers who were subject to a higher minimum wage following the reform. Although graphs are compelling, an analysis of the effect of the policy in a regression framework allows for the effects of other variables and permits a calculation of the elasticity of employment with respect to the minimum wage.

Table 2 makes this graphical argument explicit, presenting results from a standard difference-in-difference estimation in a linear probability model as given in section 2. The coefficient β_1, which is noted in the table as $Post\ Reform\ X\ Above\ 25$, represents the mean effect of the minimum wage difference on employment. The results in table 2 indicate that the differential cut in the minimum wage is associated with a 3 percentage point relative increase in employment for work-

ers above the age of 25, who had a smaller minimum wage cut. The point estimate is significant at the .01 level. The results are robust to the inclusion of demographic and industry controls, gender, migrant status, educational attainment, permanency of position under Greek law, and industry dummies for retail and food services.

Table 3 presents more detailed results, analogous to those in table 2 but with age and time period fixed effects replacing post and treatment indicators and the dependent variable being changed to an indicator of full time employment:

$$e_{it} = \alpha_t + \alpha_i + \beta_1 \mathbb{1}[t > Q1, 2012] * \mathbb{1}[Age \geq 25]_{it} + \gamma X'_{it} + \epsilon_{it} \tag{2}$$

The results in table 3 are quite similar to those in table 2 , again indicating that β_1, which is the mean effect of the relative minimum wage difference on employment, is roughly .038. In all specifications the results are significant at the .01 or .05 level. The results change very little when demographic and industry sector controls are added. The effect of the minimum wage reform is also larger for individuals who might be expected to be affected by a binding minimum wage: columns (7) and (8) indicate that the results become larger when the sample is restricted to low eduction individuals and individuals who were unable to secure permanent positions, which are difficult to lose in Greece. When the sample is restricted to individuals who did not attend university, and who presumably compete for lower skill and wage positions, the coefficient remains .038. Column (8) presents the sample restricted to individuals who did not attend university and who were unable ever to secure permanent positions in the survey. Greece has a two tier labor market, in which permanent positions, typically in the public sector and requiring education, are protected by the constitution. Involuntary separation from a permanent position is very difficult in Greece. When the sample is restricted to individuals who were unable to obtain a permanent position and who did not enter university, the effect becomes even larger. The coefficient representing the mean effect of the relative minimum wage difference on employment is 4.6.

The magnitude of these estimates is large in comparison to previous studies. Two factors regarding the reform and the minimum wage in Greece account for the large observed effect of the minimum wage. First, Greece has the highest minimum wage relative to the average wage in

the OECD, and a large portion of Greek workers receive the minimum wage. Second, the large observed effect is in part due to the fact that the coefficient β_1 pools a larger substitution and a scale effect as opposed to the majority of studies of the minimum wage that use geographic variation. Section 4.3 will discuss separately how to recover estimates of the substitution and the scale effects.

The basic pattern of the reform decreasing employment for workers with a higher minimum wage is confirmed by a number of other variables. Table 4 presents the fixed effects difference-in-difference regression specified above with a number of different outcome variables y_{it}. Consistent with the earlier results, columns (3) and (4) indicate that unemployment increased by .047 points more for the group with the higher minimum wage following the reform. The results are significant at the .01 level. Columns (5) and (6) also indicate that the coefficient on log hours worked per worker is between -.123 and -.127 and significant at the .01 level. This implies that, for individuals subject to the higher minimum wage, hours worked dropped by approximately 12% relative to those subject to the lower minimum wage. The impact on hours is greater than the impact on employment, which is compatible with severance protections for many workers. Columns (1) and (2) presents results for log monthly wages. The coefficient β_1 in both specifications is approximately .05 and significant at the .05 level, indicating that for individuals subject to the higher minimum wage, average wages rose by approximately 5% relative to those subject to the lower minimum wage. Column (2) formalizes the evidence presented in figure 1, namely that wages decreased at a greater rate for workers below the age of 25 who received the larger allowable wage cut.

Figure 4 provides evidence that the timing of the results is consistent with the Greek minimum wage reform. Each panel in figure 4 plots a fixed effects specification of the main difference in difference specification, in which the treatment indicator is interacted with an indicator for each time period.[13] No trend is observed for any of the outcome variables before the reform, whereas after the reform takes effect wages increase for the treated group, unemployment increases, while full time employment and hours worked decrease.

[13]The specification is given by $y_{it} = \alpha_t + \alpha_i + \sum_{y=0}^{T} \beta_y \mathbb{1}[y = t] * \mathbb{1}[Age \geq 25]_{it} + \gamma X'_{it} + \epsilon_{it}$.

4.2 Employment Dynamics

4.2.1 Hires, Destructions and Transitions

The previous portion of this section has established that there was a significant employment effect of the minimum wage following the Greek reform. There are two non-mutually exclusive channels through which this employment effect can occur. First, employers may lay off costlier workers subject to the higher minimum wage. Second, employers may hire more workers subject to the lower minimum wage. Table 5 addresses these two effects and analyzes the employment dynamics of the minimum wage reform.

Hires are defined analogously to arrival rates: as individuals who are unemployed or out of the labor force in one quarter, who successfully enter into employment in the next quarter. Thus a hire is defined as $H^{i,t} = \mathbb{1}[p^{i,t}_{e,u} = 1 | p^{i,t-1}_{u,u} = 1 \cup p^{i,t-1}_{e,u} = 1]$ where $p^{i,t}_{e,u}$ is an indicator of whether or not individual i who entered the survey unemployed u is employed e in period t. Destructions are analogously defined as individuals who are employed and leave the labor force, $D^{i,t} = \mathbb{1}[p^{i,t}_{u,e} = 1 | p^{i,t-1}_{u,e} = 1 \cup p^{i,t-1}_{e,e} = 1]$. The estimates in this section employ the same difference-in-difference strategy as in the preceding section. The coefficients on the interaction term can be interpreted as the differential probability of either being hired from unemployment or leaving the labor force from employment for the group subject to the higher minimum wage after the reform.

The definitions of hires and destructions introduces a selection problem before and after the reform if the minimum wage reform changes the composition of the employed and unemployed. For example, if the minimum wage effect is entirely through job destructions, we may still observe an effect on hires if low ability workers who have difficulty finding another job are fired following a reform. To deal with this concern, recently hired or separated individuals are respectively excluded from the pool of out of the labor force or employed individuals. Recently hired or separated individuals are defined as individuals who were hired or separated from their jobs in the past year.

Table 5 presents the standard difference-in-difference specification, except for the fact that the dependent variable is now an indicator of whether an individual entered a new job or faced a job destruction in the past quarter.[14] The point estimates for hires are between -.029 and -.045, and significant at the .01 level. The estimates correspond to a hires elasticity of -1.83, which is

[14] Appendix tables A2 and A3 present alternative definitions for hires and destructions.

substantially larger than that estimated in the US and Canada. Changes in minimum wages having a larger effect in Greece as opposed to North America is not surprising given that a much larger fraction of workers earn the minimum wage in Greece.

The point estimates for the rate of destructions are between -.002 and -.001, and insignificant at any conventional significance level. The effect on hires is much larger in comparison to the total number of hires and destructions; during the time period employment is declining rapidly in Greece. The results are quite similar if the sample is restricted to individuals who did not attend university, and who are more likely to enter minimum wage employment. The results indicate that the observed disemployment effects occur primarily through a slowed rate of new hires for workers above the age of 25, as opposed to job separations. This is consistent with high firing costs and required severance payments in the Greek economy, in contrast to evidence in the US from Dube, Lester, and Reich (2013), Canada from Brochu and Green (forthcoming) and Portgual from Portugal and Cardoso (2006) but consistent with Meer and West (2012). The effect is precisely what is predicted by a search model with job-to-job transitions when search efficiency is low, as would be expected in a deep recession. This point will be discussed further in section 4.5.

While most search models treat job destructions as exogenous, a higher minimum wage can also affect job-to-job transitions. Employed workers with higher wages are less likely to search while employed for other higher paying positions. Whether the job transition rate is affected can be tested directly. The final two columns of table 5 present results from the main fixed effects difference in difference specification, with the dependent variable being job transitions. A transition is defined as an indicator of whether an individual has switched industries in the past year, $T^{it} = \mathbb{1}[p^{i,t}_{e',e} = 1 | p^{i,t-1}_{u,e} = 1 \cup p^{i,t-1}_{e,e} = 1]$ with $e' \neq e$. For job transitions the point estimate is negative and insignificant at the .05 level. There may be no effect for the full sample of workers due to the fact that search efficiency is lower in a deep recession.[15] However, once the sample is restricted to lower education individuals, we find that individuals who are subject to the higher minimum wage are less likely to transition to another job, as a search model with higher search efficiency would predict.

Figure 5 shows that the timing of the results is consistent with the Greek minimum wage re-

[15] Dickens, Riley, and Wilkinson (2014) mention that increased search activity may explain why they find a positive impact on employment using an aged based regression discontinuity approach. Dickens, Riley, and Wilkinson (2012) also consider disemployment effects for workers in the UK during recessionary periods.

form. Each panel in figure 5 plots a fixed effects specification of the main difference-in-difference specification, in which the treatment indicator is interacted with an indicator for each time period. No effect is observed for separations, while relative hires drop for the treated group following the reform. Transitions are also seen to drop following the reform, although there is a lag which may reflect longer search durations for workers searching on the job.

The first row of table 7 also provides evidence that individuals subject to the higher minimum wage are less likely to search for employment while on the job. The dependent variable is an indicator of whether an individual reported seeking employment, with the sample restricted to unemployed individuals. The point estimates are all negative and significant at the .01 level. The results are consistent with most search models, which predict that individuals will engage in less search activity if wages are higher.

4.2.2 Job Seeking, Dismissal, and Quits

While the results in table 5 point to a small or negligible impact of the minimum wage on separations, the results may mask substantial heterogeneity. Individuals may leave employment through both voluntary quits and involuntary separations. For example, it is possible that a higher minimum wage could reduce quits while concurrently increasing dismissals. The average effect on transitions from employment to unemployment could be zero, despite potentially substantial effects on both quits and dismissals.

The last three rows in table 7 distinguish between different types of employment-to-unemployment transitions. No effect is found for involuntary separations: dismissals and contract expirations. The point estimates are close to zero and precisely estimated, ruling out larger short term effects of the minimum wage on involuntary dismissals. These estimates are consistent with severance restrictions provided to some workers in the with the Greek labor market. Greek law requires that employers pay substantial severance pay to some dismissed workers, and collective bargaining agreements in many industries make it difficult to dismiss employees.

Turning to voluntary quits, the point estimates in each specification are near -.001 and insignificant in all specifications. The results indicate that individuals subject to the higher minimum wage were not less likely to leave their positions voluntarily for non-employment. This result, along with the results in table 5 pointing to an increase in the minimum wage reducing transitions, is

consistent with the job-ladder model with substantial search fictions.

The job-ladder model predicts that an increase in the minimum wage will decrease quits when search frictions are low, while other models such as the match quality model predicts that an increase in the minimum wage will increase layoffs.[16] Table 7 points to no effect on quits, but also no effect on layoffs, which is consistent with the job-ladder model with search frictions but not the match quality model.

The final row of table 5 presents results in which the dependent variable is an indicator of whether or not an individual is in the labor force, employed or unemployed and seeking work. The reduction in wages can have theoretically ambiguous effects on labor force participation. First, a decrease in wages should encourage exit and discourage entry into the labor force, reducing labor force participation. Second, the increase in job finding resulting from the decrease in wages should discourage exit and encourage entry into the labor force. The results in 5 indicate that individuals subject to the smaller minimum wage cut were less likely to leave the labor force. This is suggestive that a higher minimum wage could have some positive long term employment effect in keeping individuals attached to the labor force.

This section and the previous one have established that the Greek minimum wage reform was associated with large employment effects, and that the effect is primarily present through a relative reduction in hires for workers subject to the larger minimum wage. The results indicate a full time employment elasticity of -1.86, which is much higher than most estimates reported in the survey by Neumark and Wascher (2007).[17] The magnitude of the effect is very large as the coefficient pools both a scale and substitution effect, as employers likely substituted younger minimum wage workers for older workers subject to a higher minimum wage. It is not surprising that the minimum wage reform had a significant effect on employment in the Greek case as the Greek minimum wage was especially likely to bind. Throughout the decade before the reform, Greece had one of the highest minimum wages relative to average wages in the OECD.

The fact that the effect of the minimum wage on new hires is much greater than the effect on separations is intuitive. In Greece, as in the US, a large proportion of minimum wage workers are

[16]The intuition behind the match quality model is that firms will be reluctant to lay off workers if the pool of searching workers is of poor quality. A higher minimum wage will induce higher quality workers to enter the labor force.

[17]The full time employment elasticity is given by $\frac{\Delta Employment/Employment}{\Delta MW/MW} = \frac{.038/.4}{.051}$. The other elasticities are computed similarly.

recent hires. While the large employment effect is evidence of a lack of binding monopsony power in the Greek labor market, the main parameter of interest is the scale elasticity.[18] The substitution effect largely reflects employers hiring one type of worker over another, whereas the scale effect reflects a net creation of jobs following the minimum wage cut. The next section discusses how to obtain separate estimates of the scale and substitution effects.

4.3 Substitution and Scale Effects

The results in the preceding subsection indicate a very large effect of the minimum wage on the relative employment of workers subject to a lower minimum wage. The minimum wage reform affects employment through two channels. First, a substitution effect is present as employers may substitute younger minimum wage workers for older workers who are subject to a higher wage. The substitution effect can be identified by the elasticity of substitution between younger and older workers σ_{YO} by the labor income share of younger workers $1 - s$ where $s = \frac{w_O L_O}{\sum_{i=Y,O} w_i L_i} = .64$. Second, there is a scale effect as a decline in labor factor costs leads to a corresponding decrease in product prices, increasing the quantity of output sold. The scale effect is the factor share of older workers s by the demand elasticity η. The total effect of the minimum wage reform η_{MW}, or the elasticity of demand for older workers with respect to their wages, is thus given by:[19]

$$\eta_{MW} = (1 - s)\sigma_{YO} + s\eta \tag{3}$$

The estimates of the effect of the minimum wage on employment in the previous section combine both substitution and scale effects. The scale elasticity η can be treated as a lower bound for the employment effects of the minimum wage as it does not include the effect of substituting younger workers for older workers.[20] To determine whether the minimum wage reform affected overall employment, two approaches can be used. First, following Pereira (2003) younger workers

[18] It is important to note that this does not rule out monopsony structure in the labor market. Very high minimum wages can still have negative employment effects in a monopsonistic labor market.

[19] The key assumptions are that there are only two types of labor inputs and a constant returns to scale production function. See appendix A.3 for a further discussion.

[20] However, the long term employment effects of the minimum wage reform are likely larger since there is also a capital substitution effect. See appendix A.3 for a further discussion.

subject to the lower minimum wage can be compared with workers several years older who are presumably not as close substitutes for young workers as workers immediately above the threshold. The disadvantage of this approach is that the common trends assumption is less likely to be satisfied for older workers. The second approach for determining the overall effect of the minimum wage reform on employment is to compute the elasticity of substitution σ_{YO} directly and use it along with estimates of s to compute η.

Panel B of table 6 provides estimates of the difference-in-difference comparing workers below the age of 25 to those between the ages of 29 and 35. The coefficient β_1, which is noted in the table as $PostXTreatment$, represents the mean effect of the minimum wage difference on unemployment. The results indicate that relative unemployment rose by 1.32 percentage points, and full time employment declined by 1.42 percentage points for the group subject to the higher minimum wage. The results are significant at the .01 and .05 levels. The estimates in table 6 are substantially smaller than those in 3, suggesting that indeed workers between the ages of 22 and 24 are more substitutable for workers between the ages of 25 and 27. If as in Pereira (2003) we assume that employment substitution is unlikely to occur between young workers and much older workers the coefficient β_1 will give the true minimum wage impact on employment. This corresponds to a full time employment elasticity of -.46, which is similar to that found by Pereira (2003) (-.4) using a similar reform for teenage workers in Portugal.

While the estimates derived from comparing workers below 25 with older workers are plausible, there may still be some substitutability between very young and old workers. To address this concern, estimates of σ_{YO} can be obtained directly and used to obtain estimates of η. The estimates of σ_{YO} are obtained by using the Katz and Murphy (1992) method. The groups are constructed by nine levels of education according to ISCE groups, number of years worked, gender and the job sector. Assuming a CES structure, we can restrict the analysis to two factors, old workers above the minimum wage threshold, and young workers below the threshold, since for other inputs in the production function the demand shifts can be defined to include the effects of changes in the prices or supplies of other inputs. Following Ottaviano and Peri (2012),[21] estimates of $-1/\sigma_{YO}$ can be

[21]The estimates are obtained as in Katz and Murphy (1992). Estimates of $-1/\sigma_{YO}$ as opposed to direct estimates of σ_{YO} are obtained due to measurement error in wages. This method is used rather than obtaining direct estimates of σ_{YO} due to the empirical challenges presented by measurement error in wages. The HFLS records wages in €100 bands, introducing classical measurement error which will bias estimates of σ_{YO} towards zero. Estimates of σ_{YO} obtained directly by regressing $\ln(L_{Ykt}/L_{Okt})$ on $\ln(w_{Ykt}/w_{Okt})$ lead to implausibly small estimates, which would

obtained via the following specification:

$$\ln\left(\frac{w_{Ykt}}{w_{Okt}}\right) = \alpha_k + \alpha_t - \frac{1}{\sigma_{YO}}\ln\left(\frac{L_{Ykt}}{L_{Okt}}\right) + \varepsilon_{kt} \tag{4}$$

where α_k are group fixed effects capturing the relative productivity of young and old workers in the same group and α_t are time period fixed effects allowing for common temporal shocks across all groups, for example, due to the deteriorating macroeconomic climate. w_{Ykt} and w_{Okt} are the average wages of young and old workers in group k in quarter-year t. L_{Ykt} and L_{Okt} are employment given by the number of workers in group k in quarter-year t. The term ε_{kt} is a mean zero random variable which is assumed independent of labor supply.

Estimates of $-1/\sigma_{YO}$ may be biased due to the simultaneous determination of wages and labor supply. To address this issue, $\ln\left(\frac{L_{Ykt}}{L_{Okt}}\right)$ can be instrumented using the opening of closed professions in Greece. In July of 2011 Greece opened approximately 140 heavily regulated closed professions. Professions in Greece previously required licenses for entry, and it was difficult for younger workers to obtain licenses promptly. The reform made is much likelier for younger workers to operate in professions. The opening of closed professions was associated with an approximate 25% increase in the ratio of younger workers to older workers, with a first stage F statistic of 9.

Panel A reports our estimates of $-1/\sigma_{YO}$, gradually adding in group and year effects. In the final column, the ratio of labor shares is instrumented using the opening of closed professions. The point estimates are similar to the OLS results, however the standard errors are much larger. When both types of effects are included, the results in panel A indicate $\sigma_{YO} = 4.67$. This estimate is broadly in line with other studies estimating σ_{YO}, although in the lower range of estimates.[22] There are a number of reasons why workers in different age groups may not be perfect substitutes, including cohort and life-cycle differences as well as preferences for certain types of jobs. The term σ_{YO} can be substituted into $\eta_{MW} = (1-s)\sigma_{YO} + s\eta$ to obtain an employment elasticity of -.28. This estimate is slightly smaller than the previous estimate, which may still include a labor

lead to larger estimates of η.

[22] For comparison, Card and Lemieux (2001), Murphy and Welch (1992) and Ottaviano and Peri (2012) find a range of elasticities near 5 in the United States.

substitution effect.

Table 6 provides estimates that allow us to identify the substitution and scale effects. Panel A provides estimates of $-1/\sigma_{YO}$ while panel B provides estimates from a difference-in-difference specification in which the treatment group is replaced with individuals between the ages of 29 and 35. The two estimates of the employment effect of the minimum wage are broadly similar, although the estimate using the first method is slightly larger. This is not surprising, as it is likely that there is still some degree of substitutability for very young and very old workers.

4.4 Validity of the Empirical Design

The earlier sections have documented robust effects of the minimum wage reform on employment, which are seen only through new hires and not through separations. This section will show that the effects are robust to alternative specifications, and that groups that were unaffected by the reform showed no discernible employment effects. The results presented earlier are robust to several alternative specifications. Moreover, various placebo tests fail to find any significant effects for placebo reforms at different times, or for groups that would have been unaffected by the differential minimum wage cut.

Table 8 presents several robustness checks. First, columns (1) though (6) of the first row vary the age threshold in the main sample. In the first column, the dependent variable is an indicator of whether or not an individual is unemployed. In the second column, the dependent variable is the log hours worked. In the third column, the dependent variable is an indicator of whether or not an individual works full time. In the main analysis, the sample is restricted to individuals between the ages of 22 and 27. In columns (1) through (3), 28 year olds are included in the sample. In column (4) though (6), 22 year olds are dropped from the sample. In all specifications of table 8, the results are of the same sign as in the main results and significant at the 10 percent level or of greater significance.

The second row of table 8 drops various groups and time periods from the sample. In columns (1)-(3) of the second row, the age group that is closest to the reform threshold, 25 year olds, is dropped from the sample. In all cases the point estimates do not change substantially and the results remain significant at the .05 level or lower. The basic results are also robust to varying the age threshold further. Finally, columns (4)-(6) of the second row present the results when the

period in which the reform went in effect is dropped. When the first quarter of 2012 is dropped from the results, the coefficient remains significant at the .05 level or of greater significance and the magnitude of the coefficients increase. The results indicate that the results are robust to alternative specifications, and that the main results of the study are not driven by particular choice of specifications.

Table 9 varies the definition of hires and displacements. In the main analysis, hires are defined as individuals who are unemployed or out of the labor force in one quarter, who successfully enter into employment in the next quarter. Displacements are defined analogously. In table 9, a hire is defined as an indicator of whether or not an individual transitions from disemployment to employment in a particular quarter. A separation is defined as in indicator of whether or not an individual transitions form employment to disemployment in a quarter. The results are quite similar to the results in table 5, with the exception that in one specification there is a significant negative effect on separations for individuals who did not attend university.

Table 10 presents various placebo tests to evaluate the validity of the empirical design. Columns (1) through (4) present the results of a placebo reform. The dependent variable is again an indicator of whether or not an individual is unemployed. Instead of the reform taking place in the first quarter of 2012, as it actually occurred, it is assumed that the reform took place in the third quarter of 2010 and the third quarter of 2011. In both placebo reform tests the year 2012 is dropped from the sample, as one would expect to see a significant result from the reform that actually took place. In both cases, with and without the inclusion of controls, the results of the placebo reforms indicate a small coefficient β_1 that is not significantly different from zero. The results of the placebo tests strengthen the validity of the empirical strategy, when a reform that did not take place is simulated no significant effects are found on unemployment.

Columns (5) through (8) present a second type of placebo test. In these tests the standard fixed effects difference in difference specification is used, however groups which would have been unaffected by the reform are examined. One concern is that workers above and below the age of 25 may have been affected by different shocks following the first quarter of 2012, or that cohort effects may be generating the observed results. To deal with these concerns, individuals who would not have been affected by the reform can be examined. In columns (7) through (8), the dependent variable is an indicator of whether or not an individual is self employed. Individuals who were

self employed would not have been affected by the differential change in the minimum wage. No significant effect is found from the reform on the propensity to enter self employment. The point estimate is very close to zero, and not statistically significant. These results point to the estimates not being driven by cohort effects or shocks that affected those under 25 differently from those just above the age of 25. Columns (5) to (6) present a similar placebo test to columns (7) and (8). The sample is restricted to individuals between the ages of 26 and 31. It is assumed in this specification that the reform affected individuals between the ages of 29 and 31 differentially from individuals between the ages of 26 and 28. Again the point estimates are very close to zero and not significant at any conventional level. The results again strengthen the validity of the empirical design as no significant effect is found for groups not affected differentially by the reform.

4.5 Economic Interpretation and Implications

Traditionally static labor demand models have been used in analyzing the effects of the minimum wage. Competitive static models predict that an increase in the minimum wage will (weakly) decrease employment. If firms have monopsony power, minimum wages can increase, decrease or have no effect on employment dependent on the level of the minimum wage in relation to the equilibrium wage.[23] However, static models do not offer predictions regarding whether the employment adjustments resulting from changes in the minimum wage will take place through hires or separations.

Employment dynamics can be analyzed in the framework of a search and matching model. In this framework, increases in minimum wages have opposing effects on job creation by reducing the demand for labor while simultaneously increasing search incentives. The effect of the minimum wage on job creation is thus ambiguous and depends on whether the supply or demand side dominates. If search effort improves significantly, then employment may not be affected or may increase. However if labor demand is reduced significantly, hiring will decrease substantially and employment will decrease.

What does the search and matching model predict in a deep recession? Following Hornstein, Krusell, and Violante (2011), Nagypal (2005) and Flinn (2006), offers arrive to unemployed work-

[23]The results of this paper indicate that even if firms have monopsony power in Greece, the minimum wage is binding above the equilibrium wage, leading to reduced employment levels.

ers at a rate $\lambda(\underline{w})$. The offer arrival rate $\lambda(\underline{w})$ is a function of the minimum wage $\underline{w}$. The minimum wage affects firm profits (Draca and van Reenen (2011)) and hence an increase may drive some firms out of the market, or the minimum wage may cause some firms to post fewer vacancies (Bontemps, Robin, and van den Berg (1999)).

Once a worker is employed, jobs are destroyed at an exogenous rate σ. Employed workers also engage in on the job search and take the highest wage offer. Offers arrive to employed workers at the rate $\lambda_e = \phi\lambda(\underline{w})$ where ϕ is a parameter measuring the efficiency of on-the-job search. The flow-balance between employment and unemployment, $\lambda(\underline{w})(1-e) = \sigma e$, implies that the employment (and unemployment) rate is a function of only the separations rate and the arrival rate:

$$e = \frac{\lambda(\underline{w})}{\lambda(\underline{w}) + \sigma} \tag{5}$$

It can be shown that the effect of the minimum wage on employment is a function of only the elasticity of the arrival rate and the minimum wage and the unemployment rate:

$$\frac{d\ln e}{d\ln \bar{w}} = \varepsilon_{\lambda(\underline{w}),\underline{w}} u \tag{6}$$

The effect of the minimum wage on employment thus depends on the elasticity $\varepsilon_{\lambda(\underline{w}),\bar{w}} = \frac{d\ln\lambda(\underline{w})}{d\ln\bar{w}}$ and the unemployment rate u. If $\varepsilon_{\lambda(\underline{w}),\bar{w}}$ is a structural parameter that does not vary over the business cycle, the effect of the minimum wage on employment should be larger when the unemployment rate u is higher. The results of the search model allow a derivation of the arrivals elasticity. As in Dube, Lester, and Reich (2013) and Hornstein, Krusell, and Violante (2011) the search model predicts that the effects of a minimum wage cut will be greater when the initial unemployment rate is high. Given a Greek youth unemployment rate of .3 in early 2012, and our earlier estimate of an arrivals elasticity of -1.83, the model gives an employment elasticity of -.55, which is larger than the earlier empirical estimates of the employment elasticity.

It is intuitive that the effects of a minimum wage on employment should depend on the elasticity of arrivals, and hence on the job creation margin. Minimum wage employees tend to be new

hires, and hence changes in the minimum wage should affect workers who are potential new hires. There are significant costs associated with hiring new employees, such as interviewing and training, as well as costs associated with laying off current employees, such as severance pay and firing aversion. To the author's knowledge, no studies have found a positive effect of minimum wage increases on separations. In the presence of substantial firing costs, it is natural that the minimum wage would not affect the job destruction rate.[24] However, some studies such as Brochu and Green (forthcoming), Portugal and Cardoso (2006) and Dube, Lester, and Reich (2013) have found negative, significant and large effects of the minimum wage on separations. Other studies including Meer and West (2012) and this one find a significant effect on hires, but smaller effects on separations. How can these seemingly contradictory findings be reconciled? In fact, the aforementioned search model with on-the-job transitions can reconcile these findings. When search efficiency is very low, the minimum wage should have little effect on job turnovers and hence on separations, but the minimum wage will still affect the offer arrival rate and thus can have a substantial impact on hires.

The mean separation and hire rates are given by the sum of the exogenous job destruction rate or arrival rate and the job-to job transition rate:

$$\mathbb{E}[s] = \sigma + \frac{\sigma(\sigma + \lambda_e)\ln(\frac{\sigma+\lambda_e}{\sigma})}{\lambda_e} \qquad \mathbb{E}[h] = \lambda(\underline{w}) + \frac{\sigma(\sigma + \lambda_e)\ln(\frac{\sigma+\lambda_e}{\sigma})}{\lambda_e} \tag{7}$$

The left hand side is the job destruction or arrival rate, while the right hand side is the job to job transition rate. As the job destruction rate is exogenous, the minimum wage only has a (negative) effect on the separations rate through decreasing the job to job transition rate. It is well known that vacancies and quits decrease in recessions, which implies lower search efficiency ϕ and hence a low job turnover rate. Thus during a recession, when search efficiency ϕ is very low, the left hand term should dominate and the minimum wage should have little effect on separations. However,

[24] It is worthwhile to note that Brochu and Green (forthcoming) find a significant effect of the minimum wage on reducing layoffs in Canada. They present a search and matching model which rationalizes this finding, the basic intuition being that firms are less likely to lay off workers when the minimum wage is high as they are less likely to find a good match for a replacement worker if the minimum wage is higher. This is less applicable to Greece which has very strong employment protections, making it difficult for firms to react to changes in the minimum wage by laying off workers. More research would be valuable in this area as there may be very different effects of minimum wage legislation on layoffs between North American and European countries with varying employment protection schemes.

the minimum wage will still effect the offer arrival rate $\lambda(\underline{w})$ so hires will decrease if the minimum wage is increased.

Both $E[s]$ and $\frac{d\mathbb{E}[s]}{d\ln\underline{w}}$ are increasing in on-the-job search costs ϕ, and moreover $\frac{d\mathbb{E}[s]}{d\ln\bar{w}} = 0$ when $\phi = 0$, i.e. there is no on the job search. Thus the results regarding the relationship between accessions and separations and the minimum wage are in fact in line with the predictions of a search model. This study focuses on a reform in Greece during a deep recession, when there are presumably few vacancies and search is inefficient, i.e. ϕ is quite low. In line with the predictions of the search model, the study finds negative point estimates for both hires and separations, however the magnitude of the effect is much larger for hires than separations. Moreover the effect on separations is entirely through a job to job transitions channel, and we see no effect on job destructions.

5 Concluding Remarks

Three contributions are made in this paper. First, employment increases following cuts in statutory minimum wages. Second, this effect is entirely through new hires of workers. No effect is found on job destructions from the changes in the minimum wage, and effects are found on hires and job-to job transitions. Third, the observed effects are consistent with the predictions of a search model with on-the-job transitions. The employment effects of the minimum wage are through both reduced labor demand, and increased search incentives. During recessions, vacancies and search efficiency are very low, and the reduced labor demand effects of the minimum wage dominate, reducing employment.

The 2012 Greek minimum wage reform offers a particularly attractive policy change which can be used to identify the employment effects of the minimum wage. The debate on the effects of the minimum wages is as old as the policy, with a large number of studies finding negative, no or even positive effects of the minimum wage on employment. The 2012 Greek minimum wage reform provides a well-suited context in which to study the effect of the minimum wage, that does not suffer from concerns such as geographic heterogeneity that confound other studies. Greece is a particularly interesting country to study minimum wage effects, given the extremely high level of the minimum wage relative to average wages. The evidence from this reform can

serve as a cautionary tale: very high minimum wages *do* have significant disemployment effects. The fact that the minimum wage may be low and non-binding in many countries previously studied as well as the presence of search frictions may in part explain why it has been difficult to reach a consensus on the effects of the minimum wage. If search frictions also play a role in the effect of the minimum wage, this may call for further research regarding the effects of the minimum wage over the business cycle. Many US states have unemployment benefits that vary over the business cycle precisely to reduce moral hazard risks. If the disemployment effects of the minimum wage are also greater during recessions, states could consider minimum wages that vary over the business cycle. Further research would be valuable on the effect of search frictions on the employment effects of the minimum wage, as well as on employment dynamics and the optimality of the minimum wage over the business cycle.

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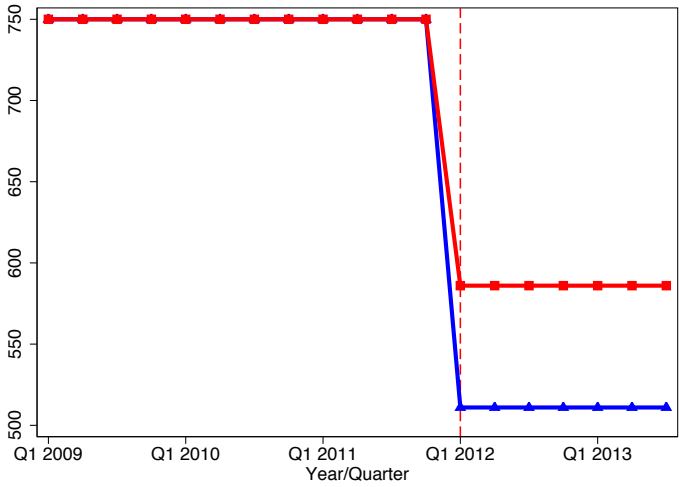
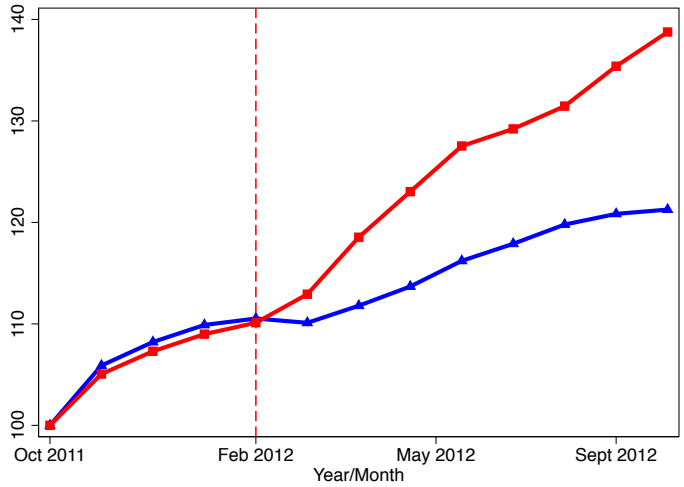
Figure 1: Nominal Minimum Wage and Unemployment 2009-2013

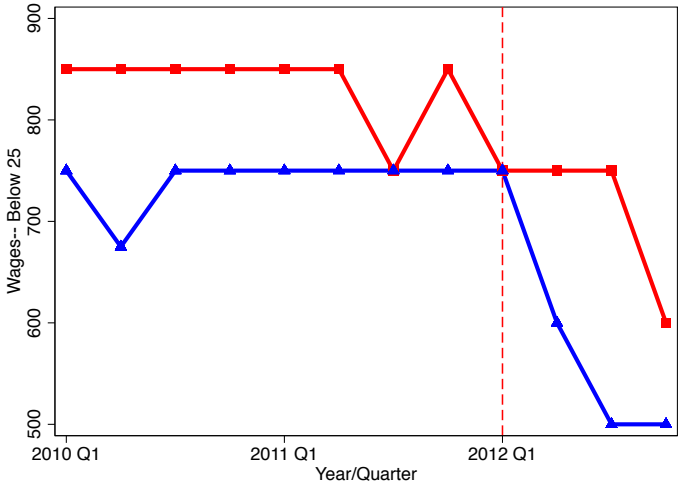
Panel A: Nominal Minimum Wage



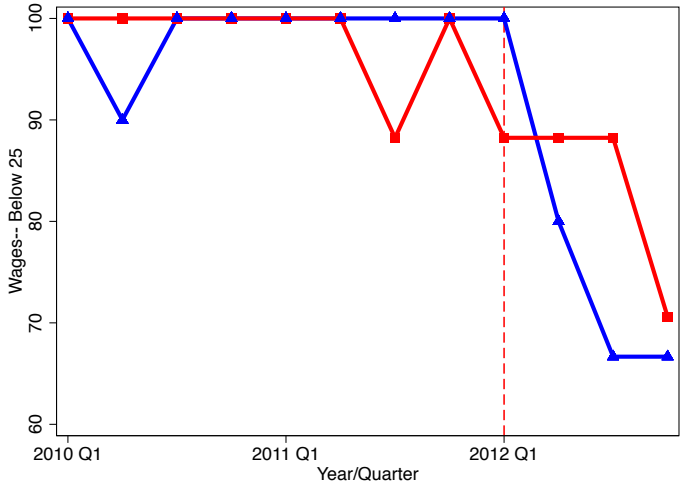
Panel B: Unemployment



Panel C: 25^{th} Percentile: Wages



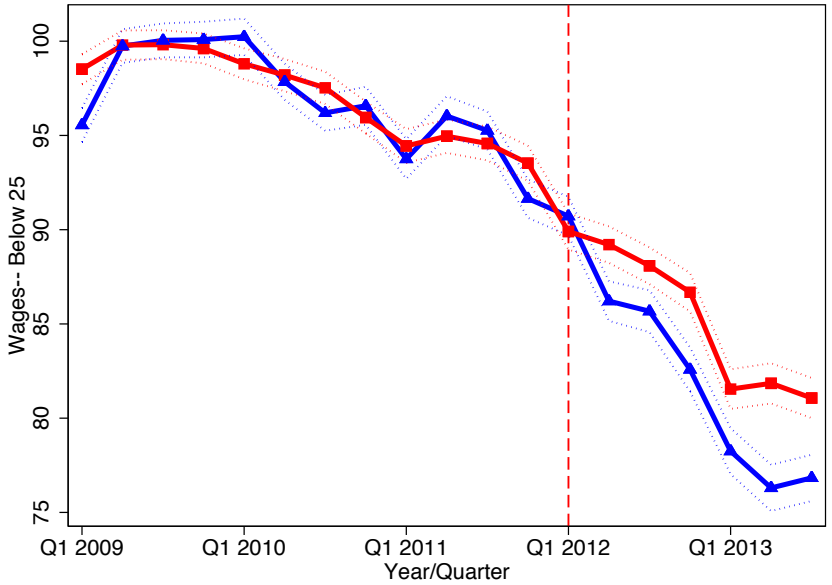
Panel C: 25^{th} Percentile: Wages



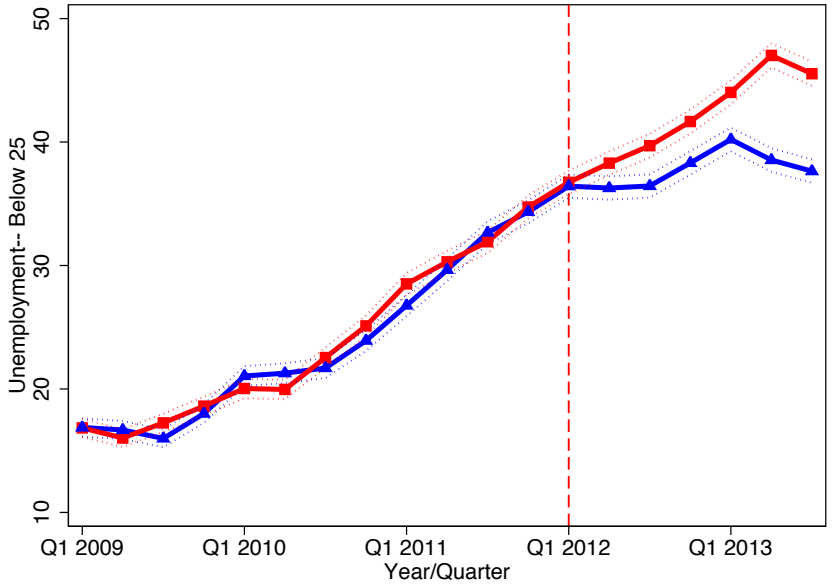
Notes: Panel A plots the quarterly statutory minimum wage by age group. Panel B plots the monthly unemployment by age group. The data source is Eurostat in panel B, and the Hellenic Labor Force Survey in panels C and D. The blue line noted with triangles is the outcome variable for workers under 25, and the red line noted with squares is the outcome variable for workers 25 and above. In the second column, each sample is normalized to 100 in September, 2011. The red dashed line at February, 2012, signifies that the minimum wage reform.

Figure 2: Greek Average Wage and Unemployment 2009-2013

Panel A: Average Log Wage

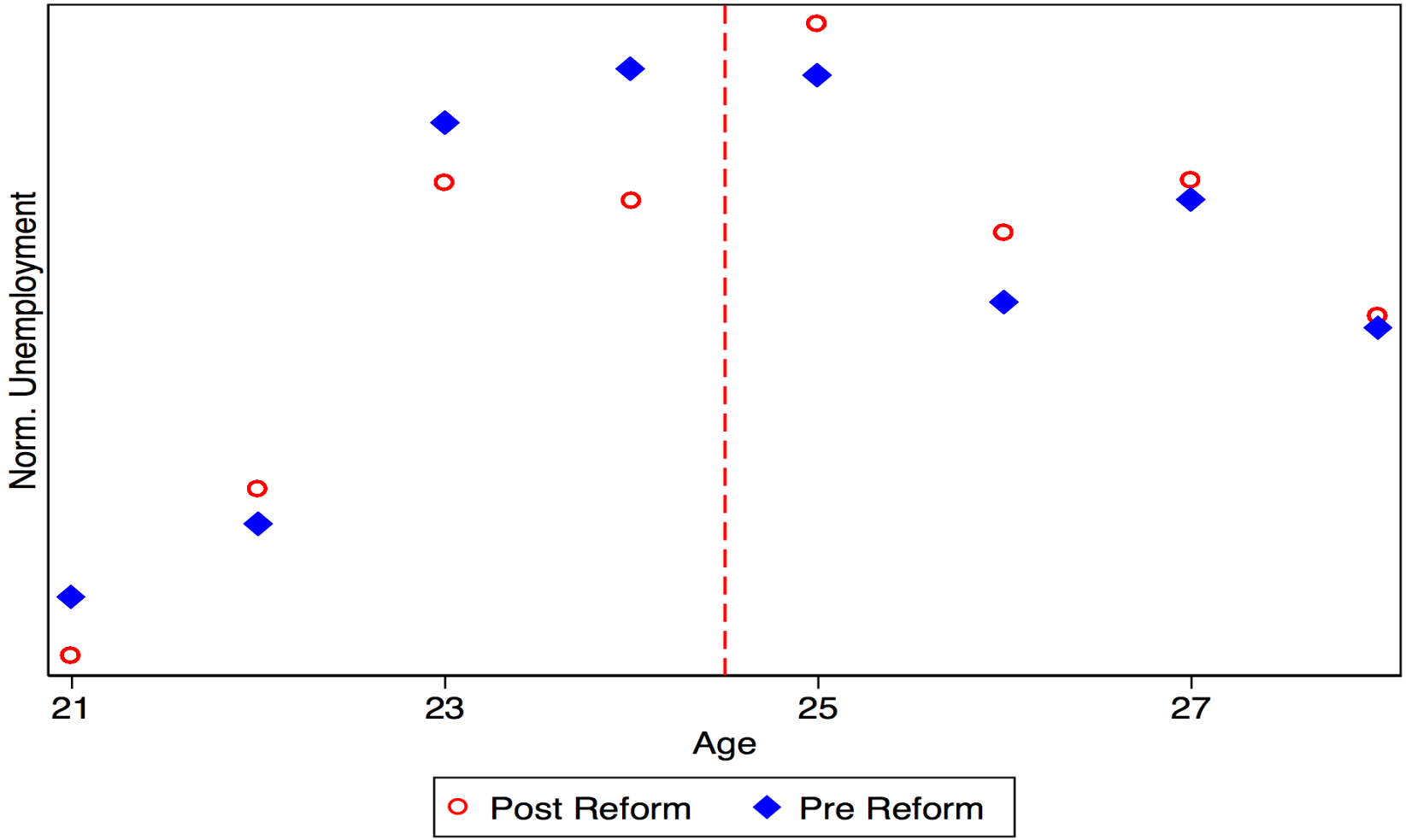


Panel B: Unemployment



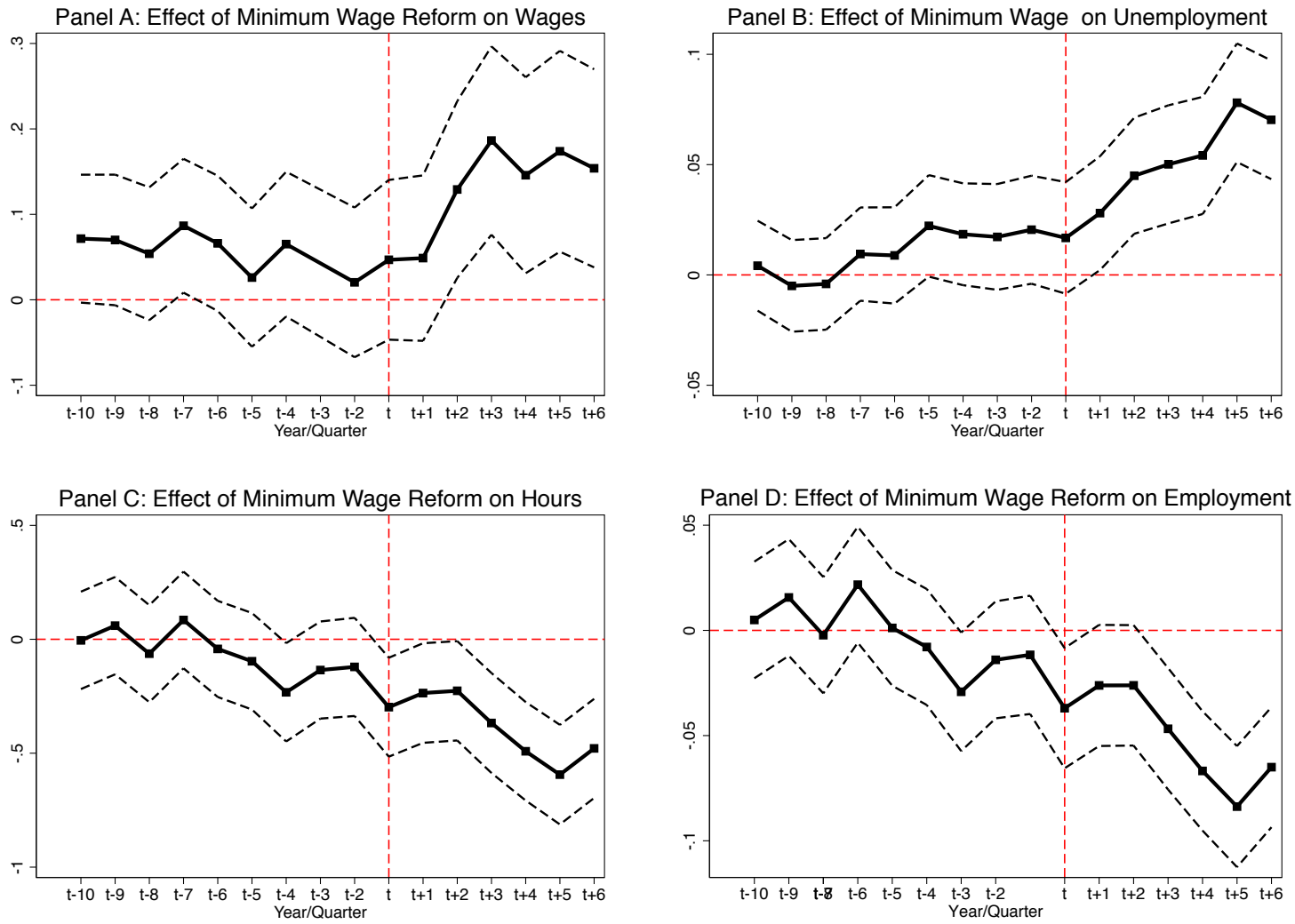
Notes: Panel A of the above figure plots the mean log wage by age group. The data source is the Greek Labor Force Survey. The blue line noted with triangles is the mean log wage for workers under 25, and the red line noted with squares is mean log wage for workers 25 and above. A 95% confidence interval is given by dotted lines that correspond to the color of the group in question. The wage is recorded in 100 euro bands. The mean log wage has been normalized to 100 in Quarter 1, 2011. Panel B plots the mean unemployment by age group. The data source is the Greek Labor Force Survey. A 95% confidence interval is given by dotted lines that correspond to the color of the group in question. Individuals between the ages of 22 and 27 are included in the sample. The red dashed line at Quarter 1, 2012, signifies that the minimum wage reform went into effect.

Figure 3: Unemployment by Age Group



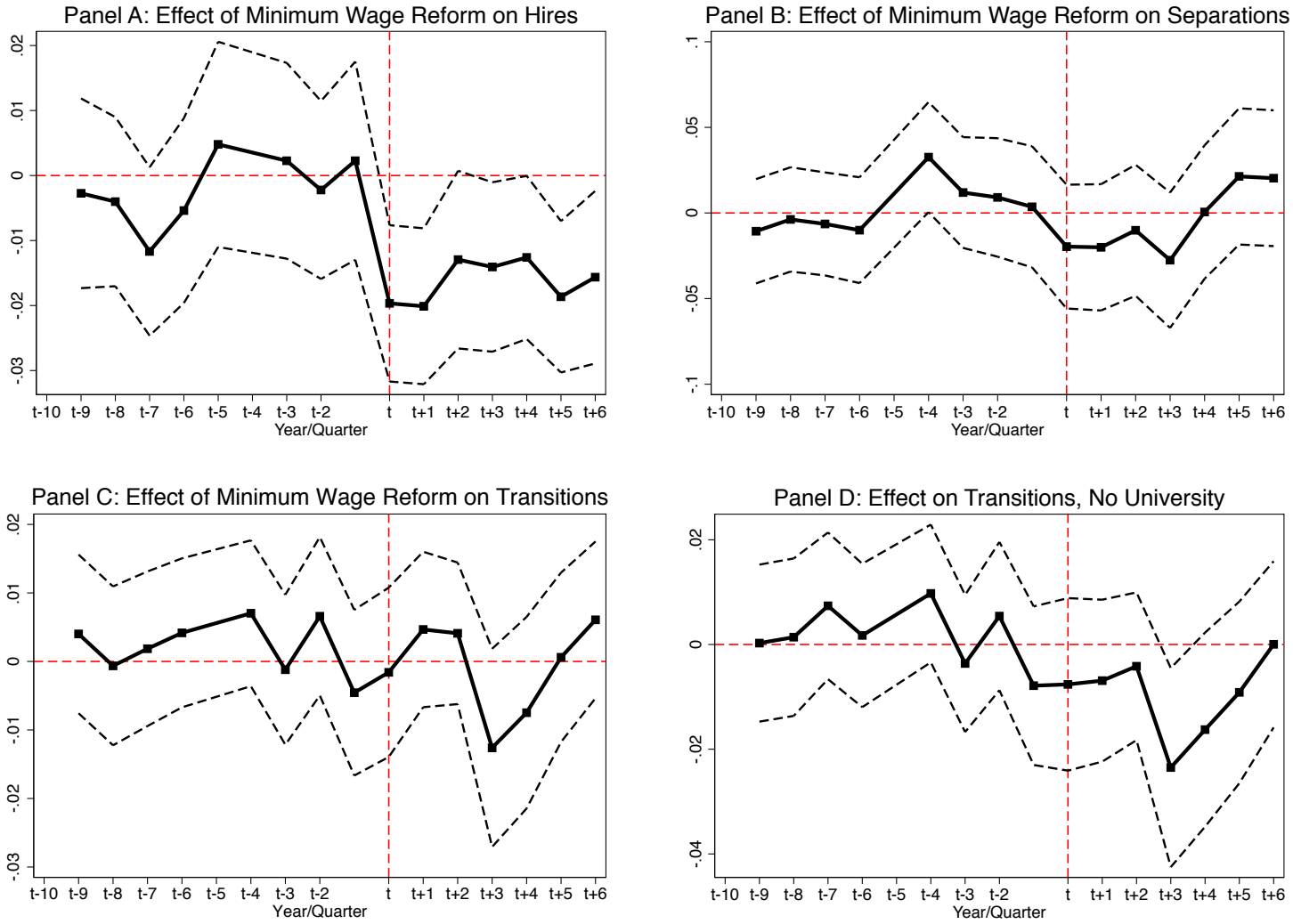
Notes: Each dot represents the mean unemployment rate of the specific age group, normalized by the average unemployment rate of individuals between the ages of 22 and 28. The blue diamonds are observations in Q3, 2011, before the minimum wage reform took place and the red circles are observations in the final period of data when the reform is in effect Q4, 2012. The red dashed line represents the cutoff between those above and including the age of 25, who received the smaller minimum wage cut, and those below the age of 25 who received a larger minimum wage cut. The data source is the Greek Labor Force Survey.

Figure 4: Treatment Effect over Time



Notes: This figure plots the coefficients β_y of interactions between indicators of whether or not an individual belongs to the treatment group of workers 25 and above and time period dummies, $y_{it} = \alpha_t + \alpha_i + \sum_{y=0}^{T} \beta_y \mathbb{1}[y = t] * \mathbb{1}[Age \geq 25]_{it} + \gamma X'_{it} + \epsilon_{it}$. The dependent variable in the regression is listed above the figure, and controls are included analogous to the main results. A 95% confidence interval is plotted in dotted lines around the coefficients. The data source is the Greek Labor Force Survey. The red dashed line at Quarter 1, 2012, signifies that the minimum wage reform went into effect.

Figure 5: Treatment Effect over Time



Notes: This figure plots the coefficients β_y of interactions between indicators of whether or not an individual belongs to the treatment group of workers 25 and above and time period dummies, $y_{it} = \alpha_t + \alpha_i + \sum_{y=0}^{T} \beta_y \mathbb{1}[y = t] * \mathbb{1}[Age \geq 25]_{it} + \gamma X'_{it} + \epsilon_{it}$. The dependent variable in the regression is listed above the figure, and controls are included analogous to the main results. A 90% confidence interval is plotted in dotted lines around the coefficients. The period prior to the reform is excluded from the sample. The data source is the Greek Labor Force Survey. The red dashed line at Quarter 1, 2012, signifies that the minimum wage reform went into effect.

Table 1: Summary Statistics

	Pre-Reform		Post-Reform	
	Under 27 Above 25	Under 25 Above 22	Under 27 Above 25	Under 25 Above 22
Age	26.03	22.99	26.03	23.01
	(0.82)	(0.82)	(0.82)	(0.81)
Unemployment	0.22	0.21	0.37	0.32
	(0.41)	(0.41)	(0.48)	(0.47)
Wage	855.16	791.36	755.70	692.37
	(247.66)	(225.98)	(237.04)	(189.79)
Hire	0.30	0.20	0.20	0.14
	(0.46)	(0.40)	(0.40)	(0.35)
Separation	0.14	0.19	0.21	0.26
	(0.35)	(0.39)	(0.40)	(0.44)
Transition	0.02	0.02	0.01	0.01
	(0.14)	(0.15)	(0.10)	(0.12)
Quit	0.01	0.03	0.01	0.03
	(0.12)	(0.18)	(0.12)	(0.18)
Dismissal	0.05	0.07	0.09	0.10
	(0.22)	(0.25)	(0.29)	(0.30)
Female	0.48	0.49	0.47	0.47
	(0.50)	(0.50)	(0.50)	(0.50)
Non-Greek	0.12	0.12	0.10	0.09
	(0.32)	(0.32)	(0.29)	(0.28)
Public	0.05	0.04	0.04	0.05
	(0.22)	(0.20)	(0.19)	(0.22)
Education	4.47	4.83	4.32	4.68
	(1.52)	(1.17)	(1.48)	(1.17)
Food Service	0.05	0.05	0.05	0.04
	(0.22)	(0.22)	(0.21)	(0.19)
Retail	0.09	0.07	0.08	0.04
	(0.28)	(0.25)	(0.27)	(0.20)
Administration	0.04	0.02	0.04	0.02
	(0.20)	(0.15)	(0.20)	(0.16)
Agriculture	0.04	0.03	0.04	0.03
	(0.20)	(0.17)	(0.20)	(0.17)
N	32,261	29,723	8,962	8,311

Notes: The mean of the variables in the first column are presented, with standard deviations below in parentheses. Appendix A.2 contains a discussion of the construction of analysis variables. Each observation is an individual-quarter. The data source is the Greek Labor Force Survey.

Table 2: Results for the Probability of Full Time Employment

	(1)	(2)
After Reform X Above 25	-0.0279***	-0.0382***
	(0.0081)	(0.0072)
After Reform	-0.1200***	-0.1149***
	(0.0056)	(0.0048)
Above 25	0.1960***	0.0907***
	(0.0041)	(0.0037)
Controls	NO	YES
Observations	75,261	75,261

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. The dependent variable in all specifications is an indicator of whether an individual is employed full time. The data source is the Greek Labor Force Survey. Individuals between the ages of 22 and 27 are included in the sample. The period immediately before the reform has been excluded from the sample. The mean of the dependent variable is .376. Controls in column (2) include gender, immigrant status, educational attainment, employment type and sector. The specification includes a dummy for individuals in the treatment group (above the age of 25) and a dummy for being post the reform (after Q1, 2012). Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. Standard errors are clustered at the individual level in all specifications.

Table 3: Main Results: Full Time Employment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
After Reform X Above 25	-0.0301***	-0.0306***	-0.0306***	-0.0284***	-0.0293***	-0.0377***	-0.0376***	-0.0516***
	(0.0077)	(0.0076)	(0.0076)	(0.0076)	(0.0075)	(0.0072)	(0.0086)	(0.0082)
Married		-0.1724***	-0.1720***	-0.1152***	-0.1253***	-0.1063***	-0.1183***	-0.0916***
		(0.0053)	(0.0054)	(0.0054)	(0.0054)	(0.0051)	(0.0058)	(0.0061)
Immigrant			-0.0024	-0.0030	-0.0139**	-0.0005	0.0051	-0.0216***
			(0.0058)	(0.0057)	(0.0056)	(0.0053)	(0.0056)	(0.0060)
Female				-0.1442***	-0.1426***	-0.1419***	-0.1756***	-0.1175***
				(0.0034)	(0.0033)	(0.0032)	(0.0037)	(0.0037)
Disabled					-0.5320***	-0.4398***	-0.4464***	-0.2684***
					(0.0092)	(0.0090)	(0.0081)	(0.0073)
Conscript					-0.4954***	-0.4572***	-0.5258***	-0.2998***
					(0.0410)	(0.0415)	(0.0376)	(0.0262)
Food Service						0.2802***	0.2920***	0.3880***
						(0.0074)	(0.0084)	(0.0124)
Retail						0.3123***	0.3190***	0.3984***
						(0.0058)	(0.0071)	(0.0118)
Agriculture						0.3993***	0.4038***	0.6017***
						(0.0071)	(0.0074)	(0.0080)
Observations	75,261	75,261	75,261	75,261	75,261	75,261	48,913	36,346

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. The dependent variable in all specifications is an indicator of whether an individual is employed full time. Employment is defined as persons aged 15 years and over who, during the reference week preceding the survey, have worked for at least one hour or more or were temporarily absent from work. Other analysis variables are described in appendix A.2. The data source is the Greek Labor Force Survey. Individuals between the ages of 22 and 27 are included in the sample.The period immediately before the reform has been excluded from the sample. The mean of the dependent variable is .376 in columns (1)-(6). Column (7) restricts the sample to individuals who have not completed college, and column (8) restricts the sample to individuals who did not complete college and never obtained a permanent job during the sample period. All specification include age and year fixed effects. All specifications include dummies for the highest level of education attained. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. Standard errors are clustered at the individual level in all specifications.

Table 4: Main Results: Wages, Employment and Hours

	(1)	(2)	(3)	(4)	(5)	(6)
	Log Monthly Wage		Unemployment		Log Hours Worked	
After Reform X Above 25	0.0561**	0.0512**	0.0467***	0.0468***	-0.1274***	-0.1230***
	(0.0249)	(0.0248)	(0.0078)	(0.0078)	(0.0290)	(0.0288)
Age Effects	✓	✓	✓	✓	✓	✓
Time Effects	✓	✓	✓	✓	✓	✓
Controls		✓		✓		✓
Observations	28,430	28,430	75,261	75,261	75,261	75,261

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. The data source is the Greek Labor Force Survey. Analysis variables are described in appendix A.2. Individuals between the ages of 22 and 27 are included in the sample.The period immediately before the reform has been excluded from the sample. In columns (1) and (2) the dependent variable is log monthly wage. The mean of the dependent variable in column (1)-(2) is 1.684. In columns (3) and (4) the dependent variable is an indicator of whether an individual is employed full time. The mean of the dependent variable is .362. In columns (5) and (6) the dependent variable is log hours worked. The mean of the dependent variable in columns (5)-(6) is 1.478. The age and year fixed effects in the specification are noted by check marked in the second and third to last rows. All specifications include dummies for the highest level of education attained. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. Standard errors are clustered at the individual level in all specifications.

Table 5: New Hires and Job Displacements

	(1)	(2)	(3)	(4)	(5)	(6)
	Hire		Destruction		Transition	
Full Sample						
After Reform X Above 25	-0.0450***	-0.0286***	-0.0018	0.0011	-0.0016	-0.0018
	(0.0087)	(0.0066)	(0.0115)	(0.0087)	(0.0033)	(0.0033)
Constant	0.2019***	0.3007***	0.1881***	0.3872***	0.0235***	0.0052
	(0.0030)	(0.0103)	(0.0037)	(0.0132)	(0.0014)	(0.0046)
Observations	43,357	43,357	36,276	36,276	37,174	37,174
No University						
After Reform X Above 25	-0.0386***	-0.0250***	-0.0239	-0.0075	-0.0086*	-0.0086*
	(0.0101)	(0.0074)	(0.0146)	(0.0108)	(0.0045)	(0.0046)
Constant	0.1558***	0.1149***	0.1827***	0.4049***	0.0238***	0.0040
	(0.0031)	(0.0156)	(0.0043)	(0.0216)	(0.0017)	(0.0094)
Observations	28,633	28,633	22,620	22,620	22,350	22,350

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. In columns (1) and (2) the dependent variable is an indicator of whether or not an individual was newly hired in the past three periods. In columns (3) and (4) the dependent variable is an indicator of whether or not an individual was displaced from their job in the past three periods. In columns (5) and (6) the dependent variable is an indicator of whether or not an individual transitions to a job in another industry. The data source is the Greek Labor Force Survey. Analysis variables are described in appendix A.2. All specifications include age and year fixed effects. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. All specifications include dummies for the highest level of education attained. Standard errors are clustered at the individual level in all specifications.

Table 6: Substitution and Scale Effects

Panel A	(1)	(2)	(3)	(4)
	Estimates of $-1/\sigma_{YO}$			
Full Sample	-0.1843***	-0.1414***	-0.2136***	-0.2145
	(0.0593)	(0.0437)	(0.0541)	(0.7164)
Men	-0.1705*	-0.1387*	-0.2137**	-0.2480
	(0.0950)	(0.0677)	(0.0907)	(0.7609)
Women	-0.2001***	-0.1101	-0.2189***	-0.2614
	(0.0693)	(0.0651)	(0.0589)	(0.2661)
Group Effects	✓		✓	✓
Time Effects		✓	✓	✓
Observations	152	152	152	152
Panel B	(1)	(2)	(3)	(4)
	Unemployment	Unemployment	FT Employment	FT Employment
Post X Treatment	0.0128*	0.0132**	-0.0137**	-0.0142**
	(0.0066)	(0.0065)	(0.0067)	(0.0066)
Age Effects		✓		✓
Time Effects		✓		✓
Observations	99,867	99,867	99,867	99,867

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. The data source is the Greek Labor Force Survey. Analysis variables are described in appendix A.2. Panel A presents estimates of $-1/\sigma_{YO}$ where σ_{YO} is the elasticity of substitution between workers in our sample above and below the age of 25. Estimates are computed using the Katz-Murphy method, estimating $\ln(w_{Ykt}/w_{Okt}) = \alpha_k + \alpha_t - \frac{1}{\sigma_{YO}}\ln(L_{Ykt}/L_{Okt}) + \varepsilon_{kt}$, where α_k are group fixed effects and α_t are time period fixed effects. Groups are defined by educational level, experience gender and job type. Fixed effects are noted by a checkmark in the final two rows of panel A. In column 4 of panel A, the labor shares are instrumented using an interaction between an indicator of a professional industry and an indicator of professional services being opened after July, 2011. In panel A all estimates are clustered at the group level. Panel B provides difference in difference estimates in which the treatment groups are individuals between the ages 29 and 35. Individuals between the ages of 25 and 28 are excluded from the sample. Fixed effects are noted by a checkmark in the final two rows of panel B. Estimates without age and year fixed effects include a treatment group dummy and a dummy indicating whether or not the minimum wage reform in in effect. The dependent variable is noted above the estimates. All results in panel A are clustered at the individual level.

Table 7: Job Seeking and Displacement Types

	(1)	(2)	(3)	(4)	(5)	(6)
			Seeking Employment			
After Reform	-0.0271***	-0.0274***	-0.0276***	-0.0265***	-0.0265***	-0.0271***
X Above 25	(0.0081)	(0.0081)	(0.0081)	(0.0081)	(0.0081)	(0.0080)
			Dismissal			
After Reform	0.0058	0.0057	0.0053	0.0046	0.0045	0.0053
	(0.0088)	(0.0088)	(0.0088)	(0.0088)	(0.0088)	(0.0087)
			Contract Expiration			
After Reform	-0.0120	-0.0124	-0.0125	-0.0136	-0.0135	-0.0098
X Above 25	(0.0094)	(0.0094)	(0.0094)	(0.0094)	(0.0094)	(0.0092)
			Quit			
After Reform	-0.0013	-0.0018	-0.0018	-0.0021	-0.0011	-0.0003
X Above 25	(0.0046)	(0.0046)	(0.0046)	(0.0046)	(0.0045)	(0.0045)
			Out of Labor Force			
After Reform	-0.0151***	-0.0143***	-0.0146***	-0.0155***	-0.0137***	-0.0104**
X Above 25	(0.0051)	(0.0049)	(0.0049)	(0.0049)	(0.0047)	(0.0047)

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. The dependent variable in each specification is listed above the estimates. Controls are added in gradually and are analogous to the first six columns of table 3. The data source is the Greek Labor Force Survey. Analysis variables are described in appendix A.2. All specifications include age and year fixed effects. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. All specifications include dummies for the highest level of education attained. Standard errors are clustered at the individual level in all specifications.

Table 8: Robustness Checks

	(1) Unemployment	(2) Log Hours Worked	(3) Full Time Employment	(4) Unemployment	(5) Log Hours Worked	(6) Full Time Employment
		Ages 22-28			Ages 23-27	
After Reform X Above 25	0.0552***	-0.1598***	-0.0483***	0.0507***	-0.1453***	-0.0357***
	(0.0078)	(0.0257)	(0.0069)	(0.0095)	(0.0312)	(0.0084)
Observations	82,698	82,635	82,698	58,347	58,306	58,347
		Drop 25 Year Olds			Drop Q1, 2012	
After Reform X Above 25	0.0528***	-0.1671***	-0.0484***	0.0560***	-0.1478***	-0.0413***
	(0.0094)	(0.0316)	(0.0085)	(0.0085)	(0.0280)	(0.0075)
Observations	58,470	58,426	58,470	66,254	66,207	66,254

Notes: $*p < .1$, ** $p < .05$, *** $p < .01$. In the first three columns of row one the sample is restricted to individuals between the ages of 22 and 28. In the second three columns of row one the sample is restricted to individuals between the ages of 23 and 27. In the first three columns of row two 25 year olds are dropped from the sample. In the second three columns of row two the first quarter of 2012 has been dropped from the sample. In columns (1) and (4) the dependent variable is an indicator of whether or not an individual is unemployed. The mean of the dependent variable is .285. In columns (2) and (4) the dependent variable is log hours worked. The mean of the dependent variable in columns (5)-(6) is 1.478. In columns (3) and (6) the dependent variable is an indicator or whether or not an individual is employed full time. The mean of the dependent variable is .362. Self employed and family workers are excluded from the sample in all specifications. The data source is the Greek Labor Force Survey. Analysis variables are described in appendix A.2. All specifications include age and year fixed effects. All specifications include dummies for the highest level of education attained. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. Standard errors are clustered at the individual level in all specifications.

Table 9: Robustness: New Hires and Job Displacements

	(1)	(2)	(3)	(4)	(5)	(6)
	Hire		Destruction		Transition	
Full Sample						
After Reform X Above 25	-0.0063*	-0.0066**	-0.0002	-0.0023	-0.0016	-0.0014
	(0.0036)	(0.0029)	(0.0035)	(0.0033)	(0.0033)	(0.0033)
Constant	0.0220***	0.0313***	0.0147***	0.0312***	0.0235***	0.0048
	(0.0011)	(0.0044)	(0.0011)	(0.0048)	(0.0014)	(0.0046)
Observations	39,142	39,142	37,659	45,244	37,174	37,174
No University						
After Reform X Above 25	-0.0109***	-0.0086**	-0.0065	-0.0094**	-0.0086*	-0.0083*
	(0.0042)	(0.0034)	(0.0045)	(0.0041)	(0.0045)	(0.0046)
Constant	0.0181***	-0.0008	0.0142***	0.0556***	0.0238***	0.0094
	(0.0012)	(0.0077)	(0.0013)	(0.0087)	(0.0017)	(0.0094)
Observations	28,633	28,633	22,620	22,620	22,350	22,350

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. This table uses alternative definitions of hires, displacements and transitions. The dependent variable is an indicator of whether or not an individual was hired, displaced or transition in a particular quarter. In columns (1) and (2) the dependent variable is an indicator of whether or not an individual was newly hired in the past three periods. In columns (3) and (4) the dependent variable is an indicator of whether or not an individual was displaced from their job in the past three periods. In columns (5) and (6) the dependent variable is an indicator of whether or not an individual transitions to a job in another industry. The data source is the Greek Labor Force Survey. Analysis variables are described in appendix A.2. All specifications include age and year fixed effects. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. All specifications include dummies for the highest level of education attained. Standard errors are clustered at the individual level in all specifications.

Table 10: Placebo Tests

	Reform begins Quarter 3, 2011		Reform begins Quarter 3, 2010		Treatment Group is Above 27		Dependent Variable is Self Employed	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Full Time Employment				
After Placebo	0.0122	0.0101	-0.0114	0.0151	-0.0000151	-0.000329	-0.00643	-0.00762
X Above 25	(0.0152)	(0.0117	(0.0108)	(0.00822)	(0.00870)	(0.00860)	(0.00529)	(0.00514)
				Unemployment				
After Placebo	0.00250	0.00360	-0.00292	-0.00205	-0.00433	-0.00563	..	..
X Above 25	(0.0121)	(0.0114)	(0.00762)	(0.00758)	(0.00667)	(0.00652)	..	..
				Log Hours Worked				
After Placebo	0.00856	0.000807	0.0457	-0.00107	0.0339	0.0423	..	..
X Above 25	(0.0563)	(0.0422)	(0.0400)	(0.0299)	(0.0323)	(0.0308)	..	..
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Observations	33,508	33,508	33,508	33,508	73,418	73,418	79,257	79,257

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. Columns (1) and (2) present a placebo test in which the policy change took effect one year earlier, in Q2, 2011. Columns (3) and (4) present a placebo test in which the policy change took effect in Q4, 2010. The years in the sample are 2010 and 2011. In columns (1) to (4) periods in which the minimum wage reform is in effect are not included in the sample. Columns (5) and (6) present a placebo test in which the dependent variable is an indicator of whether or not an individual is self employed or is employed by a family member. Columns (7) and (8) present a placebo test in which neither age group is affected by the minimum wage reform. The treatment group is individuals between the ages of 28 and 30, and the control group is individuals between the ages of 25 and 27. The data source is the Greek Labor Force Survey. Analysis variables are described in appendix A.2. All specifications include year and age fixed effects. All specifications include dummies for the highest level of education attained. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. Standard errors are clustered at the individual level in all specifications.

A Appendix

A.1 Institutional Background: The Minimum Wage in Greece

The minimum wage in Greece is governed by the National Collective General Agreement (NCGA). Since 1984, Greek law has mandated an eight hour workday and a 40 hour work week. The monthly minimum wage is set in accordance with the 40 hour work week. Overtime pay is strictly regulated. Under special circumstances, the work week can be extended by 5 hours a week at 50% increase in base pay. Further overtime hours are possible at 150% above base pay, with a maximum of 3 overtime hours per day. Overtime hours may not surpass 120 in one year. The Ministry of Employment and the Organization of Mediation and Arbitration oversee labor disputes in Greece.

Law 4046/2012 was passed on the 12th of February as part of an austerity package negotiated between the Greek government, the European Union, the European Central Bank the International Monetary Fund. Prior to March 1, 2012 monthly net minimum wage for all workers in Greece was €751. Following March 1, 2012 the minimum wage fell differentially for workers above and below the age of 25. Age or cohort based policy thresholds are relatively common in Greece. Saez, Matsaganis, and Tsakloglou (2012) use a cohort based reform to examine payroll tax incidence. For workers 25 and above, the minimum wage was cut by 22% to €586 and for workers under the age of 25 the minimum wage was lowered by a larger amount, 32% to €511. The minimum wage is reset for individuals through a seniority allowance of 5% after three years of employment. The seniority allowance can be repeated for six three-year terms, or 18 years of total service. A marriage bonus of 10% is also no longer included in the minimum wage following the passage of law 4046/2012.

A large proportion of Greek workers are covered by the minimum wage in comparison to many other OECD countries. The Greek Labour Force Survey indicates over 12% of Greek workers earned at or below the minimum wage in the first quarter of 2010. Nearly 29% of new hires earn the minimum wage. Nearly half of workers in the 22 to 27 age group earn at or below the minimum wage. Eurostat figures indicate that in 2011 Greece had the highest minimum wage relative to average wages in the EU, making the minimum wage very likely to bind in Greece. Figure A2 depicts the minimum wage over average monthly earnings in selected OECD countries.

A.2 Hellenic Labor Force Survey Variable Definitions

The Hellenic Labor Force Survey consists of a repeated panel of individuals above the age of 15 and below the age of 74, providing a comprehensive look at the Greek labor market. Some groups such as conscripts living on base, permanent hotel clients, and foreign embassy staff are excluded. The Hellenic Labor Force Survey is harmonized with European legislation, specifically Council Regulation No. 577/98. The Hellenic Labor Force Survey contains the variables necessary for this paper's analysis: employment status and age, as well as a number of other demographic variables. Eurostat (2012), International Labor Organization (2010) and Eurostat (2010) provide detailed information on the survey.

The Greek Labor Force Survey has produced annual estimates of Greek labor force data since 1981, and from 1998 the survey has been a continuous quarterly survey. The data is collected by employees of the Hellenic Statistical Service who go door to door with paper and pencil. There are 200 interviewers and 10 supervisors, and interviewers are both permanent and temporary workers. Like other European labor force surveys, the Greek survey is a large household sample survey consisting of 32,600 households each quarter. This corresponds to a sampling rate of about .85%. The Greek survey is harmonized with European legislation, specifically Council Regulation No. 577/98. Participation in the survey is compulsory but in practice penalties for refusal are light, so the actual response rate is 92%. The Hellenic Statistical Service imputes non-responses. Responses are anonymized and answers to the survey are not punishable under law, and illegal employment activities are reported. Non-response to the survey is punishable. Households are randomly selected using the 2001 census, and stay in the sample for six quarters. Each period one sixth of the sample is replaced. The survey collects data on employment status as well as demographic and job characteristics, as well as educational attainment. The variables are defined as follows:

Employment- Persons aged 15 years and over who, during the reference week preceding the survey, have worked for at least one hour or more or were temporarily absent from work due to illness, vacation, strikes, bad weather or machine breakdown etc. This includes paid apprentices and unpaid family members as well as workers who are searching for other positions, persons who performed work for pay or profit during the reference period but were in school, workers who are retired and receiving a pension, workers registered as jobseekers at an employment office or receiving unemployment benefits while working, full and part-time students working full or part-

time, participants in employment promotion schemes if they work on a regular basis, and volunteer and career members of the armed forces. The variable was constructed from the HLFS variable *katap*.

Unemployment-All persons aged 15 years and over, without work, who were seeking work and have taken specific steps (such as registration at a private or public employment office, placing or answering advertisements, applications to employers, seeking assistance of friends or relatives) during the last 4 weeks to find a job and are available to work within two weeks. The variable was constructed from the HLFS variable *katap*.

Transition- This variable was constructed from the job in which an employed person worked one year prior to the survey. The sample includes all persons aged 15 years and over, who have been employed for the past year and have changed industry. This information is only available for employees who began work two years before they were surveyed. The variable was constructed from the HLFS variables *E45*, *E92*.

Separation- This variable was constructed from the end date for the non-employed. All persons aged 15 years and over who were employed for at least one month during the time period. This variable is equal to zero if the individual is not working, and one when an individual begins employment. Individuals who begin working in the past year are excluded. This information is only available for individuals who ended work two years before they were surveyed. The variable was constructed from the HLFS variables *E50a*, *E50b*.

Hire- This variable was constructed from the start date for employees. The sample includes all persons aged 15 years and over who were not employed for at least one month during the time period. This variable is equal to zero if the individual is not working, and one when an individual begins employment. Individuals who were laid off in the past year are excluded. This information is only available for individuals who ended work two years before they were surveyed. The variable was constructed from the HLFS variables *E21a*, *E21b*.

Dismissal- This variable was constructed from the end date for the non-employed who stated that the reason they left employment in their last job was dismissal or being made redundant. The sample includes all persons aged 15 years and over who were employed for at least one month during the time period. This variable is equal to zero if the individual is not working, and one is the individual satisfied the definition mentioned earlier. This information is only available for

individuals who ended work two years before they were surveyed. The variable was constructed from the HLFS variables *E50a*, *E50b*, *E51*.

Expiration- This variable was constructed from the end date for the non-employed who stated that the reason they left employment in their last job was a contract of limited duration having ended. The sample includes all persons aged 15 years and over who were employed for at least one month during the time period. This variable is equal to zero if the individual is not working, and one is the individual satisfied the definition mentioned earlier. This information is only available for individuals who ended work two years before they were surveyed. The variable was constructed from the HLFS variables *E50a*, *E50b*, *E51*.

Quit- This variable was constructed from the end date for the non-employed who stated that the reason they left employment in their last job was personal or family responsibilities, looking after children, conscription, education, illness or other reasons. The sample includes all persons aged 15 years and over who were employed for at least one month during the time period. This variable is equal to zero if the individual is not working and one when an individual is in one of the aforementioned categories. Individuals who begin working in the past year are excluded. This information is only available for individuals who ended work two years before they were surveyed. The variable was constructed from the HLFS variables *E50a*, *E50b*, *E51*.

Hours of Work- Usual and actual hours of work per week in the main job and actual hours in secondary job. Coded as 0 for individuals not in the labor force. The variable was constructed from the HLFS variable *e25_orR*.

Wages- Monthly take-home pay from main job. Wages are recorded in €100 bands unless below €499 or above €1,750. The variable was constructed from the HLFS variable *e95*.

Education- Coded as 1 through 9 based on the International Standard Classification of Education. 1 denotes that the highest level of completed education is postgraduate study, whereas 8 denotes that an individual did not attend school. The variable was constructed from the HLFS variable *e80_r1*.

A.3 Law of Total Demand

A.3.1 Two Factor Model

This section of the appendix and the next present a simple model of the effects of the minimum wage, in which employers may substitute between older and younger workers. The model is used to motivate the results and discussion in the text.

The derivation of the the employment elasticity of the minimum wage makes use of the law of total demand $\eta_{MW} = (1-s)\sigma_{YO} + s\eta$ where $s = \frac{w_O L_O}{\sum_{i=Y,O} w_i L_i}$. This presumes that there are two types of workers that can be substituted to produce an output good. There is a unit mass of workers, labor supply for a particular class of workers is nested in a larger CES structure

$$L = \left[\sum_{i \in Y,O} L_i^{\frac{\sigma_{Y,O}-1}{\sigma_{Y,O}}} \right]^{\frac{\sigma_{Y,O}}{\sigma_{Y,O}-1}} \tag{8}$$

The law of total demand is well known, and relies on the assumption of a demand function for output $Y = D(p)$ with $\frac{dlogY}{dlogp} = \eta$. Assuming constant returns to scale, the total cost function is given by $C(w_Y, w_O, Y) = Y\gamma(w_Y, w_O)$ where $\gamma(w_O, w_Y)$ is the unit cost function and w_Y and w_O are the wages of the two types of workers. Let L_O and L_Y be the labor demanded in each sector. From the optimality condition it is the case that $L_O = \frac{\partial C(w_O, w_Y, Y)}{\partial w_O}$ and thus

$$logL_O = log\frac{\partial C(w_O, w_Y)}{\partial w_O} = logY + log\gamma_{w_O} \tag{9}$$

It can be shown after some algebra, keeping in mind that the cost function is homogeneous of degree one which implies that C_x is homogeneous of degree zero and consequently $w_O C_{w_O w_O} + w_Y C_{w_O w_Y} = 0$, that the following holds

$$\frac{\partial logL_O}{\partial logw_O} = \eta\frac{w_O\gamma_{w_O}}{\gamma} + \frac{\gamma_{w_O w_O}Y}{\gamma_{w_O}C_{w_O}} =$$

$$-\eta\frac{C_{w_O}w_O}{\gamma Y} - \frac{w_Y}{w_O}\frac{C_{w_O w_Y}CL_Y w_O}{C_{w_O}C_{w_Y}C} = \tag{10}$$

Recalling that the constant output elasticity of substitution can be given by $\sigma_{YO} = \frac{CC_{w_O w_Y}}{C_{w_O} C_{w_Y}}$, the above equation can be rewritten as

$$-\eta \frac{L_O w_O}{C} - \frac{w_O}{w_O} \sigma_{YO} \frac{L_Y w_Y}{C} \tag{11}$$

Recalling that $s = \frac{w_Y L_Y}{\sum_{i=Y,O} w_i L_i}$ gives the result that

$$-\eta_{MW} = -\eta s - \sigma_{YO}(1-s) \tag{12}$$

A.3.2 The Scale Elasticity as a Lower Bound for the Employment Effect

There are three reasons why the scale elasticity η should be viewed as a lower bound for the true employment effect of the Greek minimum wage reform. First, and perhaps most importantly, any effects of labor-capital substitution will be differenced out between the two groups. Thus the difference-in-difference estimate β_1 captures only the scale effect and the labor-labor substitution effects of the minimum wage reform. Including the effect of labor-capital substitution would make the true employment effects of the minimum wage reform larger.

Second, the estimates of the scale elasticity will underestimate the true employment effect if we consider substitution between older workers and young workers below the age of 22 who were not in the analysis sample. If we consider a multi factor model with labor groups $i \in I$, the total employment effect for older workers will be given by $-\eta_{MW} = -\eta s' - \sum_i \sigma_i s_i$, where s_i are the factor shares for each group i and σ_i are the elasticities of substitution between each group. Empirically it is the case that $s' > \sum_{i \neq Y} s_i$ since workers below the age of 22 are less likely to be in the labor force. The given is estimate is $\hat{\eta} = \frac{\eta_{MW} - \sigma_{YO} * (1-s)}{s}$ which can be rewritten as $\hat{\eta} = \left[\eta_{MW} - \sigma_{YO} * \frac{s^Y}{s^Y + s'}\right] \frac{s' + s^Y}{s'}$. The true η is given by $\eta = \left[\eta_{MW} - \sum_i \sigma_{O,i} s_i\right] \frac{1}{s'}$ which is larger than $\hat{\eta}$ as long as $\frac{1 - s' - s^Y}{s^Y} \eta_{MW} - \sum_{i \neq Y} \sigma_{O,i} s_i > 0$, which is the case.

Finally, any measurement error resulting from the HFLS imputation or misreporting in em-

ployment will attenuate estimates of the inverse of the elasticity of substitution between younger and older workers, which will lead to an underestimated effect of true employment effects. The measurement error in $\frac{L_{Ykt}}{L_{Okt}}$ will bias estimates of $-\frac{1}{\sigma_{YO}}$ towards zero, meaning that the true value of σ_{YO} is smaller than the estimated value $\hat{\sigma_{YO}} = \frac{\sigma_\epsilon^2}{\sigma_\epsilon^2+\sigma_\nu^2}\sigma_{YO}$ where σ_ν^2 is the variance of the measurement error.

A.4 Job Ladders Model

In this section, an equilibrium search model with on-the-job transitions is outlined following Hornstein, Krusell, and Violante (2011) and Nagypal (2005). The discussion in section 4.3 is complemented using the model. We assume that labor supply for a particular class of workers is nested in a larger CES structure. Individuals are risk-neutral, infinitely lived and discount the future at rate r. Unemployed individuals receive offers at a rate $\lambda(\underline{w})$, which is a decreasing function of the minimum wage $(\underline{w})$. Employed individuals receive offers at a rate $\lambda_e = \phi\lambda(\underline{w})$ where ϕ captures the efficiency of on-the-job search. Conditional on receiving an offer, wages are drawn from an i.i.d. distribution $F(w)$ with support $[\underline{w}, \bar{w}]$. Assume without loss of generality that unemployed workers accept all offers $F(w^*) = 0$. While unemployed, a worker receives a utility flow b which includes unemployment benefits and the benefits of leisure. While employed, jobs are destroyed at an exogenous rate σ. The flow values of employment and unemployment are given by the following Bellman equations

$$rW(w) = w + \lambda_e \int_w^{\hat{w}} [W(z) - W(w)]dF(z) - \sigma[W(w) - U] \tag{13}$$

$$rU = b + \lambda(\underline{w}) \int_{\underline{w}}^{\hat{w}} [W(z) - U]dF(z) \tag{14}$$

An expression for employment can be derived from the flow-balance between employment and unemployment. The flow-balance between employment and unemployment, $\lambda(\underline{w})(1 - e) = \sigma e$, implies that the employment (and unemployment) rate is a function of only the destruction and

arrivals rates

$$e = \frac{\lambda(\underline{w})}{\lambda(\underline{w}) + \sigma} \tag{15}$$

Total employment is given by $L = \sum_{i \in Y,O} e_i$. In section 4.3, it is stated that the employment elasticity is a function only of the equilibrium unemployment rate and the arrival elasticity, $\frac{d\ln(e)}{d\ln\underline{w}} = \varepsilon_{\lambda,\underline{w}} u$ and this property is used to estimate the arrivals elasticity. To show this, the natural logarithm of the employment rate (10) can be taken

$$\ln(e) = \ln(\lambda(\underline{w})) - \ln(\lambda(\underline{w}) + \sigma) \tag{16}$$

It is straightforward to compute

$$\frac{d\ln(e)}{d\ln\underline{w}} = \frac{\lambda'(\underline{w})\underline{w}}{\lambda(\underline{w})} - \frac{\lambda'(\underline{w})\underline{w}}{\lambda(\underline{w}) + \sigma} \tag{17}$$

The above term can be rearranged as $\frac{\lambda'(\underline{w})\underline{w})}{\lambda(\underline{w})}[\frac{\sigma}{\lambda(\underline{w})+\sigma}]$. Keeping in mind that $1-e = u$ and $\varepsilon_{\lambda,\underline{w}} = \frac{\lambda'(\underline{w})\underline{w}}{\lambda(\underline{w})}$ the above term can be rearranged as a function only of the equilibrium unemployment rate and the arrival elasticity $\frac{d\ln(e)}{d\ln\underline{w}} = \varepsilon_{\lambda,\underline{w}} u$.

The equilibrium wage distribution $G(w)$ can be found as a function of the wage offer distribution by using the steady state inflows and outflows balance. The measure of workers with wage below w is given by $(1-u)G(w)$. Agents leave this stock if they are forced to separate at rate σ, or if they receive a better offer at rate $\lambda_e[1 - F(w)])$. Workers enter this stock from unemployment at rate $u\lambda F(w)$ which leads to the flow balance $(1-u)G(w)(\sigma + \lambda_e[1 - F(w)]) = u\lambda F(w)$. Rearranging the preceding equation and recalling (10) gives us an expression for $G(w)$

$$G(w) = \frac{\sigma F(w)}{\sigma + \lambda_e[1 - F(w))]} \tag{18}$$

The total separations rate s is given by the sum of the separations rate σ and the job-to-job transitions rate from workers receiving better offers, $\lambda_e(\underline{w}) \int_{\underline{w}}^{\hat{w}} [1 - F(w)] dG(w)$. Following Nagypal (2005), the job to jobs transition rate can be written as

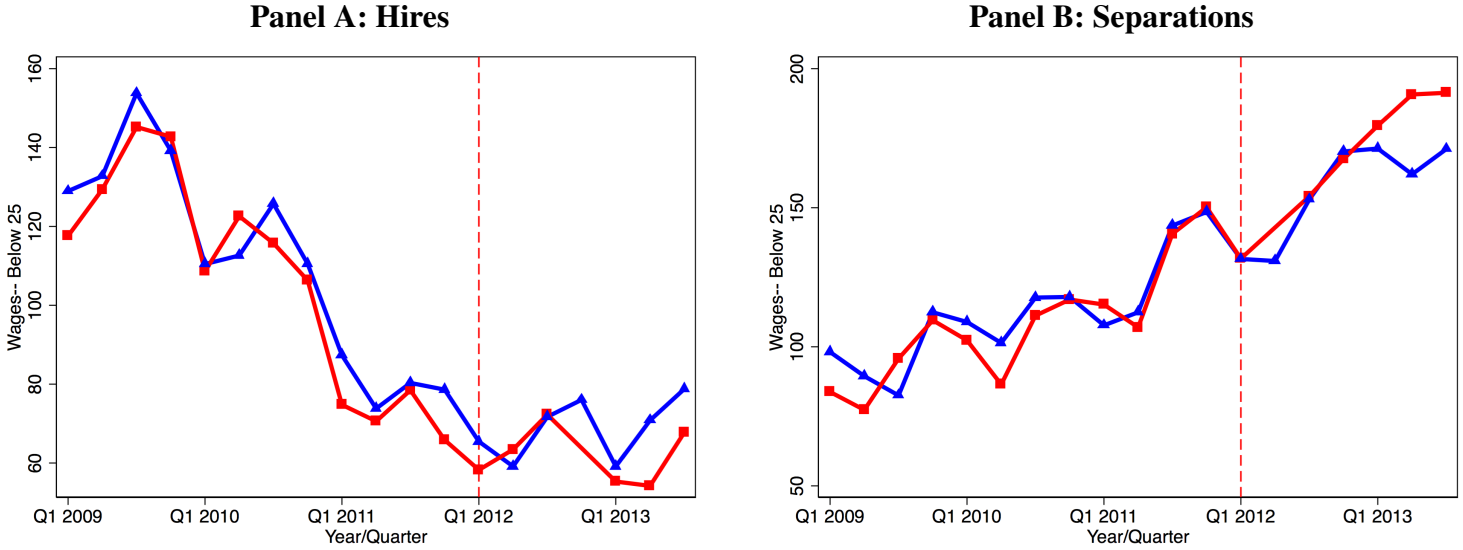
$$\frac{\sigma(\sigma + \lambda_e) \ln(\frac{\sigma+\lambda_e}{\sigma})}{\lambda_e} \tag{19}$$

It is straightforward to compute

$$\frac{d\sigma(\sigma + \lambda_e) \ln(\frac{\sigma+\lambda_e}{\sigma})/\lambda_e}{d\lambda_e} = \frac{\sigma(\lambda_e - \sigma \ln(\frac{\lambda_e+\sigma}{\sigma})))}{\lambda_e^2} \tag{20}$$

The term $\frac{d\sigma(\sigma+\lambda_e) \ln(\frac{\sigma+\lambda_e}{\sigma})/\lambda_e}{d\lambda e}$ will be positive if $\lambda_e - \sigma \ln(\frac{\lambda_e+\sigma}{\sigma})$ is positive. To see that this is the case, define $\kappa = \frac{\lambda}{\sigma}$. Assuming that λ_e decreases the job to job transition rate is equivalent to $\lambda_e - \sigma \ln(\frac{\lambda_e+\sigma}{\sigma}) \leq 0$ which can be rewritten $\kappa \leq \ln(1 + \kappa)$ which implies that $e^{\kappa} \leq 1 + \kappa$. This condition is never true for $\kappa > 0$, and thus $\frac{d\sigma(\sigma+\lambda_e) \ln(\frac{\sigma+\lambda_e}{\sigma})/\lambda_e}{d\lambda e} \geq 0$. Since λ_e is increasing in the efficiency of on the job search, ϕ, if on the job search efficiency is lowered the job turnover rate is lowered.

Figure A1: Hires and Separation by Age Group

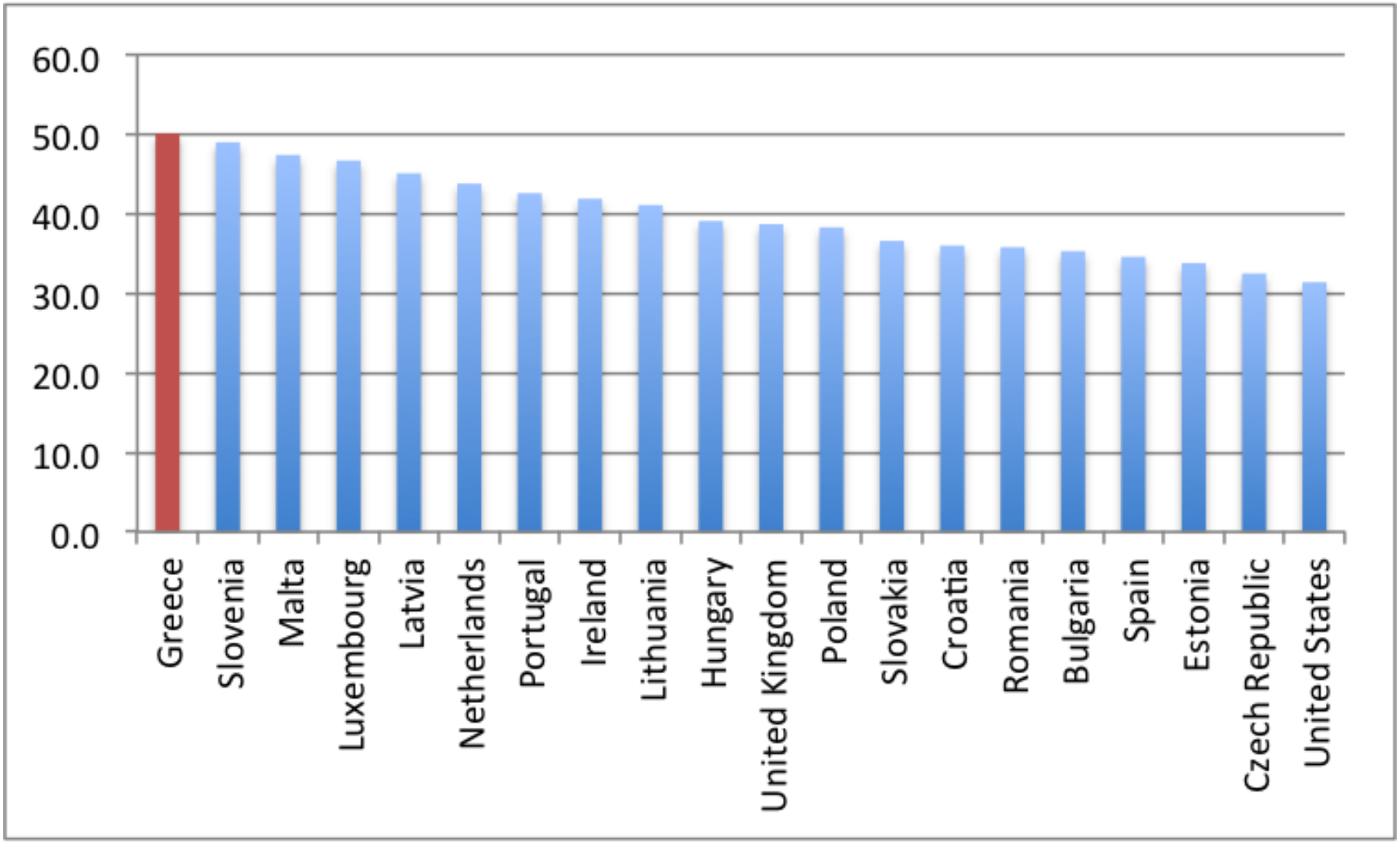


Notes: The above figure plots the mean hire and separation rate by age group. The data source is the Greek Labor Force Survey. The blue line is the mean unemployment rate for workers under 25, and the red line is mean unemployment rate for workers 25 and above. A 95% confidence interval is given by dotted lines that correspond to the color of the group in question. Individuals between the ages of 22 and 27 are included in the sample. The red dashed line at Quarter 1, 2012, signifies that the minimum wage reform went into effect.

Figure A2: Wage Distribution Before and After the Reform

Notes: The above figure plots the kernel density estimate of the wage distribution using a bandwidth of 150. The data source is the Greek Labor Force Survey. The blue solid line is the density before the reform, and the red dashed line is the density after the reform. A 95% confidence interval is given by dotted lines that correspond to the color of the group in question. Individuals between the ages of 22 and 27 are included in the sample. The red dashed line shows the minimum wage before the reform went into effect.

Figure A3: Minimum Wage as a Proportion of Average Monthly Earnings



Notes: The figure above depicts the minimum wage over average monthly earnings in selected OECD countries in 2011. Average monthly earnings are Purchasing Power Parity adjusted. The source of the data is Eurostat Minimum Wage statistics.

Table A1: Main Results: Unemployment Excluding Self Employed and Family Workers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
After Reform X Above 25	0.0514***	0.0509***	0.0513***	0.0511***	0.0439***	0.0436***	0.0642***	0.0980***
	(0.0086)	(0.0086)	(0.0086)	(0.0086)	(0.0076)	(0.0076)	(0.0097)	(0.0130)
Female		0.0322***	0.0313***	0.0199***	-0.0276***	-0.0304***	-0.0670***	-0.0868***
		(0.0033)	(0.0033)	(0.0033)	(0.0030)	(0.0031)	(0.0038)	(0.0051)
Immigrant			-0.0832***	-0.0509***	-0.0326***	-0.0321***	-0.0361***	-0.0536***
			(0.0046)	(0.0049)	(0.0046)	(0.0047)	(0.0051)	(0.0074)
Education				-0.0244***	-0.0325***	-0.0330***	0.0278***	0.0347***
				(0.0014)	(0.0012)	(0.0012)	(0.0028)	(0.0038)
Permanently Employed					-0.4185***	-0.4138***	-0.3359***	
					(0.0025)	(0.0026)	(0.0033)	
Food Service						-0.0285***	-0.0051	-0.0418***
						(0.0058)	(0.0064)	(0.0153)
Retail						0.0159***	0.0519***	0.1786***
						(0.0044)	(0.0057)	(0.0196)
Agriculture						-0.0292**	-0.0769***	-0.1578***
						(0.0120)	(0.0122)	(0.0250)
Administration						-0.0709***	-0.0275***	-0.0673**
						(0.0050)	(0.0078)	(0.0275)
Observations	70,061	70,061	70,061	70,061	70,061	70,061	45,010	31,883

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. The dependent variable in all specifications is an indicator of whether an individual is unemployed. The data source is the Greek Labor Force Survey. Individuals between the ages of 22 and 27 are included in the sample. The mean of the dependent variable is .376 in columns (1)-(6). Column (7) restricts the sample to individuals who have not completed college, and column (8) restricts the sample to individuals who did not complete college and never obtained a permanent job during the sample period. All specifications include age and year fixed effects. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. Standard errors are clustered at the individual level in all specifications.

Table A2: Main Results: Hires

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
After Reform X Above 25	-0.0294***	-0.0300***	-0.0299***	-0.0302***	-0.0159***	-0.0123**	-0.0138**	-0.0157**
	(0.0081)	(0.0081)	(0.0081)	(0.0081)	(0.0057)	(0.0056)	(0.0060)	(0.0064)
Female		-0.0597***	-0.0611***	-0.0718***	-0.0288***	-0.0235***	-0.0479***	-0.0458***
		(0.0037)	(0.0038)	(0.0037)	(0.0027)	(0.0026)	(0.0028)	(0.0030)
Immigrant			0.0348***	0.0816***	0.0540***	0.0352***	0.0297***	0.0307***
			(0.0064)	(0.0066)	(0.0050)	(0.0046)	(0.0045)	(0.0048)
Education				-0.0360***	-0.0194***	-0.0217***	0.0062***	0.0044**
				(0.0015)	(0.0011)	(0.0011)	(0.0018)	(0.0019)
Permanently Employed					0.8761***	0.8197***	0.8306***	
					(0.0021)	(0.0031)	(0.0045)	
Food Service						0.4082***	0.4298***	0.7578***
						(0.0162)	(0.0194)	(0.0229)
Retail						0.2471***	0.2383***	0.4576***
						(0.0161)	(0.0208)	(0.0437)
Agriculture						0.6033***	0.5979***	0.8244***
						(0.0274)	(0.0279)	(0.0208)
Administration						0.4399***	0.5214***	0.7513***
						(0.0255)	(0.0460)	(0.0488)
Observations	44,107	44,107	44,107	44,107	44,107	44,107	29,357	27,017

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. The dependent variable in all specifications is an indicator of whether an individual is hired in the current year. The data source is the Greek Labor Force Survey. Individuals between the ages of 22 and 27 are included in the sample. Column (7) restricts the sample to individuals who have not completed college, and column (8) restricts the sample to individuals who did not complete college and never obtained a permanent job during the sample period. All specifications include age and year fixed effects. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. Standard errors are clustered at the individual level in all specifications.

Table A3: Main Results: Separations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
After Reform X Above 25	-0.0040	-0.0059	-0.0055	-0.0061	0.0063	0.0075	0.0086	0.0557**
	(0.0140)	(0.0140)	(0.0140)	(0.0140)	(0.0088)	(0.0088)	(0.0112)	(0.0266)
Female		0.0460***	0.0447***	0.0633***	0.0072**	0.0077**	0.0335***	0.0785***
		(0.0048)	(0.0048)	(0.0051)	(0.0034)	(0.0035)	(0.0048)	(0.0119)
Immigrant			-0.0160**	-0.0466***	-0.0703***	-0.0713***	-0.0697***	-0.1923***
			(0.0066)	(0.0071)	(0.0053)	(0.0054)	(0.0060)	(0.0151)
Education				0.0239***	0.0129***	0.0148***	-0.0013	0.0040
				(0.0020)	(0.0014)	(0.0014)	(0.0033)	(0.0079)
Permanently Employed					-0.6229***	-0.6145***	-0.6280***	
					(0.0047)	(0.0047)	(0.0060)	
Food Service						-0.1093***	-0.1262***	-0.3328***
						(0.0066)	(0.0075)	(0.0193)
Retail						-0.0506***	-0.0636***	-0.1663***
						(0.0043)	(0.0053)	(0.0201)
Agriculture						-0.0903***	-0.0759***	-0.1999***
						(0.0144)	(0.0148)	(0.0365)
Administration						-0.0951***	-0.1252***	-0.4569***
						(0.0055)	(0.0090)	(0.0309)
Observations	30,113	30,113	30,113	30,113	30,113	30,113	17,907	6,357

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. The dependent variable in all specifications is an indicator of whether an individual separates from their job in the current year. The data source is the Greek Labor Force Survey. Individuals between the ages of 22 and 27 are included in the sample. Column (7) restricts the sample to individuals who have not completed college, and column (8) restricts the sample to individuals who did not complete college and never obtained a permanent job during the sample period. All specifications include age and year fixed effects. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. Standard errors are clustered at the individual level in all specifications.

Table A4: Regression Results for Table 4

	(1) Log Wage	(2) Unemployment	(3) Hourly Wage	(4) Unemployment
Treatment*Period4	0.0701	0.0042	0.0597	0.0157
	(0.0464)	(0.0124)	(0.1299)	(0.0169)
Treatment*Period5	0.0539	-0.0050	-0.0632	-0.0023
	(0.0473)	(0.0126)	(0.1294)	(0.0168)
Treatment*Period6	0.0866*	-0.0041	0.0847	0.0217
	(0.0476)	(0.0126)	(0.1289)	(0.0167)
Treatment*Period7	0.0660	0.0094	-0.0423	0.0012
	(0.0481)	(0.0128)	(0.1283)	(0.0167)
Treatment*Period9	0.0651	0.0222	-0.2328*	-0.0292*
	(0.0515)	(0.0140)	(0.1312)	(0.0171)
Treatment*Period10	0.06650	0.0184	-0.1350	-0.0140
	(0.0466)	(0.0140)	(0.1295)	(0.0169)
Treatment*Period11	0.0204	0.0172	-0.1213	-0.0116
	(0.0532)	(0.0146)	(0.1310)	(0.0171)
Treatment*Period13	0.0468	0.0168	-0.2981**	-0.0370**
	(0.0568)	(0.0154)	(0.1320)	(0.0174)
Treatment*Period14	0.0488	0.0280*	-0.2359*	-0.0262
	(0.0589)	(0.0157)	(0.1329)	(0.0175)
Treatment*Period15	0.1291**	0.0450***	-0.2261*	-0.0261
	(0.0629)	(0.0160)	(0.1325)	(0.0174)
Treatment*Period16	0.1864***	0.0501***	-0.3675***	-0.0468***
	(0.0670)	(0.0163)	(0.1333)	(0.0176)
Treatment*Period17	0.1458**	0.0542***	-0.4916***	-0.0668***
	(0.0697)	(0.0161)	(0.1313)	(0.0172)
Treatment*Period18	0.1738**	0.0780***	-0.5941***	-0.0837***
	(0.0714)	(0.0163)	(0.1329)	(0.0175)
Treatment*Period19	0.1539**	0.0703***	-0.4790***	-0.0650***
	(0.0705)	(0.0164)	(0.1322)	(0.0173)
Observations	25,591	70,061	70,061	70,061

Notes: *$p < .1$, ** $p < .05$, *** $p < .01$. The dependent variable is listed in the header above each column. The data source is the Greek Labor Force Survey. Individuals between the ages of 22 and 27 are included in the sample. All specifications include age and year fixed effects as well as controls, ethnicity, gender, education, contract type and sector. The final two columns restrict the sample to individuals who did not complete college or university. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. Standard errors are bootstrapped with 50 replications in all specifications.

Table A5: Regression Results for Table 5

	(1) Hire	(2) Separation	(3) Transition	(4) Transition
Treatment*Period4	-0.0040	-0.0107	0.0070	0.0003
	(0.0079)	(0.0185)	(0.0090)	(0.0091)
Treatment*Period5	-0.0117	-0.0038	0.0013	0.0014
	(0.0079)	(0.0185)	(0.0083)	(0.0091)
Treatment*Period6	-0.0054	-0.0064	0.0065	0.0074
	(0.0086)	(0.0183)	(0.0089)	(0.0085)
Treatment*Period7	0.0048	-0.0101	0.0094	0.0017
	(0.0096)	(0.0188)	(0.0084)	(0.0083)
Treatment*Period9	0.0023	0.0326*	0.0105	0.0097
	(0.0092)	(0.0195)	(0.0083)	(0.0080)
Treatment*Period10	-0.0022	0.0119	-0.0004	-0.0036
	(0.0083)	(0.0197)	(0.0083)	(0.0080)
Treatment*Period11	0.0023	0.0091	0.0106	0.0054
	(0.0093)	(0.0210)	(0.0087)	(0.0086)
Treatment*Period13	-0.0197***	-0.0196	-0.0023	-0.0076
	(0.0073)	(0.0220)	(0.0080)	(0.0100)
Treatment*Period14	-0.0201***	-0.0201	0.0076	-0.0069
	(0.0073)	(0.0224)	(0.0084)	(0.0094)
Treatment*Period15	-0.0129	-0.0101	0.0074	-0.0042
	(0.0083)	(0.0233)	(0.0092)	(0.0086)
Treatment*Period16	-0.0141*	-0.0276	-0.0101	-0.0235**
	(0.0079)	(0.0240)	(0.0096)	(0.0115)
Treatment*Period17	-0.0126*	0.0006	-0.0057	-0.0163
	(0.0076)	(0.0237)	(0.0097)	(0.0113)
Treatment*Period18	-0.0187***	0.0214	0.0021	-0.0091
	(0.0071)	(0.0242)	(0.0089)	(0.0105)
Treatment*Period19	-0.0156*	0.0203	0.0059	0.0000
	(0.0081)	(0.0241)	(0.0099)	(0.0097)
Observations	51,605	38,119	38,909	23,368

Notes: $*p < .1$, $** p < .05$, $*** p < .01$. The dependent variable is listed in the header above each column. The data source is the Greek Labor Force Survey. Individuals between the ages of 22 and 27 are included in the sample. All specifications include age and year fixed effects as well as controls, ethnicity, gender, education, contract type and sector. The final two columns restrict the sample to individuals who did not complete college or university. Observations are at the quarterly level sampled between Q1, 2009 and Q3, 2013. Standard errors are bootstrapped with 50 replications in all specifications.