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The Impact of Bologna Process in the Portuguese Labour Market

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ABSTRACT

The Bologna Process appears with the aim to build the, so called, European Higher Education Area (EHEA) where it's possible to promote comparable graduate degrees among European countries, employability and mobility of students, graduates and higher education staff, as well as contribute to a lifelong learning of the European citizens. In this sense, the Bologna reform brought a new structural paradigm into the European higher education system and might have generated a different behaviour pattern of the main agents involved (students, national governments and schools).

Several empirical analyses have tested/estimated the impacts of the Bologna reform in the Higher Education system. However, the number of analyses committed to evaluate the effects of the bologna reform on labour markets are still low and regarded with some reluctance, since the reform is recent and data is quite scarce. So that, the main goal of this work is to find evidence of the impact of the Bologna Process in the Portuguese labour market.

Our main findings which followed a difference-in-differences strategy (DD) show a statistical significance of the DD estimator, but only in the female model. Nevertheless, these results must consider, in future analyses, structural variables such as (un)employment rates, in order to refine the model in an aggregated supply/demand equilibrium view.

Resumo

O Processo de Bolonha aparece com o objetivo de criar, o chamado, Espaço Europeu de Ensino Superior (EHEA), onde é possível existirem cursos superiores comparáveis entre os países europeus, empregabilidade e mobilidade de estudantes, graduados e professores, assim como contribuir para uma aprendizagem ao longo da vida dos cidadãos europeus. Neste sentido, a reforma de Bolonha veio trazer um novo paradigma estrutural ao sistema de ensino superior Europeu e pode ter originado um diferente padrão de comportamento dos principais agentes envolvidos (estudantes, governos e escolas).

Várias análises empíricas têm testado/estimado os impactos da reforma de Bolonha no sistema de ensino superior. No entanto, o número de análises dedicadas em avaliar os efeitos da reforma de Bolonha no mercado de trabalho são ainda poucas e encaradas com alguma relutância, uma vez que a reforma é recente e os dados são escassos. Assim, o objetivo principal deste trabalho é encontrar evidência do impacto do Processo de Bolonha no mercado de trabalho Português.

As nossas principais conclusões seguiram uma estratégia de diferenças-em-diferenças (DD) e mostram uma significância estatística do estimador DD, mas apenas no modelo feminino. Contudo, futuras análises deverão considerar variáveis estruturais, como as taxas de (des)emprego, de forma a refinar o modelo numa visão agregada de equilíbrio entre a oferta e a procura.

Contents

1   INTRODUCTION

The Bologna Process appears with the aim to build the, so called, European Higher Education Area (EHEA) where it's possible to promote comparable graduate degrees among European countries, employability and mobility of students, graduates and higher education staff, as well as contribute to a lifelong learning of the European citizens.

The Bologna Process is the culmination of several agreements made, initially, between Education ministers of European Union Countries and afterwards with other European countries. Chronologically, the agreements were the following: Sobornne Declaration (1998), Bologna Declaration (1999) and Ministerial Conferences of Prague (2001), Berlin (2003), Bergen (2005), London (2007), Leuven (2009) and Budapest-Vienna (2010). All these agreements and declarations were sustained by the Lisbon Recognition Convention (1997) which addressed a harmonized Higher Education (hereafter HE) for the states subscribers based in a credit system (European credit transfer and accumulation system, ECTS) and fundamentally structured in 3+2 years of specialization in two distinct cycles.

Several empirical analysis have tested/estimated the impacts of the Bologna reform in the decisions of individuals to enrol into college (Cappelari, L. and Lucifora, C., 2009), others have exploited the conditions in which higher institutions implemented the new Bologna structure in its academic programmes (Veiga and Amaral, 2008; Portela et al., 2009). Others have evaluated the impacts of

Bologna process in college enrollment and drop-out rates (Horstschraer, J. and Sprietsma, M, 2010).

The main goal of this work is to find evidence of the impact of Bologna Process in the Portuguese labour market. It is a first attempt to study the effects in changes in the Portuguese higher education system that necessarily have extended to the labour market, with new job applicants with different characteristics and, consequently with new methodologies adopted by firms to hire employees.

In this work, we use *Quadros de Pessoal* an administrative data set collected by the Ministry of Solidarity and Social Security (MSSS). Our main purpose is to analyse the effects of the Bologna reform on the college wage premium. We explore the reform as quasi-experiment and use a difference-in-differences strategy. We consider a treatment group - graduated and post graduated individuals whose courses were affected by the Bologna reform - and a control group - graduated and post graduated whose courses were not affected by the Bologna reform. We have two periods. A before period, prior to the reform and an after period, corresponding to the years that follow the introduction of the reform.

The Bologna reform brought a new structural paradigm into the European Higher Education System and might have generated a different behaviour pattern of the main agents involved. Concerning the measurement of its effects in the labour market we should consider that this analysis needs to be regarded with some caution, since the reform occurred along with other reforms in the labour market. However, as far as these reforms had a similar impact on treatment and

control individuals they do not threaten our identification. We show that there is a statistical significance of the impact of Bologna process in the Portuguese labour market, but only in the female model. According to these results, female graduates whose courses were affected by the Bologna reform (treatment group) have wages 2,5 % - 3 % higher than those in the the control group.

The struture of the document is as follows. In subsection 2.1, we focus on the legal framework of the Bologna Process in Portugal, in subsection 2.2 we describe the Bologna Process implementation and its characteristics in Portugal, Germany and in Italy. In subsection 3.1, we review the empirical evidence and methodology used to analyse the behaviour of higher education agents after the implementation of the Bologna Process. In subsection 3.2 we discuss the existing empirical evidence of the impact of the Bologna Process in the labour market. In section 4, we present the data used and provide some descriptive analysis. In section 5, we describe the empirical strategy and in section 6 the results. Section 7 presents the concluding remarks.

2   THE BOLOGNA PROCESS IMPLEMENTATION

2.1   *A Tertiary Education Reform in Portugal*

In Portugal the implementation of the Bologna Process is being done through a profound legal reform of tertiary education, called by the Ministry of Science, Technology and Higher Education as the new Framework of Higher Education

Qualifications in Portugal (MSTHE, 2009).

The Basic Law on the Educational System, Law 49/2005 was approved in 2005 by the Portuguese parliament establishing the following goals: "The creation of conditions in which all citizens may have access to a lifelong learning"; "The adoption of a tertiary education organizational model of three cycles" where there is a "transition from an educational system based on knowledge transmission to a system based on skills development" and "the adoption of the European credit system (ECTS), based on the students work." The promulgation of the Decree Law 74/2006 proceed with the modifications introduced by the Law 49/2005 related to the two tier system approved in the Bologna Process. In 2008, the government has improved the Decree Law 74/2006 through the promulgation of the Decree Law 107/2008 which introduced a two year balance of the implementation of the Bologna Process in Portugal. Finally, in 2009, the government has promulgated the Decree Law 230/2009 that amended the previous ones (Decree Law 74/2006 and Decree Law 107/2008) in particular subjects, such as requirements to achieve a PhD. degree and simplification of the individual student process.

2.2   *Bologna Process: A common European two tier system based on competences development, employability and mobility*

The implementation of a two tier system common to some European countries imposed a change from a four or five year academic degree - *Licenciatura* in the

case of Portugal - into a three year cycle of studies. In many countries, as it was the case of Portugal, this implied a huge effort on tertiary education structure reform.

Nevertheless, there were different timings, intensities and, as the literature supports, different goals on implementing this reform among European countries. In Portugal, the decree-law 74/2006 passed by the government in 2006, has promulgated the degree structure of the Bologna Process that, according to Veiga and Amaral (2008), was applied with "a very short time limit" to Universities and Polytechnics to submit their proposals of new study programmes for 2006/2007 and 2007/2008. However, it should be noted that the same Decree Law has established that the adjustment to Bologna would be completed at the end of 2008/2009. Thus, all cycles of studies were organized in 2009/2010 following the new Bologna structure. Moreover, Cardoso, A.R. et al. (2008) observed that institutions were given an option to adopt the new programmes in 2006/2007 or in the two subsequent academic years. According to Veiga and Amaral (2008) this short deadline to submit proposals and an "unexpected flood of proposals by higher education institutions to the Ministry" may evidence an implementation "in form rather than in substance".

Portela et al. (2009) stated that "about 43 per cent of the academic programs have adjusted to Bologna in 2006/2007". Even though, they considered that the possibility of an implementation "in form rather than in substance" may have occurred because of the coexistence of old-type programmes and Bologna-type

programmes and due to "the absence of an Agency of Accreditation" that was created just in the end of 2007. In the same way, the Government assured that in 2007/2008 about 90 per cent of academic degrees offered by Universities and Polytechnics were already adjusted to the new Bologna-type structure (Decree Law 107/2008) which confirms the fast implementation of the reform. Additionally, Veiga and Amaral (2008) have supported the idea that Portuguese Higher education institutions (hereafter HEI) viewed the Bologna Process as a chance to implement in their degree programmes a "pedagogic and curricular reform" given priority to the Law 49/2005's goal: "transition from an educational system based on knowledge transmission to a system based on skills development" over European mobility and employability political main goals of Bologna.

In Germany, for instance, the Bologna reform implementation occurred in 2000/2001 and it was given the opportunity to Universities to decide when they would start the new Bologna-type curricula. According to Horstschraer, J. and Sprietsma, M. (2010), in the academic year 2006/2007, only 53 % of the University departments "had implemented the Bachelor degree for more than 75 % of their first-year students."

The case of Italy is considered the pioneer case of the Bologna Process. The reform was introduced in 2001 with the promulgation of Law 509/1999 that reduced on one or two years the duration of university degrees. Several authors support that the main goal in the Italian reform was to solve critical problems of the Italian HE.

3 Review of the Emprical Evidence of the Bologna Reform Effects

3.1 *Higher Education Agents Changing Behaviour Patterns*

As previously discussed, the Bologna reform had a major impact on the European higher education system (hereafter HES). A large literature has analysed the impact in terms of demand and supply of HE agents, once the reform was adopted and data became available. The scarcity of data, since the reform is still recent, imposed analyses using survey data and based on case studies (for instance, Lopes, M. and Fernandes, G. (2010) study the case of ISEG in Portugal and Bratti, M., Broccolini, C. and Staffolani, S. (2006) the case of Marche Polytechnic University in Italy). Cappelari, L. and Lucifora, C. (2009) illustrate in their research, the weaknesses of this type of approach.

Bratti, M., Broccolini, C. and Staffolani, S. (2006) considered that "the main goals of the university reform were to bring the Italian HEI in line with the European university model and to promote international student mobility" since shorter degree courses "aimed to increase the number of graduates, to lower their average age at graduation and to reduce drop-out rates." Bratti, M., Broccolini, C. and Staffolani, S. (2006) perception's is that a shorter first cycle of studies implies a greater demand of prospective students with different characteristics from the previous ones in the old system, because there was a reduction on the

opportunity cost to get an academic degree and less complexity in the degrees.

The same authors in Bratti, M., Broccolini, C. and Staffolani, S. (2007), build up a theoretical model to identify how changes in "Higher Education standard" affect graduation rates and enrolment decisions of individuals. They conclude that lowering the HE standard helps to achieve, what they called, "a mass tertiary education" since the number of students is pushed up, but not necessarily increases the HES efficiency in terms of drop-out and graduation rates.

Cappelari, L. and Lucifora, C. (2009) consider that the shorter duration of first cycle of studies may imply diminishing costs to access HE and consequently expect "less able students from unfavourable backgrounds to increase their enrolment rates relative to otherwise similar individuals." However, this shorter length of the first cycle of studies and "the lower (perceived) complexity" (as shown by Bratti, M., Broccolini, C. and Staffolani, S. (2006)) may produce lower drop-out rates. In the opposite way, increasing the inflow of less able students may imply an increase in the drop-out rates. They conclude that the probability of secondary education leavers to enrol in the HES is higher after the reform, and this effect is stronger in "marginal students", this is "individuals with good schooling ability but unfavourable family background". Concerning drop-out rates, they find out a small contribution of the reform for those students that don't enter college before the reform. In this sense, Cappelari, L. and Lucifora, C. (2009) consider that the new regime has a quality downgrade of the curricula contents, as well as of the market value of degrees. In this regard, as considered in Cardoso,

A.R. et al. (2008), firms might "value the new first cycle degrees less than old degrees (e.g. because of reduced complexity of studies)".

Cardoso, A.R. et al. (2008) is one of the most cited portuguese paper in what concerns the impact of the Bologna Process in HE programmes. They used administrative data of candidates to HE programmes between 2003/2004 and 2006/2007 (the last one, the year of the Bologna Process implementation in Portugal). Their purpose is to uncover the behaviour of both demand and supply (HEI) when there are programmes restructured according to the Bologna process. Their results show that HEI took the lead on restructuring programmes in the whole HES have encountered an increasing demand of candidates. Furthermore, institutions which have implemented integrated masters without reducing the required number of years to complete an academic degree faced, as well, an increase in demand of such programmes.

The overall impact of Bologna will be the result of two competing effects. On one hand, comparable degrees among and within European Countries could withdraw obstacles to mobility. On the other hand, the new first cycle of Bologna "interpreted as a compressed version" of the old *Licenciatura* could reflect a downgrade on the quality of the degree and, so that, the new graduates employability is also reduced comparing the old *Licenciatura* graduates employability, because employers receive a negative sign in the labour market from the new graduates.

In our approach we will expect that these findings will be reflected in different college wages. For this purpose, we will compare graduate workers whose courses

were affected by the Bologna reform (treatment group) to those that were not (control group). Simultaneously, we'll compare both groups before and after the Bologna reform.

3.2   *Labour Market and Bologna Process: A Signaling issue*

Bosio, G., Leonardi, M. (2011) is one of the first attempts to observe and to understand the impact of the Bologna Process in the Italian Labour Market. They have observed that the reform may produce two different effects in the labour market: the gradual substitution of pre-bologna graduates by Bologna graduates and the increase of the total supply of graduates. There was a positive effect of the reform in the employment probability of male graduates, more or less the same in all Italian regions. Otherwise, on average, there was a weak positive effect of the reform in the employment probability of female graduates, but a negative effect in the South where we can find a remarkably supply excess of graduates.

Notwithstanding, they have considered that will be useful to understand the effect of substitution of the demand of firms and improve the analysis over the reform's effects in wages and in employment rates taking into account the selection process of firms when hiring postgraduate and/or master degree holders and the respective students' decision to obtain such academic degrees. Since, as Bratti, M., Broccolini, C. and Staffolani, S. (2006) have considered, firms in order to

screen job applicants are searching for post graduated candidates, due to a higher number of graduates in the labour market that makes more difficult to select high ability applicants. And, due to the perception of the reduction of the workload in graduation programmes as being a decrease of the amount of basic knowledge and skills needed by Bologna graduates, which brings to the labour market younger, but less skilled graduates. Students, by consequence, feel that their graduation is not suitable to the market as well and, thus, are induced to move into post-graduation programmes in order to signal their competences.

4   DATA DESCRIPTION

4.1   *Data Sources*

We use the *Quadros de Pessoal* data set, an administrative data set collected by the Ministry of Solidarity and Social Security (MSSS). In our analysis, we select the sample of all employees up to 30 years of age, between 2002 and 2009, in order to observe individuals before and after the Bologna reform implementation, which occured in 2006.

Our main purpose at this stage is to analyse the reform effects on the college wage premium. The variables extracted from *Quadros de Pessoal* are the following: worker data - *wage, age, gender, nationality, education, occupation, professional situation* (employer or employee), *type of employment contract, year of admission*; firm data - *distric, economic sector, type of firms, number of work-*

ers, *number of establishments*, *sales* and *equity*.

Education is classified according to the National classification of the fields of education and training (CNAEF), *Occupation* follows the National classification of occupations (CNP) and *Economic sector* follows the Portuguese classification of economic activities (CAE).

4.2   *Descriptive Statistics*

In the Appendix, the Table 1 presents the main descriptive statistics by gender. We will split our analysis by gender, due to the large supply of female graduates and the difference in labour market behaviour of the two groups (male and female graduates).

In our dataset there are 54 % of women and 46 % of men, in total, we analyse 7.579.463 observations between 2002 and 2009. In terms of origin, our dataset shows us that about 95 % of workers have portuguese nationality. In terms of spatial distribution, about a third of workers are concentrated in the district of Lisbon, the remaining are spread over the country.

Given the age range of our analysis, the number of graduated workers is remarkably low (15 %) compared to the number of non graduated workers (85 %). Furthermore, the share of graduated men is higher than the share of graduated women. This is an important feature since the group of interest in our analysis is graduated workers.

The database reflects the global importance of services in terms of employment. About 61 % of workers develop their activity in the services sector.

Related to the type of employment contrat we observe that the majority of workers (aged up to 30) are permanent employees (58 %), however there is a considerable number of temporary employees (42 %). The full time contract is the prevalent type of employment contract (92 %).

5   MODEL SPECIFICATION

In this section we describe the methodology used in the empirical analysis to study the impact on wages of the Bologna reform.

5.1   *What explains worker's wages*

We start with a typical regression model that includes explanatory variables of wages across time and individuals. These variables include worker's observable characteristics, such as age, work experience, location, type of contract, occupation and education. To control for non observable individual abilities (motivation, mental skills, communication skills, family background, etc) we have included an individual-specific intercept, α_n, in our regressions (as suggested by Angrist, J.D and Pischke, J-S. 2009). The estimated regression function is as folows:

$$y_{n,t} = \alpha_n + \lambda_t + X'_{n,t}\beta_k + \epsilon_{n,t} \tag{1}$$

where $y_{n,t}$ is the logarithm of wages, α_n is the individual specific intercept

that controls the non observable characteristics of individuals and abilities that do not change over time, but varies over individuals. λ_t captures year fixed effects and $X'_{n,t}$ is a 1 x p vector of worker observable variables that change over time and individual. β is the 1 x k vector of coefficients on X. $\epsilon_{n,t}$ is the disturbance term.

$X'_{n,t}$ includes the following variables: *Age, Age2, T.contract, Contract, Education, Occupation, Economic Sector, Pernortrab* and *District.* In the appendix, we describe for each variable the corresponding categories and the categories of reference used (table 5).

Since the *Quadros de Pessoal* database is a longitudinal database in an unbalanced panel (annual data on several worker-firm pairs), we can choose to introduce individual effects as fixed-effects or random effects. The basic difference between these models is considering the individual-level effect as correlated to regressors (fixed-effect model) or uncorrelated to regressors (random-effect model). To find the better suited model to our regressions we run the Hausman Test in which the null hypothesis is considering the absence of correlation between effects and regressors and the residual term following the random-effect model (Hausman, J.A. 1978). The Hausman test verifies if the difference $(\hat{\beta}_{FE} - \hat{\beta}_{RE})$ is statiscally significant (Baum, C. F. 2006).

Table 2, in the appendix, provides the results for estimation (1) relative to a semi-elasticity model. The results are addressed to the full sample and by gender. All estimations are fixed-effects (within) models, since the null hypothesis of the

Hausman test is rejected.

The regression (1) will allow us to observe how wages vary across individuals when employees' characteristics change. Our results are in line with labour economics literature. For example, older (aged up to 30) and more qualified workers earn more than younger and less qualified ones. Also, individuals with a full-time job have higher wages than individuals with a part-time job.

In table 2, the highest coefficient (not considering the constant variable) is the one related to full time contracts. A full time job contributes, on average, in 34,1 % to a larger base monthly wage comparing to a part-time job, *ceteris paribus*. In all regressions *Education.2* (primary school) and *Education.5* (post secondary school) are variables that, on average, do not affect wages, since they are not significant in a five percent of level of significance.

Taking into consideration graduated and post-graduated individuals which are our group of interest for the analysis of the Bologna process impact in the labour market, we observe that, on average, college dregree holders earn more about 7 % than no years of schooling individuals, *ceteris paribus*.

Even with a rather homogeneous sample in terms of age, we are able to identify important differences related to the labour market characteristics that influence wages.

5.2   *Difference - in - Difference Estimator*

As we have stated in chapters 2 and 3, the bologna reform imposed an one year reduction in the old *Licenciatura*, changing the HES paradigm to a two tier system of academic degrees. Nevertheless, simultaneously, the Bologna reform considered exceptions for specific courses related to jobs that internationally require longer years of training. In these cases, the required years to obtain an academic degree did not change with the introduction of the Bologna Process in the Portuguese HES. These courses are the following: medicine, nursing, veterinary medicine, dentistry, pharmacy, architecture and engineering. So that, we'll now consider a treatment group - graduated and post graduated individuals whose courses were affected by the Bologna reform - and a control group - graduated and post graduated whose courses were not affected by the Bologna reform. For this purpose we have generated a dummy variable *Treat* which is 1, if treatment group and 0, if control group.

Therefore, new graduates were arriving in the labour market with different characteristics and in a first stage they were side by side with "old" graduates. Consequently, one of the Bologna reform effects in the labour market is the co-existence of job graduate applicants with distinct characteristics regarding the Bologna reform.

However, we can't assure the exact moment of graduation, which courses were adjusted after the decree law 74/2006 and in which Universities workers have

completed their academic degrees, because our database doesn't provide such information. So that, in the next estimations, we'll drop the 2006 observations, considered the year in which "old" graduates and "Bologna" graduates coexist in the portuguese HES, in order to avoid biased estimators.

Additionally, we must notice that during the time range selected (2002-2009) several legal labour reforms were introduced what could affect workers' wages. However, these may have had a similar impact on the treatment and control groups.

In order to evaluate the Bologna reform we need to capture the two dimensions (individuals and time) before and after the reform. Thus, in this section we'll use the difference-in-difference estimator (DD) commonly used in the literature. As Angrist, J.D and Pischke, J.-S. (2009) suggests, DD is a strategy that "use data with a time or cohort dimension to control for unobserved but fixed omitted variables", thus, in this sense, "DD is a version of fixed-effects estimation using aggregate data".

Gruber. J (1994) applied a difference-in-difference-in-difference (DDD) strategy that derives from the difference-in-difference estimator (DD) strategy to evaluate the effect of the maternity mandates on wages conducted in some states of the U.S in the end of 80's. Gruber. J (1994) has identified the states (experimental states) where the law was approved and the group of individuals affected (treatment group) in order to control the existence of systematic shocks in the labour market of those affected by the law that "are correlated with, but not due

to, the law". Our approach follows the same reasoning to identify the group of courses affected by the Bologna reform (treatment group).

We present two different DD estimations. In table 3 (appendix) we have included just dummy variables generated to control the Bologna reform effects on wages. In the table 4, we have added the variables from regression (1) - except *Education* - and the variable of interest, that measures the impact of the Bologna process in the Portuguese labour market, that is, the iteration between *Treat* and *After* variables.

The table 3 represents the output of the following regression function:

$$Lnwage_{n,t} = \alpha + Treat_n\beta_1 + After_t\beta_2$$
$$+(Treat * After)\beta_3 + \epsilon_{n,t}$$

(2)

While in the case of the table 4 we have the following regression function:

$$Lnwage_{n,t} = \alpha + Age_{n,t}\gamma_1 + Age2_{n,t}\gamma_2 + T.contract_{n,t}\gamma_3 + Contract_{n,t}\gamma_4$$
$$+\sum_{i=1}^{9} Occupation_{n,t}\gamma_5 + \sum_{i=1}^{3} Economicsector_{n,t}\gamma_6 + Pernortrab_{n,t}\gamma_7$$
$$+District_n\delta_1 + Treat_n\beta_1 + After_t\beta_2$$
$$+(Treat * After)\beta_3 + \epsilon_{n,t}$$

(3)

where n indexes individuals and t indexes years.

6   Results

Table 3 and 4 show us the results of the DD estimations. As we have addressed in the previous section, the variable of interest is the iteration between *Treat*

and *After*, because it captures the way wages vary among treatment group in comparison to control group, in years after the Bologna reform opposite to years before the reform. Hereafter we'll name this iteration as DD estimator and is given by (β_3).

In table 3, the DD estimator (β_3) have a postive coefficient in all estimates. So that, for the case of female graduates, the DD estimator suggests that after the Bologna reform implementation, treatment group wages are 3% higher than control group wages, *ceteris paribus*. In its turn, the full model shows an impact of the Bologna reform in wages that is statistically significant and positive (about 0,5%). However, in the male model, the DD estimator is not statistically significant in a five percent of level of significance (but at 10% it is).

In table 4, the behaviour of employee's characteristics is quite similar to the results of table 2, except the *District* variable that is not significant in table 4. The coefficients of table 4 related to treatment and control groups are considerable lower than coefficients in table 3.

In table 4, the DD estimator (β_3) is not statistically significant, in the full and male models. In the case of the female model, the results between table 3 and 4 are similar: after the Bologna reform implementation, treatment group wages are 2,5% higher than the control group wages, *ceteris paribus*.

7   CONCLUSION

The Bologna reform brought a new structural paradigm into the European HES that might had an impact on the behaviour of the main agents involved (students, national governments and schools). This change in the demand and supply of schooling may translate into the labour market given the importance of education on wages and employment. On one hand, the empirical evidence shows that the European HES benefited from the implementation of the Bologna process, since it was a notable improvement in the comparability of degrees among Bologna process member countries (Cardoso, A.R et al 2008) and has raised the chances to students enrol in tertiary education (Cappelari, L. and Lucifora, C. (2009). On other hand, it was also found that the quality of some academic degrees was pushed down, because of the less complexity required in some academic courses in a two-tier system approach (Bratti, M. Broccolini, C. and Staffolani, S. 2006).

The measurement of the Bologna reform effects in the labour market is quite scarce. Such reform, takes a long time to produce effects on the labour market, since we have to take into account the years of study of individuals before entering the labour market.

In our approach, we have considered 2007 as the first year of entry of new Bologna graduates (the legal date of the implementation of Bologna was 2006). The available information show that 90% of the old courses were adjusted to the new Bologna requirements in the academic year of 2007/2008. In fact, this

adjustment had necessarily imposed the coexistence of "old" and "Bologna" graduates in the labour market. Consequently, the complexity on hiring newcomers increased, due to the implicit difficulty to extract the correct sign from the new graduated job applicants.

In this sense, our results must be interpreted carefully. Nevertheless, they appear in line with empirical evidence of education and labour economics research. For instance, we find that: (i) the individuals who are permanent employees earn higher wages than temporary ones; (ii) individuals who have a full time job earn higher wages than individuals employed in part-time jobs; (iii) the returns of school investment are greater for graduates; (iv) individuals who have more experience and job positions related to administration, management and specialized tasks earn higher wages than less qualified and less experienced workers (in this estimation we do not observe significant decrease marginal returns, because we only consider individuals aged up to 30). The DD strategy finds consistent and statistical significance of the DD estimator only in the female model. According to these results, female graduates whose courses were affected by the Bologna reform (treatment group) have their wages 2,5 % - 3 % higher than wages in the control group. The full and male models do not show any impact on college wages. Nevertheless, these interpretations must consider the limitations of the DD strategy, as Bertrand, M., Duflo, E. And Mullainathan, S. (2004) suggests.

Summing up, our findings should be read as a first proposal to evaluate the impact of the Bologna reform in the labour market. In our view, future anal-

ysis should overcome the limitations of this work, first, in terms of database, as *Quadros de Pessoal* doesn't provide the information in which university or polytechnic the worker has graduated. This improvement will make possible to add further robustness to the results. It is important to know when courses were converted to the new Bologna structure, and, so, refine our analysis case by case, introducing different timings among courses and colleges. Secondly, it will be extremely useful to introduce a variable to control when individuals are precisely hired for the first time after finishing their academic degrees. Finally, the introduction of regional (un)employment rates will allow us to understand the trend of wages across regions and individuals in an aggregated supply/demand equilibrium view.

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9   APPENDIX

Table 1: Descriptive Statistics by gender

Variables	Categories	Female	Male	Total
		Percent	Percent	Percent
Nationality	Foreign	0,06	0,04	0,05
	Portuguese	0,94	0,96	0,95
District	Other Regions	0,68	0,66	0,67
	Lisbon	0,32	0,34	0,33
Education	NonGraduated	0,89	0,81	0,85
	Graduated	0,11	0,19	0,15
Economic	Ag., Fish., Ind.	0,35	0,26	0,31
Sector	Services	0,61	0,60	0,61
	Public	0,04	0,14	0,09
T.Contract	Temp.Emp.	0,42	0,41	0,42
	Perm.Emp.	0,58	0,59	0,58
Contract	Part time	0,07	0,09	0,08
	Full time	0,93	0,91	0,92
N.obs		4.096.892	3.482.571	7.579.463

Notes: *Quadros de Pessoal* data 2002-2009. Panel tabulation for Labour Input variables.

Table 2: Log wages and Employee Input Results by Gender

Dependent variable: Log wage

Indp. var.	Full		Female		Male	
	coef.	p-value	coef.	p-value	coef.	p-value
Age	0,0868	0,000	0,075	0,000	0,096	0,000
Age2	-0,001	0,000	-0,001	0,000	-0,001	0,000
District	-0,011	0,000	-0,003	0,336	-0,016	0,000
T.contract	0,020	0,000	0,023	0,000	0,018	0,000
Contract	0,341	0,000	0,327	0,000	0,363	0,000
Education.2	-0,004	0,145	-0,002	0,703	-0,005	0,098
Education.3	-0,008	0,001	-0,009	0,085	-0,010	0,003
Education.4	-0,011	0,000	-0,013	0,012	-0,012	0,000
Education.5	-0,003	0,213	-0,006	0,251	-0,002	0,53
Education.6	0,072	0,000	0,070	0,000	0,076	0,000
Education.7	0,018	0,000	0,025	0,000	0,007	0,083
Occupation.2	-0,059	0,000	-0,052	0,000	-0,062	0,000
Occupation.3	-0,084	0,000	-0,069	0,000	-0,096	0,000
Occupation.4	-0,128	0,000	-0,113	0,000	-0,143	0,000
Occupation.5	-0,143	0,000	-0,130	0,000	-0,154	0,000
Occupation.6	-0,135	0,000	-0,116	0,000	-0,148	0,000
Occupation.7	-0,124	0,000	-0,121	0,000	-0,132	0,000
Occupation.8	-0,123	0,000	-0,122	0,000	-0,131	0,000
Occupation.9	-0,154	0,000	-0,134	0,000	-0,168	0,000
Sector.2	-0,013	0,000	-0,018	0,000	-0,007	0,000
Sector.3	-0,017	0,000	-0,020	0,000	-0,014	0,000
Pernortrab	0,003	0,000	0,004	0,000	0,002	0,000
Constant	4,198	0,000	4,253	0,000	0,405	0,000
Hausman	Fixed Effects	-	Fixed Effects	-	Fixed Effects	-
N.obs	7.018.201	-	3.232.531	-	3.785.670	-
R.sq: Within	0,161	-	0,154	-	0,168	-
R.sq: between	0,246	-	0,287	-	0,212	-
R.sq: overall	0,260	-	0,282	-	0,238	-

Notes: All Regressions are computed as fixed-effects (within) regressions. Time sample 2002-2009.

Table 3: DD Estimates of the Impact of Bolgona Process on Log Wages

Indp. var.	Full		Female		Male	
	coef.	p-value	coef.	p-value	coef.	p-value
Treat	-0,241	0,000	-0,025	0,000	-0,032	0,000
After	0,235	0,000	0,197	0,000	0,260	0,000
Treat*After	0,005	0,002	0,032	0,000	0,042	0,077
Constant	6,654	0,000	6,603	0,000	6,734	0,000
Hausman	Fixed Effects	-	Fixed Effects	-	Fixed Effects	-
N.obs	1.049.017	-	613.379	-	435.638	-
R.sq: Within	0,156	-	0,137	-	0,187	-
R.sq: between	0,036	-	0,030	-	0,047	-
R.sq: overall	0,039	-	0,032	-	0,045	-

Notes: All Regressions are computed as fixed-effects (within) regressions. Time sample 2002-2009.

Table 4: DD Estimates of the Impact of Bolgona Process on Log Wages and Employee

Input

Dependent variable: Log wage

	Full		Female		Male	
Indp. var.	**coef.**	**p-value**	**coef.**	**p-value**	**coef.**	**p-value**
Treat	-0,009	0,000	-0,014	0,000	-0,013	0,000
After	0,016	0,000	-0,007	0,012	0,025	0,000
*Treat*After*	-0,002	0,283	0,025	0,000	0,003	0,134
Age	0,157	0,000	0,143	0,000	0,188	0,000
Age2	-0,002	0,000	-0,002	0,000	-0,002	0,000
District	-0,003	0,522	0,008	0,200	-0,013	0,027
T. Contract	0,023	0,000	0,020	0,000	0,027	0,000
Contract	0,289	0,000	0,279	0,000	0,310	0,000
Occupation.2	-0,059	0,000	-0,054	0,000	-0,062	0,000
Occupation.3	-0,083	0,000	-0,072	0,000	-0,090	0,000
Occupation.4	-0,128	0,000	-0,118	0,000	-0,137	0,000
Occupation.5	-0,135	0,000	-0,129	0,000	-0,139	0,000
Occupation.6	-0,079	0,000	-0,059	0,038	-0,093	0,000
Occupation.7	-0,098	0,000	-0,099	0,000	-0,098	0,000
Occupation.8	-0,104	0,000	-0,092	0,000	-0,109	0,000
Occupation.9	-0,171	0,000	-0,172	0,000	-0,166	0,000
Sector.2	-0,032	0,000	-0,026	0,000	-0,026	0,000
Sector.3	-0,049	0,000	-0,041	0,000	-0,046	0,000
Pernortrab	0,004	0,000	0,003	0,000	0,004	0,000
Constant	3,407	0,000	3,612	0,000	2,933	0,000
Hausman	Fixed Effects	-	Fixed Effects	-	Fixed Effects	-
N.obs	1.044.693	-	611.170	-	433.523	-
R.sq: Within	0,246	-	0,218	-	0,295	-
R.sq: between	0,274	-	0,255	-	0,287	-
R.sq: overall	0,275	-	0,257	-	0,289	-

Notes: All Regressions are computed as fixed-effects (within) regressions.Time sample 2002-2009.

Table 5: List of variables' description estimates

variables	Description
Age	age of the employees
Age2	squared age of the employees
Nationality	dummy variable 1 if Portuguese, 0 if Foreign
District	dummy variable 1 if Lisbon, 0 if Other regions
T.contract	dummy variable 1 if permanent employee, 0 if temporary employee
Contract	dummy variable 1 if full time contract, 0 if part time contract
Education	1. no years of school (reference category)
	2. primary school
	3. high school
	4. secondary school
	5. post secondary school
	6. Bachelor and Graduate degree
	7. Master and Phd. degree
Occupation	1. senior public administration (reference category)
	2. specialist intellectual profession
	3. technicians and associate professionals
	4. administrative staff and similar
	5. personal services and sellers
	6. farmers and skilled workers
	7. laborers, craftsmen and related workers
	8. machine operators
	9. non qualified workers
Economic sector	1. Agriculture, Fishing and Industry, 2. Services, 3. Public Administration
Pernortrab	normal working hours
Graduate	dummy variable 1 if employee with graduate degree, 0 if otherwise
After	dummy variable 1 if after DL 74/2006, 0 otherwise
Treat	dummy variable 1 if treatment group, 0 if control group