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Asymmetric labour market reforms and wage growth with fixed-term contracts: does learning about match quality matter?

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Asymmetric labour market reforms and wage growth with fixed-term contracts: does learning about match quality matter?[1]

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Empirical evidence suggests that fixed-term contracts tend to bear the adjustment cost of asymmetric reforms that increase the employment protection gap between fixed-term and open-ended contracts. However, previous studies did not take into account that fixed-term contracts can play different roles in the labour market and therefore the effect of this type of reform is heterogeneous. We estimate an endogenous regime switching model using rich administrative linked employer-employee data to study the impact of a change in Portuguese employment protection legislation that eased regulations on fixed-term contracts. Our results suggest that the implementation of this reform has a negative impact on match quality, proxied by the probability of conversion of fixed-term contracts. However, the conversion of the contract is associated with a significant increase in wage growth and not all fixed-term contracts are evenly affected by this type of reform. Everything else remaining constant, the wage growth of good matches, i.e. converted fixed-term contracts, was less penalised (-0.16 pp.) than that of non-converted fixed-term contracts (-0.55 pp.) in the years in which the changed legislation was in force. The change in legislation contributed to increase the wage growth differential between both groups in approximately 15%.

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1. INTRODUCTION

The productivity of a worker in a given firm depends on the quality of their match, which is learned over time by both parties (Jovanovic (1979)). The cost and the facility with which unproductive matches are terminated depend on the strictness of some labour market institutions, such as the employment protection legislation.

In recent years, employment protection legislation was reformed in some European countries in order to introduce some flexibility in the labour market mainly at the margin by relaxing the restrictions on the use of fixed-term contracts instead of reducing the protection of open-ended contracts (Kahn (2010), Boeri (2011)). Prior evidence indicates that fixed-term contracts tend to bear the adjustment cost of legislation that widens the employment protection gap between open-ended and fixed-term contracts due to employment and wage levels. Namely, fixed-term contracts become less likely to be converted into permanent (Boeri (2011), Centeno & Novo (2012)) and these workers may suffer a wage penalty resulting either from reforms that increase the protection of open-ended contracts (Centeno & Novo (2014)) or reforms that reduce the restrictions on the use of fixed-term contracts (Pérez *et al.* (2014)).

Notwithstanding, previous contributions have neglected the fact that fixed-term contracts can play different roles in the labour market and, therefore, asymmetric employment protection reforms may have a heterogeneous impact. Following Jovanovic (1979), who classifies a worker-firm match as an "experience good", fixed-term contracts may play a crucial role by allowing firms to experiment different matches before offering a permanent contract. Thus, if fixed-term contracts are used to extend the probationary period, their conversion into permanent contracts and the subsequent wage growth should reflect the performance of the match (Wang & Weiss (1998) and Loh (1994)). Good matches, i.e., matches that go from a fixed-term contract to an open-ended contract should be compensated through higher wage growth. They should also suffer less from the adverse impacts of reforms that widen the employment protection gap between fixed-term and open-ended contracts.

This article aims to provide further evidence of the impact of these institutional reforms by studying how they affect wage growth experienced by workers on fixed-term contracts given the learning process about match quality such contracts permit. To the best of our knowledge, this is the first empirical study on the sources of the wage growth differential between non-converted and converted fixed-term contracts and how it is affected by employment protection reforms that facilitate the use of fixed-term contracts. We focus on the change in the Portuguese employment protection legislation in 2004 that was subsequently overturned in 2009. This reform contributed to widening the protection gap between fixed-term and open-ended contracts by easing the restrictions on fixed-term contracts. More specifically, it introduced a third possible renewal of

fixed-term contracts up to a maximum legal duration of 6 years and extended the conditions in which a fixed-term worker could be hired.

In order to test the abovementioned hypotheses, we use exceptionally rich Portuguese linked employer-employee data for the period 2003 to 2009 and estimate an endogenous switching regression model, similarly to Loh (1994) and Amuedo-Dorantes & Serrano-Padial (2007). This has the advantage of taking into account the possible selection bias arising from the fact that both the conversion and the wage growth of fixed-term contracts are simultaneously determined and affected by the learning process. Firstly, we test the significance and estimate the impact of the change in legislation on a proxy of match quality: the probability of conversion of fixed-term contracts into open-ended contracts. Secondly, we assess whether the change in legislation has a different impact on wage growth experienced by good matches, i.e., converted fixed-term contracts and non-converted fixed-term contracts. Thirdly, we study the sources of the wage growth differential between those two groups using a threefold decomposition and evaluate how it is affected by the change in legislation.

Our results show that there is a statistically significant increase in the wage growth associated with the conversion of a fixed-term contract into a more stable employment relationship. Although the results suggest that match quality is negatively affected by employment protection reforms that ease the regulations on fixed-term contracts, the wage growth of good matches is less penalised by the change in legislation (-0.16 pp.) than that of non-converted fixed-term contracts (-0.55 pp.). We estimate that the implementation of this type of reform contributes to increase the wage growth differential between workers who remain on a temporary contract and those who receive an open-ended contract (15%). We argue that policy makers should tackle labour market segmentation given that asymmetric employment protection reforms that facilitate the use of fixed-term contracts may generate potential inefficiencies, such as the postponement of the conversion of the contract and the weakening of the link between this conversion and wage growth.

The next section characterises the Portuguese employment protection legislation and describes the change under analysis. Section 3 reviews some of the most relevant literature on the role of fixed-term contracts and briefly discusses the measurement of match quality. Section 4 presents the empirical approach and the dataset and Section 5 presents the main results obtained. Section 6 concludes.

2. THE PORTUGUESE EMPLOYMENT PROTECTION LEGISLATION

The Portuguese labour market is characterised by stringent employment protection legislation on regular contracts and by one of the largest employment protection gaps between temporary and open-ended contracts.

Fixed-term contracts were regulated in 1976 in the Portuguese labour market and their maximum legal duration was set at three years. In 1989 the situations in which a worker could be hired under a fixed-term contract were clearly defined and it was established that fixed-term

contracts could only be renewed twice before reaching their maximum duration. This law also entitled the worker to receive a severance payment equal to two days for each month of work when the fixed-term contract ends without conversion in a permanent contract[3].

Between 2003 and 2009, Portugal was the OECD country that most relaxed employment protection legislation (Venn (2009)). During this period, the main reform aimed to promote a more flexible labour market by easing the regulations on temporary contracts; meanwhile, the legislation on open-ended contracts was subject to little change. We examine the effect of the change to the legislation between 2004 and 2008 whereby the maximum duration and the situations in which fixed-term contracts could be used were extended. More specifically, the law introduced three changes: the possibility to renew the contract up to three times instead of just twice before reaching the maximum legal duration; the extension of the contract's maximum legal duration from three to six years; and the possibility to hire a worker on a fixed-term contract to satisfy temporary requirements at the firm level and notably to indirectly substitute an employee. The 2004 legislation also made it mandatory for firms to provide training for workers on fixed-term contracts of more than six months so as to bring their working conditions more in line with those on open-ended contracts. In 2009, the maximum legal duration of fixed-term contracts was restored to three years.

According to Eurostat, the proportion of temporary contracts in the total employment more than doubled between 1995 and 2009, reaching 22% in 2009. Given the growing representativeness of temporary contracts and the recurrent use of such changes in legislation on the Portuguese labour market, the impact of asymmetric employment protection reforms and, especially, how they affect workers on fixed-term contracts are major and current policy concerns.

3. LEARNING ABOUT MATCH QUALITY IN TWO-TIER SYSTEMS

3.1. The Role of Fixed-term Contracts in Two-tier Systems

There is no consensus in the literature on the role of fixed-term contracts in the labour market. According to the segmented labour market theory, the labour market is composed of two segments characterised by distinct wage-setting behaviours and different non-pecuniary conditions. The primary segment offers higher wages, better working conditions and career progress and as Dickens & Lang (1985) highlight, tends to offer positive returns to schooling and experience, while the wage equation associated with the secondary segment is flat. Most fixed-term contracts are found in this secondary segment and suffer a non-negligible wage penalty relatively to open-ended contracts (Blanchard & Landier (2002) for France, Pfeifer (2012) and Hagen (2002) for Germany, Jimeno & Toharia (1993) for Spain, Mertens *et al.* (2007) for Germany and Spain, Pavlopoulos (2013) for Germany and UK and Brown & Sessions (2005)

[3] In 2004, the severance payment was equal to three days for each month of work for contracts with less than 6 months of duration and to two days for each month of work for contracts with more than six months of duration; this is not very different from the requirements in open-ended contracts i.e. 30 days per year of seniority. Nevertheless, for open-ended contracts, the administrative costs associated with a dismissal are significantly higher as discussed by Centeno & Novo (2014).

for Great Britain, Germany, France, Sweden and Portugal). Similarly, using a French database of young workers, Blanchard & Landier (2002) warn that fixed-term contracts lead to high turnover rates even when good matches are formed as firms want to avoid the high firing costs associated with permanent contracts. Hence, workers on fixed-term contracts face a greater risk of becoming unemployed (McGinnity & Mertens (2002)) and being trapped in a chain of temporary contracts, as reported by Hagen (2002) for Germany and Gash & McGinnity (2007) for French female workers. Specifically, it is more difficult for women, youngsters and males with lower levels of education to escape from successive temporary jobs, since they are less likely to be promoted to permanent contracts (Alba-Ramírez (1998)). Fixed-term workers are therefore less likely to participate in training activities (Booth *et al.* (2002), Arulampalam *et al.* (2004)).

As Bentolila & Saint-Paul (1992) predict, the introduction of temporary contracts may also make employment respond more to macroeconomic shocks. In other words, temporary workers can be used as a buffer stock that allows firms to respond to shocks more easily and at a lower cost by adjusting the employment level, especially downwards (Varejão & Portugal (2007)). This evidence is also supported by Boockmann & Hagen (2001) who argue that the probability of hiring on fixed-term contracts increases with positive fluctuations in product demand, measured by firm turnover, and with the level of employment protection of open-ended contracts.

Another strand of the literature explaining the role of fixed-term contracts rests on the screening hypothesis. Due to the existence of imperfect information, worker-firm matches are 'experience goods'(Jovanovic (1979)) and fixed-term contracts may be used to assess the quality of the match before offering a permanent contract. Hence, fixed-term contracts may play a very important role by extending the probationary period and allowing firms to screen workers at a lower cost. This is documented by the high probability of fixed-term contracts to be converted into open-ended contracts reported for some countries, e.g. in France, one third of short-term contracts are converted at their maximum legal duration (Abowd *et al.* (1999)), and in West Germany, nearly 40% of temporary contracts are converted within one year and most of them with the same employer (McGinnity & Mertens (2002)).

The use of fixed-term contracts as screening devices helps explain the heterogeneity of the pecuniary penalty associated with this type of contract and the catch-up with their permanent counterparts both in terms of wages and job stability as reported in the literature. Boockmann & Hagen (2008) find that the survival rate of German fixed-term contracts converges with that of open-ended contracts, although a match initiated with a fixed-term contract terminates more often in the two first years. Some authors using German data also argue that while the highest share of fixed-term contracts is found in the lower quartile of the wage distribution (Mertens & McGinnity (2003)[4]), the wage penalty of fixed-term contracts decreases as we move into higher quantiles (Mertens & McGinnity (2003), Pfeifer (2012), Mertens *et al.* (2007)) and it is larger for matches lasting up to two years (Pfeifer (2012)); this supports the idea that there is a group of fixed-term contracts that faces a less severe pecuniary penalty. In line with Loh (1994) and

[4]Note that the results in Mertens & McGinnity (2003) refer to West Germany only.

Wang & Weiss (1998), if fixed-term contracts are used as screening devices, their wage may converge to the level of permanent contracts when converted and, therefore, they will experience higher wage growth (Sicilian (1995)). Accordingly, some authors such as McGinnity & Mertens (2002), for Germany, and Ruiz & Gomez (2009) and Amuedo-Dorantes & Serrano-Padial (2007), for Spain, find evidence that workers with fixed-term contracts experience higher wage growth than workers with open-ended contracts, especially those lasting more than one year and staying in the same job (Amuedo-Dorantes & Serrano-Padial (2007)) and those receiving an open-ended contract (Ruiz & Gomez (2009)). This steeper wage growth path is generally more marked in the case of female workers, whose wage penalty seems to be fully reversed due to the learning effect, measured by the accumulation of experience (Pavlopoulos (2013)), whereas males seem to suffer a more persistent wage penalty (Pavlopoulos (2013), Booth *et al.* (2002)). For example, Gash & McGinnity (2007) use a matching methodology to support this conclusion by showing that, unlike men, women on fixed-term contracts in West Germany experience higher wage growth than those on permanent contracts in the two years after being hired. Finally, Mertens & McGinnity (2003) argue that although only fixed-term contracts in the highest wage growth quartiles have a wage growth premium relatively to their permanent counterparts; fixed-term contracts in the lowest quartiles of the wage distribution are more likely to experience high wage growth.

As for the Portuguese labour market, there is some evidence indicating that fixed-term contracts are used as screening devices. Varejão & Portugal (2007) argue that even establishments with a stable employment level tend to hire more, rather than separate more from workers on temporary contracts, which means that some matches are continued and converted to permanent contracts. Similarly, Portugal & Varejão (2005) contend that a significant proportion of fixed-term contracts are converted into open-ended contracts, although workers on fixed-term contracts are more likely to switch jobs and become unemployed or inactive. In fact, the probability of conversion is low when the match is formed but tends to increase during the two first years of contract (Portugal & Varejão (2009)). The screening hypothesis is also supported by the fact that workers in longer employment relationships are less likely to move to another job (Portugal & Varejão (2005)).

Although fixed-term contracts can play different roles in the labour market, they tend to bear the adjustment cost of reforms that widen the employment protection gap between fixed-term and open-ended contracts. Using a difference-in-differences analysis, Centeno & Novo (2012) find that the extension of the employment protection of open-ended contracts to firms with 11 to 20 employees has not only increased the proportion of workers on fixed-term contracts but also their churning at firm level. Consequently, these workers also received lower wages, as reported in Centeno & Novo (2014). Thus, in a segmented labour market like that of Portugal, fixed-term contracts may be used as a source of both wage and employment flexibility (Centeno & Novo (2012) and Centeno & Novo (2014)).

This paper focus on the impact of legislation reforms that facilitate the use of fixed-term contracts taking into account that this type of contract may be used to learn about match

quality, which measurement is briefly discussed in Subsection 3.2.

3.2. The Measurement of Match Quality

There is robust evidence of a non-negligible impact of match quality on wages (Hersch & Reagan (1990)) and wage growth (Yamaguchi (2010)).

However, match quality contains various dimensions and can therefore be measured by several proxies. The job-search literature predicts that, after a match is formed, better alternative matches might appear which offer a higher wage than the worker's reservation wage. Therefore, the starting wage is a good proxy to measure match quality, and turnover is the mechanism used to form more efficient matches. Accordingly, some authors such as Gaure *et al.* (2012), Centeno & Novo (2006) and van Ours & Vodopivec (2008) use the starting wage as an *a priori* measure of match quality to study the impact of unemployment benefits on match quality.

Other authors classify a match as an "experience good", whose true value is only known *a posteriori* after experimentation (Jovanovic (1979)). Jovanovic's job matching hypothesis predicts that higher value matches endure and achieve higher wages while bad matches are terminated. According to this perspective, match quality can be measured by the duration of the employment relationship and by the wage growth. More specifically, tenure is used as a proxy of match quality by Centeno (2004) and Centeno & Novo (2006) to study the effects of unemployment insurance on match quality, by Allgood *et al.* (2012) to disentangle the impact of the expected match quality on the CEO's initial compensation and by Yankow (2009) to study the impact of match quality on job search behaviour in urban areas.

Finally, a few authors, e.g. Ferreira & Taylor (2011), rely on subjective indicators of match quality based for example on worker's satisfaction and the will to switch jobs.

Given that the goal of the present analysis is to assess the impact of a change in the maximum legal duration of fixed-term contracts while taking the learning process about match quality into account, we classify a match as an "experience good" whose quality is measured *ex post*. However, tenure is not a suitable measure for our purposes since it would reflect not only the learning about match quality but also the direct impact of the reform on its upper bound. Therefore, we take the conversion of fixed-term contracts to permanent contracts and the subsequent wage growth as measures of match quality that reflect and incorporate the learning process.

In the next section, we present the econometric methodology that we find most suitable to assess the impact of the change in legislation taking into account the learning process about match quality.

4. EMPIRICAL APPROACH

According to Jovanovic (1979), a match needs to be experienced in order to evaluate its quality, which is a trial and error process. Therefore, fixed-term contracts could be an important

tool to test different matches, learn about their quality and terminate the bad ones easily and at a lower cost.

Workers are matched with firms and they are given fixed-term contracts. The quality of the match is unobserved before the match is experienced:

$$Z^*_{mt} = w^{'}_{mt}\omega + \Pi^{'}_{t}\tau + D'_t\delta + \varepsilon_{mt}, \quad \text{m=1,..., M and t=1,...,T.} \tag{1}$$

It is assumed that Z^*_{mt} is a latent continuous random variable representing the match quality of a certain worker-firm pair m at period t. The total number of matches equals M and the total number of time periods equals T. As stated in equation 1, the value associated with a certain match m depends on a set of exogenous variables, w_{mt}, including the worker's characteristics (age and its square, tenure, gender, nationality, education, occupation) and firm's characteristics (dimension, region, sector of activity, share of fixed-term contracts[5] and capital ownership). Π_t includes a set of year dummies to control for time effects and the annual unemployment rate to control for the business cycle. Since one of the purposes of the analysis is to evaluate how the change in legislation impacts on match quality, a variable D_t is also included, which is a regime dummy taking value zero in 2003 and 2009 and one in the remaining years of the sample in which the law was in force. The impact of the referred change in legislation is captured by δ.

Firms can hire a worker using a fixed-term contract up to a certain maximum legal duration, when the contract is automatically converted to permanent if the match is continued. Over time, both parties (worker and firm) learn about the value associated with the match and only good matches, i.e., matches yielding a positive value, are converted to permanent contracts since this type of contract is associated with higher labour turnover costs:

$$P_{mt} = I\left[Z^*_{mt} > 0\right]. \tag{2}$$

Thus, P_{mt} is a dummy variable taking value one when the match initiated with a fixed-term contract is converted into permanent between t-1 and t and zero when the match is continued but is not converted[6], which expresses the sign of the latent match quality. $I\left[.\right]$ is an indicator function assuming value one when the argument is true and zero otherwise. Thus, we assume that a good match is one that started with a fixed-term contract and was converted into a more stable employment relationship. Nevertheless, non-converted matches cannot be considered bad matches since the match is continued and the learning process may not yet be complete.

As Sicilian (1995) and Jovanovic (1979) argue, wage growth is a result of the learning process about match quality. Ceteris paribus, workers in good matches should experience higher wage growth than workers in low value matches. Accordingly, employment protection reforms could

[5] We considered the one period lagged value of the share of fixed-term contracts, in order to account for endogeneity.

[6] Since the unit of observation is the worker-firm match and the wage is match specific, we only considered continuing matches in order to confine the study to the wage growth on the job rather than the wage growth resulting from job mobility.

have an asymmetric impact on the wage growth of converted and non-converted matches. Since the marginal effect of the explanatory variables and the change in legislation is expected to differ, we should distinguish between the wage growth of converted and non-converted matches:

$$W_{gt} = x'_{gt}\beta_g + \Pi'_t\tau_g + D'_t\delta_g + v_{gt} \; if \; P_{mt} = 1 \tag{3}$$

$$W_{bt} = x'_{bt}\beta_b + \Pi'_t\tau_b + D'_t\delta_b + v_{bt} \; if \; P_{mt} = 0, \tag{4}$$

a good match is represented by $g = 1, ..., G$ and a non-converted match by $b = 1, ...B$ over $t = 1, ..., T$ periods of time[7].

The wage growth experienced by good matches between t-1 and t (W_{gt}) is observed if the fixed-term contract is converted into a permanent contract between t-1 and t. Otherwise, we observe the wage growth of the matches that remained with a fixed-term contract between t-1 and t (W_{bt}). Since we intend to study the differences in the wage growth between these two groups, we introduce a set of independent variables, x_{gt} and x_{bt}, in order to ascertain the contribution of certain worker and firm characteristics. We are interested in obtaining the estimates of β and δ, representing the marginal impact of each covariate and the impact of the change in legislation on the wage growth of converted and non-converted matches respectively.

In such a scenario, where the sample is not random, using the standard OLS estimation would produce inconsistent estimates[8]. We adopt an endogenous switching regression model in order to tackle the problem arising from the simultaneous decision to convert the contract and the setting of the wage level and, thus, the non-random sampling, and consistently estimate the impact of the explanatory variables and the change in legislation. This type of model is an extension of the Heckman selection model (Heckman (1979)) in which both regimes are observable. Thus, assuming that the error term of the selection equation (ε_{mt}) is drawn from a standard normal distribution $N(0,1)$, while v_{gt} and v_{bt} follow a normal distribution $N(0,\sigma_g^2)$ and $N(0,\sigma_b^2)$ respectively, and that the switch is endogenous, i.e. v_{gt} and ε_{mt} and v_{bt} and ε_{mt} are significantly correlated, we follow the two-step procedure described by Maddala (1986) in order to estimate the wage growth of both converted and non-converted matches[9]. The identification of the model is made not only through the assumption of joint normality but also by the exclusion of some covariates included in w_{mt}, from x_{gt} and x_{bt}. Specifically, we exclude two dummy variables accounting for less than 9 years of schooling, one dummy variable accounting for the activity sector of electricity production and distribution, and one dummy variable accounting for firm size of

[7] Note that the total number of converted (G) and non-converted (B) matches corresponds to the whole sample dimension (M).

[8] $E(W_{gt}|P_{mt} = 1, x_{gt}, \Pi_t, D_t) \neq x'_{gt}\beta_g + \Pi'_t\tau_g + D'_t\delta_g$ and $E(W_{bt}|P_{mt} = 0, x_{bt}, \Pi_t, D_t) \neq x'_{bt}\beta_b + \Pi'_t\tau_b + D'_t\delta_b$ since $E(v_{gt}|P_{mt} = 1, x_{gt}, \Pi_t, D_t) \neq 0$ and $E(v_{bt}|P_{mt} = 0, x_{bt}, \Pi_t, D_t) \neq 0$.

[9] Although maximum likelihood is a more efficient estimation method, it may be computationally burdensome (Maddala (1986)) and the two-step estimation is a valid alternative.

more than 401 employees. Thus, it is assumed that these variables only significantly affect the probability of conversion of fixed-term contracts and not the subsequent wage growth path[10].

As such, in the first step, equation 2 is estimated through maximum likelihood as a pooled[11] Probit regression in order to obtain the parameter estimates and compute the estimated inverse mills ratio. In the second step, a pooled generalised least square (GLS) estimator is used to estimate equations 5 and 6:

$$W_{gt} = x'_{gt}\beta_g + \Pi'_t\tau_g + D'_t\delta_g + \sigma_g\rho_{g\varepsilon}\frac{\phi(w'_{mt}\widehat{\omega} + \Pi'_t\widehat{\tau} + D'_t\widehat{\delta})}{\Phi(w'_{mt}\widehat{\omega} + \Pi'_t\widehat{\tau} + D'_t\widehat{\delta})} + u_{gt}\ if\ P_{mt} = 1 \tag{5}$$

$$W_{bt} = x'_{bt}\beta_b + \Pi'_t\tau_b + D'_t\delta_b - \sigma_b\rho_{b\varepsilon}\frac{\phi(w'_{mt}\widehat{\omega} + \Pi'_t\widehat{\tau} + D'_t\widehat{\delta})}{(1 - \Phi(w'_{mt}\widehat{\omega} + \Pi'_t\widehat{\tau} + D'_t\widehat{\delta}))} + u_{bt}\ if\ P_{mt} = 0, \tag{6}$$

where ϕ and Φ represent the standard normal density function and the standard normal cumulative distribution function. $\frac{\phi(w'_{mt}\widehat{\omega}+\Pi'_t\widehat{\tau}+D'_t\widehat{\delta})}{\Phi(w'_{mt}\widehat{\omega}+\Pi'_t\widehat{\tau}+D'_t\widehat{\delta})}$ is the inverse mills ratio in the cases in which $P_{mt} = 1$ and $\frac{-\phi(w'_{mt}\widehat{\omega}+\Pi'_t\widehat{\tau}+D'_t\widehat{\delta})}{(1-\Phi(w'_{mt}\widehat{\omega}+\Pi'_t\widehat{\tau}+D'_t\widehat{\delta}))}$ for $P_{mt} = 0$. $\rho_{g\varepsilon}$ stands for the correlation coefficient between v_{gt} and ε_{mt} and $\rho_{b\varepsilon}$ for the correlation between v_{bt} and ε_{mt}. u_{gt} and u_{bt} are the disturbances with zero mean of the wage growth regression of converted and non-converted matches, respectively. Since we have unbalanced panel data, each match may be observed more than once and, as such, the hypothesis of independence across observations does not hold. Therefore, the variance-covariance matrix of the estimators is estimated taking into account the possible correlation of the error terms within matches by clustering observations at the match level, which simultaneously accounts for the existence of heteroskedasticity.

Given that the independent and dependent variables are always observed, if the match is either converted or not, and that some matches belong to both groups over the time period considered (18,5%), there may be efficiency gains accruing from the joint estimation of both wage growth regressions (Maddala (1986)). For this reason we estimate the following regression:

$$\begin{aligned} W_{mt} \quad = \quad & x'_{gt}\beta_g + \Pi'_{gt}\tau_g + D'_{gt}\delta_g + \sigma_g\rho_{g\varepsilon}\frac{\phi(w'_{gt}\widehat{\omega} + \Pi'_{gt}\widehat{\tau} + D'_{gt}\widehat{\delta})}{\Phi(w'_{gt}\widehat{\omega} + \Pi'_{gt}\widehat{\tau} + D'_{gt}\widehat{\delta})} + \\ & x'_{bt}\beta_b + \Pi'_{bt}\tau_b + D'_{bt}\delta_b - \sigma_b\rho_{b\varepsilon}\frac{\phi(w'_{bt}\widehat{\omega} + \Pi'_{bt}\widehat{\tau} + D'_{bt}\widehat{\delta})}{(1 - \Phi(w'_{bt}\widehat{\omega} + \Pi'_{bt}\widehat{\tau} + D'_{bt}\widehat{\delta}))} + u_{mt}, \end{aligned} \tag{7}$$

in which W_{mt} is the wage growth of fixed-term matches. All variables indexed by g assume

[10] These exclusions are based on the estimation of the wage growth regression for the whole sample of fixed-term contracts (results available upon request).

[11] The model does not include unobserved match-specific heterogeneity since most variables have a lower within-variation than between-variation. In fact, converted matches appear only once in the database and approximately 64% of non-converted matches appear only twice in the sample. On average, each match is observed 1.7 times in the sample.

their real values if the match was converted and are replaced by zero otherwise and the variables indexed by b assume their real values if the match was not converted and are replaced by zero otherwise. u_{mt} is the error term with zero mean.

The main parameters of interest are $\sigma_g\rho_{g\varepsilon}$, $\sigma_b\rho_{b\varepsilon}$, δ_g and δ_b. As previously stated, good matches are expected to be associated with a steeper wage growth. Thus, the switch is expected to be endogenous, i.e. the conversion of the fixed-term contract and the subsequent wage growth should be statistically correlated. It is also expected that good matches are less penalised by reforms that widen the employment protection gap between fixed-term and open-ended contracts if a learning process about match quality is in motion. In short, according to the hypothesis under analysis, it is expected that $\rho_{g\varepsilon} \neq 0$; $\rho_{b\varepsilon} \neq 0$ and $\delta_g > \delta_b$; $\delta_g, \delta_b < 0$.

4.1. Quadros de Pessoal

The analysis is based on Quadros de Pessoal, a Portuguese linked employer-employee database collected every year in October by the Ministry of Employment. Quadros de Pessoal is an exceptionally rich database suitable for develop the proposed analysis for several reasons. Firstly, it has a broad coverage and representativeness of the population since it is mandatory for all private firms with at least one wage-earner to provide information about the firm and all their employees. Secondly, given that the information is reported by the firm and is publicly available the measurement error of some variables (such as wages) is minimized. Thirdly, we can follow firms and workers over the years and easily identify the employer-employee matches, which are both assigned with a unique identification code.

This unique labour market database contains very detailed information on the worker, such as gender, age, tenure, education, skills, nationality, occupation, wages (base wage, overtime pay, regular and irregular benefits) and hours worked. Information about the contract type has been available since 2002. Firms are characterised in terms of their location, dimension, main economic activity, age and turnover.

The unit of observation is defined as the worker-firm match, observed from 2003 until 2009[12]. After correcting the time inconsistency in some variables such as education and gender (Cardoso (2004)), the data was filtered according to the following criteria (see for example Cardoso *et al.* (2012)). We only considered full-time workers with an open-ended or a fixed-term contract, aged between 18 and 65 years old, who earn more than 80% of the legal minimum wage each year[13] and less than 100.000 euros (at 2009 prices) and work less than 400 hours per month. Moreover, we excluded individuals employed in agriculture or fishery, firms operating abroad and International Organisations.

From this sample of workers, we restrict the analysis to all matches holding a fixed-term contract in a certain year t-1 that were continued in t and either remained on a fixed-term

[12] We only considered data up to 2009 to avoid capturing the impact of the economic and financial crisis.
[13] This boundary corresponds to the minimum wage allowed for apprentices.

contract or were converted into an open-ended contract. As a double check, we only considered fixed-term contracts with tenure at time t-1[14] lower than three years in 2003 and six years in the remaining years, in accordance with the legislation in force[15]. Finally, observations below the 2nd and above the 99th percentile of the wage growth distribution were excluded. After the exclusion of the missing data on relevant variables, we end up with an unbalanced panel of 702,242 different matches observed over a 7-year period, which corresponds to a total of 1,174,269 observations.

The worker's real wage is computed on an hourly basis and corresponds to the sum of the monthly base wage, regular benefits and overtime pay divided by the total hours worked (normal and overtime). The wage growth was calculated as the subtraction of the logarithms of real hourly wage over two consecutive years and is measured as a percentage. Real variables were computed using the Consumer Price Index (2012=100) and the business cycle is accounted for by the introduction of the annual unemployment rate reported by Instituto Nacional de Estatística. A brief description of the remaining variables is presented in Appendix A.

5. EMPIRICAL RESULTS

5.1. Descriptive Statistics

Table B1 reports some summary statistics of the sample. Between 2003 and 2009, an average of 22.8% of fixed-term contracts were converted into open-ended contracts.

In the sample of fixed-term contracts, the average age of workers is 34 years, 45% are females and almost 8% are immigrants, although there is a higher share of non-native workers among non-converted fixed-term contracts. Workers on converted contracts are, on average, better educated than workers with non-converted fixed-term contracts. The former are also less concentrated in unqualified occupations (11%) than the latter group of workers (14%). The larger share of fixed-term contracts is observed in the services sector and in firms located in Lisbon and in the North region. Non-converted fixed-term contracts are found more in activity sectors and regions strongly affected by seasonality, such as construction and Algarve. It can be seen that more than 60% of workers on converted fixed-term contracts were converted in the two first years of tenure, while almost 50% of workers with non-converted fixed-term contracts have only one year of tenure. Although most fixed-term contracts are concentrated in firms with less than 100 employees, converted contracts are more represented in larger firms, notably in firms with more than 400 employees. Finally, on average, workers with converted fixed-term contracts receive higher raw hourly wages and experience higher wage growth, although there is not a significant difference in the supply of overtime hours between both types of contract.

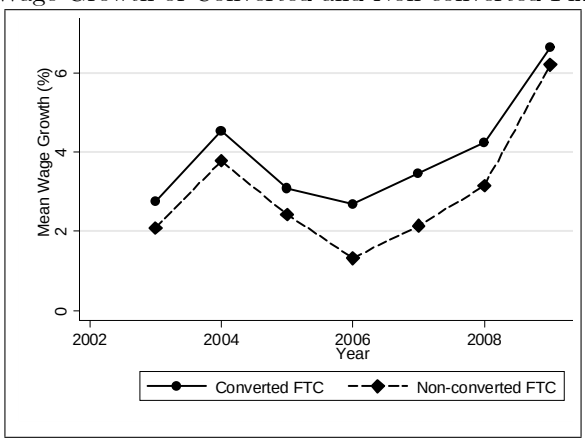
[14] Note that firms report information annually in October. Thus, for the purposes of accuracy the exclusion is made using lagged tenure.

[15] While the 2004 change in legislation applies to all fixed-term contracts, the change introduced in 2009 only applies to newly created fixed-term contracts.

Similarly to Mertens & McGinnity (2003), we compare the wage and the wage growth distributions of fixed-term contracts with the distributions in a sample of open-ended contracts. In line with their findings, although a greater proportion of fixed-term contracts is found in the lowest deciles of the wage distribution (Table B2), they are also over-represented in both the lowest and the highest wage growth deciles, with nearly 25% of fixed-term contracts concentrated in the two highest wage growth deciles vs. 19% of open-ended contracts (Table B2).

This preliminary evidence may indicate that an underlying learning process about match quality is associated with fixed-term contracts, which may be expressed by their conversion into open-ended contracts and their wage growth pattern. Figure 1 shows that the wage growth of converted fixed-term contracts is always higher than that of non-converted fixed-term contracts from 2003 until 2009, but the gap between them increased from 2005 until 2008, i.e. the period the change in the legislation was in force.

Figure 1 Hourly Wage Growth of Converted and Non-converted Fixed-term Contracts



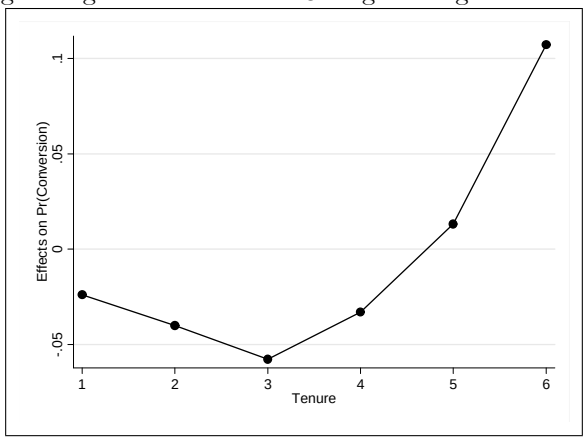
Source: Quadros de Pessoal, 2002-2009

5.2. Determinants of the Conversion of Fixed-term to Open-ended Contracts

In line with Boeri (2011) and Dolado *et al.* (2012), the results in Table 1 show that the change in Portuguese employment protection legislation that relaxed the regulations on fixed-term contracts had a negative and statistically significant impact, at a 99% confidence level, on the probability of a fixed-term contract being converted into an open-ended contract. In the years in which the change in legislation was in force, the probability of conversion was 3 percentage points lower (average marginal effect), ceteris paribus. Female fixed-term workers seem to be slightly more penalised by this type of reform than males, since the probability of conversion between 2004 and 2008 was 3.2 pp. lower for females and only 2.9 pp. lower for males (Table 1, columns (5) and (4), respectively). The results in Figure 2, based on the estimates in Table 1, column (2), indicate that this negative effect can be partly explained by the fact that

the conversion of the contract during this period may have been postponed, especially at the end of the third year of the contract (-5.8 pp.). In fact, when the interaction between tenure dummies and the legislation dummy is considered, the average marginal effect of the change in legislation on the probability of conversion is negative and statistically significant at a 5% significance level[16] in the first four years of contract.

Figure 2 Average Marginal Effect of the Change in Legislation at Years of Tenure



Source: Quadros de Pessoal, 2002-2009

Tenure has a statistically significant and an inverse U-shaped impact on the probability of transition to an open-ended contract, increasing up to three years and decreasing thereafter; this is consistent with the evidence reported by Portugal & Varejão (2005) for Portugal and Güell & Petrongolo (2007) for Spain. This may indicate that, on average, the first years are crucial for firms and workers to assess the quality of the match.

As Bowlus (1995) argues, match quality is significantly affected by the business cycle and its behaviour depends on two opposite effects. During recessions, the increasing number of unemployed workers available to fill fewer job vacancies (congestion effect) negatively affects match quality despite the larger pool of available workers for firms to screen (agglomeration effect). Similarly to Bowlus (1995), we find evidence of a procyclical behaviour of match quality, proxied by the probability of conversion. Fixed-term matches are less likely to be converted in periods of higher unemployment rates and the probability of conversion decreases by 2.1 pp. if the unemployment rate increases by 1 pp. (Table 1, column (1)), which may be explained by the firms' need for some downwards flexibility and to avoid high firing costs at times of economic distress, which is consistent with Varejão & Portugal (2007) findings. Moreover, as Güell & Petrongolo (2007) predict, when unemployment increases, firms are less willing to convert fixed-contracts into open-ended contracts since workers are less likely to quit due to the worsening of outside opportunities.

[16] Standard error of all marginal effects are available upon request.

Table 1: Determinants of the Conversion of Fixed-term into Permanent Contracts

	(1)		(2)		(3)		(4)		(5)	
	Whole Sample		Whole Sample		Whole Sample		Males		Females	
VARIABLES	Estimates	AME	Estimates	AME	Estimates	AME	Estimates	AME	Estimates	AME
immigrant	-0.0994***	-0.0269	-0.0988***	-0.0267	-0.0994***	-0.0269	-0.115***	-0.0308	-0.0789***	-0.0215
	(0.00551)		(0.00551)		(0.00551)		(0.00702)		(0.00899)	
female	-0.0231***	-0.0064	-0.0233***	-0.0065	-0.0231***	-0.0064				
	(0.00299)		(0.00299)		(0.00299)					
4 years school	0.0604***	0.0156	0.0598***	0.0155	0.0604***	0.0156	0.0775***	0.0201	0.0343	0.0088
	(0.0136)		(0.0136)		(0.0136)		(0.0172)		(0.0223)	
6 years school	0.0729***	0.0189	0.0728***	0.0189	0.0729***	0.0189	0.0880***	0.0229	0.0529**	0.0137
	(0.0136)		(0.0136)		(0.0136)		(0.0172)		(0.0223)	
9 years school	0.123***	0.0327	0.123***	0.0326	0.123***	0.0327	0.123***	0.0325	0.128***	0.0340
	(0.0136)		(0.0136)		(0.0136)		(0.0172)		(0.0222)	
12 years school	0.180***	0.0487	0.180***	0.0486	0.180***	0.0487	0.178***	0.0479	0.183***	0.0497
	(0.0137)		(0.0137)		(0.0137)		(0.0175)		(0.0224)	
bachelor	0.188***	0.0511	0.188***	0.0509	0.188***	0.0511	0.180***	0.0484	0.190***	0.0517
	(0.0162)		(0.0162)		(0.0162)		(0.0215)		(0.0253)	
university	0.256***	0.0711	0.256***	0.0709	0.256***	0.0711	0.255***	0.0706	0.255***	0.0708
	(0.0145)		(0.0145)		(0.0145)		(0.0189)		(0.0233)	
tenure_1	-0.532***	-0.1466	-0.225***	-0.1539	-0.532***	-0.1466	-0.548***	-0.1515	-0.520***	-0.1425
	(0.00816)		(0.0153)		(0.00816)		(0.0113)		(0.0118)	
tenure_2	-0.0984***	-0.0313	0.223***	-0.0387	-0.0984***	-0.0313	-0.141***	-0.0447	-0.0518***	-0.0165
	(0.00816)		(0.0153)		(0.00816)		(0.0113)		(0.0118)	
tenure_3	0.174***	0.0592	0.521***	0.0524	0.174***	0.0592	0.187***	0.0641	0.156***	0.0524
	(0.00835)		(0.0158)		(0.00835)		(0.0116)		(0.0121)	
tenure_4	-0.0790***	-0.0253	0.226***	-0.0327	-0.0790***	-0.0253	-0.101***	-0.0325	-0.0537***	-0.0171
	(0.00909)		(0.0174)		(0.00909)		(0.0126)		(0.0131)	
tenure_5	-0.126***	-0.0397	0.0616***	-0.0503	-0.126***	-0.0397	-0.148***	-0.0469	-0.101***	-0.0317
	(0.0103)		(0.0208)		(0.0103)		(0.0143)		(0.0148)	
$\text{tenure}_1 \times leg$			-0.446***							
			(0.0179)							
$\text{tenure}_2 \times leg$			-0.467***							
			(0.0179)							
$\text{tenure}_3 \times leg$			-0.502***							
			(0.0185)							
$\text{tenure}_4 \times leg$			-0.444***							
			(0.0203)							
$\text{tenure}_5 \times leg$			-0.296***							
			(0.0240)							
managers	0.116***	0.0326	0.116***	0.0325	0.116***	0.0326	0.124***	0.0346	0.114***	0.0320
	(0.0134)		(0.0134)		(0.0134)		(0.0171)		(0.0221)	
experts	-0.0427***	-0.0113	-0.0423***	-0.0112	-0.0427***	-0.0113	0.00281	0.0007	-0.0747***	-0.0197
	(0.00740)		(0.00739)		(0.00740)		(0.0109)		(0.0103)	
technicians	0.0125**	0.0034	0.0123**	0.0033	0.0125**	0.0034	0.0294***	0.0079	-0.0108	-0.0029
	(0.00612)		(0.00611)		(0.00612)		(0.00798)		(0.0101)	
admin staff	0.0646***	0.0178	0.0645***	0.0177	0.0646***	0.0178	0.0732***	0.0200	0.0540***	0.0149
	(0.00570)		(0.00569)		(0.00570)		(0.00846)		(0.00804)	
salespeople	0.128***	0.0361	0.129***	0.0363	0.128***	0.0361	0.136***	0.0378	0.122***	0.0345
	(0.00499)		(0.00498)		(0.00499)		(0.00769)		(0.00672)	

(continued)

(continuation)

	(1) Whole Sample		(2) Whole Sample		(3) Whole Sample		(4) Males		(5) Females	
VARIABLES	Estimates	AME	Estimates	AME	Estimates	AME	Estimates	AME	Estimates	AME
craftsmen	0.0645***	0.0177	0.0641***	0.0176	0.0645***	0.0177	0.0693***	0.0189	0.0403***	0.0111
	(0.00556)		(0.00555)		(0.00556)		(0.00691)		(0.0116)	
mach operators	0.0188***	0.0051	0.0186***	0.0050	0.0188***	0.0051	0.0322***	0.0087	-0.0152	-0.0041
	(0.00569)		(0.00569)		(0.00569)		(0.00731)		(0.0109)	
age	0.00154	-0.0004	0.00160	-0.0004	0.00154	-0.0004	0.00433***	-0.0004	-0.00209	-0.0003
	(0.000984)		(0.000983)		(0.000984)		(0.00128)		(0.00156)	
agesq	-4.27e-05***		-4.35e-05***		-4.27e-05***		-8.34e-05***		1.36e-05	
	(1.30e-05)		(1.30e-05)		(1.30e-05)		(1.67e-05)		(2.10e-05)	
dimension_1	0.0213***	0.0056	0.0214***	0.0056	0.0213***	0.0056	0.0366***	0.0096	0.00140	0.0004
	(0.00522)		(0.00522)		(0.00522)		(0.00707)		(0.00777)	
dimension_2	0.0342***	0.0090	0.0341***	0.0090	0.0342***	0.0090	0.0567***	0.0150	0.00839	0.0022
	(0.00403)		(0.00403)		(0.00403)		(0.00554)		(0.00592)	
dimension_3	0.189***	0.0525	0.188***	0.0523	0.189***	0.0525	0.149***	0.0409	0.240***	0.0682
	(0.00443)		(0.00443)		(0.00443)		(0.00603)		(0.00660)	
dimension_4	0.376***	0.1114	0.375***	0.1110	0.376***	0.1114	0.313***	0.0906	0.457***	0.1389
	(0.00481)		(0.00480)		(0.00481)		(0.00655)		(0.00718)	
legislation	-0.106***	-0.0300	0.340***	-0.0297	0.290***	-0.0321	-0.103***	-0.0288	-0.111***	-0.0315
	(0.00423)		(0.0175)		(0.0920)		(0.00574)		(0.00628)	
unemrate	-0.0736***	-0.0205	-0.0665***	-0.0185	-0.0736***	-0.0309	-0.0777***	-0.0215	-0.0693***	-0.0194
	(0.00165)		(0.00168)		(0.00165)		(0.00223)		(0.00246)	
public capital	0.000897***	0.0002	0.000878***	0.0002	0.000897***	0.0002	0.00132***	0.0004	0.000368***	0.0001
	(8.72e-05)		(8.71e-05)		(8.72e-05)		(0.000125)		(0.000123)	
foreign capital	0.00146***	0.0004	0.00147***	0.0004	0.00146***	0.0004	0.00154***	0.0004	0.00133***	0.0004
	(4.58e-05)		(4.58e-05)		(4.58e-05)		(6.11e-05)		(6.97e-05)	
proportion_{t-1}	-0.00607***	-0.0017	-0.00608***	-0.0017	-0.00607***	-0.0017	-0.00617***	-0.0017	-0.00591***	-0.0017
	(5.18e-05)		(5.17e-05)		(5.18e-05)		(7.01e-05)		(7.73e-05)	
leg $\times unemrate$					-0.0521***					
					(0.0118)					
Region dummies	yes		Yes		yes		yes		yes	
Sector dummies	yes		yes		yes		yes		yes	
Year dummies	yes		yes		yes		yes		yes	
Constant	0.121***		-0.242***		0.121***		0.119***		0.108**	
	(0.0278)		(0.0311)		(0.0278)		(0.0368)		(0.0427)	
Observations	1,174,269		1,174,269		1,174,269		642,813		531,456	
ll	-581255		-580836		-581255		-316559		-263983	
r2_p	0.0781		0.0788		0.0781		0.0763		0.0827	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Quadros de Pessoal, 2002-2009. Note: Probit regression with standard errors clustered in nmatch. Base categories are: gender(male), education(<4 years of schooling), tenure(6/7 years), occupation(unqualified), dimension(<11), region(north), sector(services), year(y03,y08,y09). AME stands for Average Marginal Effects

Considering that policy makers tend to implement this type of reform when unemployment is rising (Saint-Paul (1996)), they may exacerbate the business cycle's negative impact on the probability of converting the contract. This is supported by the results presented in column (3) of Table 1, where the coefficient associated with the interaction term between the regime dummy reflecting the change in legislation and the current unemployment rate (leg x unemrate) is negative and statistically significant. Thus, in the years in which the legislation that widened the employment protection gap between open-ended and fixed-term contracts was in force, there was an increase in the adverse marginal effect of the current unemployment rate on the probability of conversion (from -2.2 pp. to -3.4 pp.)[17]. Although the direct impact of the change in legislation is positive and statistically significant at a 1% significance level when this interaction is considered, its overall marginal effect is still negative and statistically significant (-3.2 pp.).

Regarding workers' characteristics, the contracts of younger[18], male and more educated workers are more likely to be converted to permanent contracts. For example, workers with a university degree are 7.1 pp. more likely to have a contract converted into a more stable employment relationship than a worker with less than four years of schooling, ceteris paribus. There is also some evidence of discrimination against immigrant workers, especially in the case of male workers (on average, male immigrant workers are 3.1 pp. less likely to receive an open-ended contract, ceteris paribus).

There is a greater tendency for fixed-term workers in management and sales occupations to be given an open-ended contract than workers performing unskilled tasks. This result was expected as fixed-term contracts are probably used less as a screening device for occupations requiring lower skill levels due to cost (Sicilian (1995)). Workers with fixed-term contracts matched either with smaller firms or firms with a larger percentage of fixed-term contracts have a slightly smaller probability of being given an open-ended contract. In fact, firms with a higher number of fixed-term contracts would be expected to have a greater need for flexibility and, thus, be less willing to change a fixed-term contract to a permanent one.

In Subsection 5.3 we distinguish between the wage growth of converted and non-converted fixed-term contracts and assess the impact of the change in legislation for both groups.

5.3. Wage growth of Converted and Non-converted Fixed-term Contracts

Assuming that firms and workers are not able to identify the true value of the match *ex-ante*, it is plausible that some matches start with fixed-term contracts and at a low wage level. However, as Sicilian (1995) argues, wage growth should reflect updated expectations of match quality. Therefore, while bad matches are terminated or remain with temporary contracts, good matches initiated with fixed-term contracts should experience higher wage growth and become a more stable employment relationship.

[17] This result is robust to the use of alternative measures of business cycle, such as the unemployment rate at the start of the match.

[18] The average marginal effect of age is statistically significant at standard significance levels.

From the estimated coefficients associated with the inverse mills ratio (Table 2, column (1)) we can conclude that the error term of the selection equation and the error term of the wage growth regression for converted fixed-term contracts are positively and significantly correlated at a 99% confidence level, which supports the need to correct for the sample selection bias. Accordingly, unobserved factors increase the likelihood of a fixed-term contract being converted into an open-ended contract and lead to an above average wage growth. These results are in line with Sicilian (1995) and Loh (1994)'s predictions, since there seems to be a non-negligible increase in wage growth associated with the conversion to a permanent contract that we estimate to be equal to approximately 1.3 pp.[19]. Nevertheless, we find that workers on non-converted fixed-term contracts do not experience either a significantly lower or a higher wage growth than a random fixed-term worker would. It seems that the wage is only renegotiated when the contract is converted, which may be the result of the higher bargaining power gained on the conversion of the contract when the worker starts benefiting from higher employment protection levels. These results may also reflect the learning process about match quality associated with the use of fixed-term contracts or could be the result of the worker's integration in the firm's internal labour market.

Similarly to what we observe for the probability of conversion, the change in legislation also has a statistically significant and negative impact on the wage growth of fixed-term contracts. However, our findings indicate that not all fixed-term contracts are penalised evenly by the change in legislation. Although the change has a negative impact on the wage growth of both non-converted and converted fixed-term contracts (-0.55 pp. and -0.16 pp., respectively), the effect is statistically significant at a 1% significance level for the former group while only statistically significant at a 5% level for converted contracts. Besides there is evidence, at a 1% significance level, that the penalisation suffered by non-converted fixed-term contracts was greater than that of converted fixed-term contracts[20]. The renegotiation of wages between 2004 and 2008 may have been postponed as it was easier for firms to use fixed-term contracts for a longer period of time. Females in non-converted matches seem to be more affected by this type of change in legislation since they experience a significant decline in wage growth of approximately 0.71 pp. in the years the change was in force. The negative impact of the change in legislation on the wage growth of male workers does not seem to differ according to match quality[21] although it is only statistically significant for converted fixed-term contracts at a 95% confidence level.

It seems that the change in legislation affects the wage growth path of fixed-term contracts directly and indirectly through the link between contract's conversion and wage growth (IMR x legislation, Table 3). Specifically, in the years the legislation was in force, this link was weakened for both types of contract, especially for non-converted fixed-term contracts. When this interaction is considered, the direct impact of the change in legislation on the wage growth of non-converted matches remains negative and statistically significant, but for converted fixed-

[19] Evaluated at the sample mean inverse mills ratio
[20] The p-value of the Wald test of the equality of coefficients equals 0.0000.
[21] The p-value of the Wald test of the equality of coefficients equals to 0.2061.

Table 2: Determinants of the Wage Growth of Non-converted and Converted Fixed-term Contracts

	(1)			(2)			(3)		
	Whole Sample		Wald Tests	Males		Wald Tests	Females		Wald Tests
VARIABLES	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value
inverse mills ratio	0.305	1.050***	0.0438	0.556*	1.947***	0.0231	-0.183	-0.0451	0.7542
	(0.205)	(0.284)		(0.323)	(0.473)		(0.254)	(0.334)	
immigrant	0.138***	0.110	0.8114	0.156***	0.0589	0.5413	0.155**	0.124	0.8537
	(0.0443)	(0.105)		(0.0598)	(0.144)		(0.0654)	(0.152)	
female	-0.103***	-0.0537	0.3829						
	(0.0243)	(0.0500)							
9 years school	0.134***	0.347***	0.0034	0.232***	0.484***	0.0107	-0.0527	0.0600	0.2904
	(0.0295)	(0.0652)		(0.0408)	(0.0880)		(0.0414)	(0.0959)	
12 years school	0.531***	0.981***	0.0000	0.653***	1.138***	0.0001	0.338***	0.662***	0.0097
	(0.0363)	(0.0768)		(0.0514)	(0.106)		(0.0505)	(0.112)	
bachelor	1.132***	2.025***	0.0000	1.306***	2.335***	0.0002	0.869***	1.522***	0.0108
	(0.0870)	(0.163)		(0.132)	(0.240)		(0.116)	(0.223)	
university	1.138***	2.378***	0.0000	1.390***	3.069***	0.0000	0.908***	1.681***	0.0000
	(0.0585)	(0.117)		(0.0904)	(0.176)		(0.0774)	(0.160)	
$tenure_1$	0.377***	0.113	0.1710	0.323***	-0.375	0.0253	0.495***	0.768***	0.2521
	(0.0721)	(0.178)		(0.110)	(0.289)		(0.0940)	(0.218)	
$tenure_2$	0.346***	0.644***	0.0318	0.218**	0.282	0.7648	0.518***	1.075***	0.0019
	(0.0626)	(0.125)		(0.0924)	(0.195)		(0.0842)	(0.159)	
$tenure_3$	0.106	0.287**	0.2085	0.125	0.229	0.6325	0.0965	0.486***	0.0377
	(0.0693)	(0.125)		(0.104)	(0.189)		(0.0918)	(0.162)	
$tenure_4$	-0.140**	-0.0912	0.7567	-0.176*	-0.311	0.5716	-0.0890	0.185	0.1815
	(0.0705)	(0.141)		(0.104)	(0.215)		(0.0951)	(0.182)	
$tenure_5$	0.0675	-0.120	0.2963	-0.121	-0.466*	0.2054	0.282***	0.287	0.9829
	(0.0814)	(0.162)		(0.120)	(0.247)		(0.110)	(0.209)	
managers	0.679***	2.390***	0.0000	0.571***	2.288***	0.0000	1.048***	2.830***	0.0001
	(0.121)	(0.249)		(0.157)	(0.317)		(0.193)	(0.420)	
experts	0.542***	1.055***	0.0003	0.860***	1.479***	0.0050	0.497***	0.988***	0.0084
	(0.0610)	(0.126)		(0.0983)	(0.194)		(0.0776)	(0.166)	
technicians	0.851***	1.499***	0.0000	0.900***	1.593***	0.0000	0.962***	1.729***	0.0001
	(0.0505)	(0.108)		(0.0681)	(0.149)		(0.0794)	(0.169)	
admin staff	0.650***	1.301***	0.0000	0.593***	1.458***	0.0000	0.857***	1.453***	0.0000
	(0.0442)	(0.0934)		(0.0722)	(0.149)		(0.0565)	(0.122)	
salespeople	0.151***	0.607***	0.0000	-0.132**	0.211	0.0358	0.409***	0.953***	0.0000
	(0.0375)	(0.0853)		(0.0655)	(0.146)		(0.0443)	(0.103)	

(continued)

(continuation)

	(1)			(2)			(3)		
	Whole Sample		Wald Tests	Males		Wald Tests	Females		Wald Tests
VARIABLES	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value
craftsmen	0.00460	0.447***	0.0000	0.134**	0.723***	0.0000	-0.293***	-0.346**	0.7841
	(0.0414)	(0.0934)		(0.0537)	(0.125)		(0.0757)	(0.171)	
mach. operators	-0.467***	-0.0117	0.0000	-0.323***	0.359***	0.0000	-0.427***	-0.524***	0.5689
	(0.0429)	(0.0939)		(0.0589)	(0.132)		(0.0690)	(0.152)	
age	-0.224***	-0.233***	0.5117	-0.287***	-0.316***	0.1514	-0.164***	-0.141***	0.2617
	(0.00714)	(0.0134)		(0.00995)	(0.0186)		(0.0102)	(0.0192)	
agesq	0.00211***	0.00212***	0.9716	0.00272***	0.00296***	0.3633	0.00164***	0.00123***	0.1261
	(9.21e-05)	(0.000177)		(0.000127)	(0.000241)		(0.000133)	(0.000258)	
$dimension_1$	0.367***	0.379***	0.9071	0.310***	0.291**	0.8862	0.476***	0.555***	0.5814
	(0.0371)	(0.0901)		(0.0520)	(0.123)		(0.0521)	(0.132)	
$dimension_2$	0.430***	0.395***	0.6387	0.458***	0.326***	0.1865	0.415***	0.553***	0.1923
	(0.0278)	(0.0666)		(0.0391)	(0.0903)		(0.0391)	(0.0967)	
$dimension_3$	0.269***	0.207***	0.3899	0.234***	0.0852	0.1405	0.320***	0.296***	0.8135
	(0.0332)	(0.0624)		(0.0456)	(0.0884)		(0.0481)	(0.0878)	
legislation	-0.547***	-0.159**	0.0000	-0.419***	-0.264**	0.2061	-0.711***	-0.0276	0.0000
	(0.0387)	(0.0759)		(0.0547)	(0.110)		(0.0540)	(0.104)	
unemrate	1.293***	1.164***	0.0001	1.175***	0.998***	0.0005	1.425***	1.343***	0.0569
	(0.0152)	(0.0305)		(0.0219)	(0.0473)		(0.0211)	(0.0399)	
public capital	-0.00103	0.0134***	0.0000	0.00438***	0.0167***	0.0000	-0.00655***	0.0100***	0.0000
	(0.000792)	(0.00130)		(0.00117)	(0.00190)		(0.00107)	(0.00178)	
foreign capital	0.00595***	0.00105	0.0000	0.00410***	0.000419	0.0123	0.00856***	0.00279**	0.0001
	(0.000515)	(0.000854)		(0.000716)	(0.00123)		(0.000742)	(0.00119)	
$proportion_{t-1}$	-0.00213***	-0.0177***	0.0000	-0.00370***	-0.0230***	0.0000	0.000679	-0.0103***	0.0000
	(0.000690)	(0.00183)		(0.00105)	(0.00286)		(0.000885)	(0.00233)	
Region dummies	yes			yes			yes		
Sector dummies	yes			yes			yes		
Year dummies	yes			yes			yes		
Constant	-2.037***			0.193			-4.766***		
	(0.232)			(0.342)			(0.310)		
Observations	1,174,269			642,813			531,456		
Adjusted R-squared	0.033			0.030			0.041		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Quadros de Pessoal, 2002-2009. Note: GLS regression with standard errors clustered in nmatch. 4 years school, 6 years school, dimension_4 and electricity excluded for identification purposes. Base categories are: gender(male), education(< 9 years school), tenure(6/7 years), occupation(unqualified), dimension(<11, >400), region(north), sector(electricity and services), year(y03,y08, y09). Wald test of equality of the coefficients between converted and non-converted fixed-term contracts.

term contracts it becomes positive although not statistically significant for males. In fact, the indirect penalisation of the change in legislation on wage growth is especially relevant to explain the negative but non-significant association between the probability of conversion and the subsequent wage growth observed for females with a converted contract (Table 2, column (3)). In the years the legislation was not in force, females with converted fixed-term contracts experienced a statistically significant (at a 10% significance level) increase in wage growth of approximately 0.78 pp.

The results also indicate that human capital variables have different returns for converted and non-converted fixed-term contracts (Table 2, column (1)). For both types of match, the returns on education are increasing, but they are always higher (at a 1% significance level) for converted fixed-term contracts, especially for levels of higher education. For example, for converted fixed-term contracts, a worker with a university degree experience a 2.4 pp. higher wage growth than a worker with less than nine years of schooling, while for non-converted matches this increase is only equal to 1.1 pp., ceteris paribus.

Moreover, as Amuedo-Dorantes & Serrano-Padial (2007) argue, the duration of the contract plays an important role in the explanation of the wage growth path and the evidence gathered shows that the moment at which the contract is converted has important implications. Workers only experience a significant higher wage growth than that at the end of the contract if their contracts are converted in the second or third year of tenure, while they face a wage growth penalisation of approximately 0.14 pp. in the fourth year of tenure if the contract is not converted.

The effects of workers' idiosyncratic characteristics, such as nationality, age and gender, are not statistically different in converted and non-converted matches at standard significance levels (Table 2). Ceteris paribus, apart from contract conversion, older workers experience lower wage growth and the rate at which the wage growth decreases slows with age up to about 53 and 55 years for non-converted and converted fixed-term contracts, respectively. Although native and female workers with non-converted fixed-term contracts experience lower wage growth rates on average, the wage growth rate of converted fixed-term contracts does not seem to be significantly affected by gender or nationality.

The highest wage growth rate is experienced by managers when the contract is converted and by technicians when the contract is not converted. It is also worth noting that machine operators experience lower wage growth than unqualified workers if the contract is not converted (-0.47 pp.) and they experience neither a statistically significant higher or a lower wage growth if the contract is converted; this may be due to the use of fixed-term contracts to screen matches for this occupation which requires specific training.

Contrary to what is reported for the conversion probability, the wage growth of fixed-term contracts seems to be countercyclical; this can be explained by the fact that during recessions firms separate from a higher share of less-educated and, thus, low-wage workers, while maintaining the employment relationship with high-wage earners.

Table 3: Direct and Indirect Impact of the Change in Legislation on the Wage Growth of Non-converted and Converted Fixed-term Contracts

	(1)			(2)			(3)		
	Whole Sample		Wald Tests	Males		Wald Tests	Females		Wald Tests
VARIABLES	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value
inverse mills ratio	1.363***	1.326***	0.9278	1.607***	1.941***	0.6104	1.098***	0.635*	0.3411
	(0.228)	(0.302)		(0.357)	(0.494)		(0.287)	(0.362)	
IMR x legislation	-1.743***	-0.594***	0.0000	-1.643***	-0.226	0.0000	-2.151***	-1.166***	0.0017
	(0.156)	(0.165)		(0.222)	(0.234)		(0.214)	(0.225)	
legislation	-1.175***	0.544***	0.0000	-1.001***	0.00634	0.0012	-1.504***	1.323***	0.0000
	(0.0687)	(0.208)		(0.0968)	(0.299)		(0.0949)	(0.282)	
Constant	-1.652***			0.624*			-4.344***		
	(0.237)			(0.351)			(0.317)		
Observations	1,174,269			642,813			531,456		
Adjusted R-squared	0.033			0.030			0.041		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Quadros de Pessoal, 2002-2009. Note: GLS regression with standard errors clustered in nmatch. 4 years school, 6 years school, dimension_4 and electricity excluded for identification purposes. The control variables included are immigrant, female, education dummies, tenure dummies, occupation dummies, age, agesq, firm's dimension dummies, region dummies, unemployment rate, capital ownership, lagged share of FTC, sector dummies and year dummies. Wald test of equality of the coefficients between converted and non-converted fixed-term contracts.

5.4. Wage Growth Differential Between Non-converted and Converted Fixed-term Contracts

The aim of this subsection is to identify the main sources of the wage growth differential between non-converted and converted fixed-term contracts. To that end, we adopt a threefold decomposing initially proposed by Winsborough & Dickenson (1971). We start by decomposing the mean wage growth differential $(\overline{W}_{bt} - \overline{W}_{gt})$ into endowment and coefficient effects, and the interaction of both using the estimates of equations 3 and 4 without correcting for selectivity:

$$\begin{aligned} \overline{W}_{bt} - \overline{W}_{gt} \quad = \quad & [(\overline{x}_{bt} - \overline{x}_{gt})'\widehat{\beta}_g + (\overline{\Pi}_{bt} - \overline{\Pi}_{gt})'\widehat{\tau}_g + (\overline{D}_{bt} - \overline{D}_{gt})'\widehat{\delta}_g] + \\ & [\overline{x}'_{gt}(\widehat{\beta}_b - \widehat{\beta}_g) + \overline{\Pi}'_{gt}(\widehat{\tau}_b - \widehat{\tau}_g) + \overline{D}'_{gt}(\widehat{\delta}_b - \widehat{\delta}_g)] + \\ & [(\overline{x}_{bt} - \overline{x}_{gt})'(\widehat{\beta}_b - \widehat{\beta}_g) + (\overline{\Pi}_{bt} - \overline{\Pi}_{gt})'(\widehat{\tau}_b - \widehat{\tau}_g) + (\overline{D}_{bt} - \overline{D}_{gt})'(\widehat{\delta}_b - \widehat{\delta}_g)] \ , \end{aligned} \tag{8}$$

where the first term in square brackets on the right hand side of the equation is the endowment effect, i.e., the part of the differential due to differences in the characteristics between non-converted and converted fixed-term matches. The second term in square brackets is the coefficient effect and corresponds to the part of the differential due to differences in the remuneration of characteristics between both groups. Finally, the third term corresponds to the interaction between the endowment and coefficient effects. These effects are computed using converted fixed-term contracts as the reference group. The results of the estimated differential are in Table 4.

On average, workers in good matches experience a higher wage growth than workers on non-converted fixed-term contracts, which is in line with our initial predictions. The observed average wage growth associated with good matches is equal to 4.02%, while workers with non-converted fixed-term contracts experience an average wage growth of 3.20% between 2003 and 2009. Thus, the mean wage growth differential between non-converted and converted fixed-term contracts is equal to -0.81 pp., which is statistically significant at standard significance levels.

The results show that more than 91% of this differential is due to differences in the remuneration of characteristics between both types of match. Good worker-firm matches not only appear to be better rewarded for their characteristics but also to have better endowments. Both effects and their interaction are statistically significant at standard significance levels.

However, as shown in the previous subsection, it is important to account for the selectivity bias arising from the correlation between the conversion of the contract and the subsequent wage growth. To do so we decompose the mean selectivity corrected wage growth differential (equations 5 and 6) by adapting Reimers (1983)'s methodology and estimating the contribution of the selectivity effect equals to: $-\widehat{\sigma}_b\widehat{\rho}_{b\varepsilon}\frac{\phi(w'_{mt}\widehat{\omega}+\Pi'_t\widehat{\tau}+D'_t\widehat{\delta})}{(1-\Phi(w'_{mt}\widehat{\omega}+\Pi'_t\widehat{\tau}+D'_t\widehat{\delta}))} - \widehat{\sigma}_g\widehat{\rho}_{g\varepsilon}\frac{\phi(w'_{mt}\widehat{\omega}+\Pi'_t\widehat{\tau}+D'_t\widehat{\delta})}{\Phi(w'_{mt}\widehat{\omega}+\Pi'_t\widehat{\tau}+D'_t\widehat{\delta})}$. According to the results in Table 4, the selectivity effect is statistically significant and widens the wage growth differential. When this effect is considered, the contribution of the characteristics (endowment effect) to the wage growth differential increases to over 51% and the coefficient effect no longer

Table 4
Threefold Decomposition of the Wage Growth Differential

Sample	E[Wb|p=0]	E[Wg|p=1]	Differential	Endowments	Coefficients	Interaction	Selectivity
Overall	3.203	4.016	-0.813***	-0.247***	-0.742***	0.175***	no
contribution (%)				-30.32%	-91.17%	21.49%	
legislation				0.000	-0.144***	0.000*	
contribution (%)				0.01%	-17.72%	0.05%	
Overall	3.203	4.016	-0.813***	-0.418***	0.255	0.346***	-0.997***
contribution (%)				-51.39%	31.38%	42.55%	-122.54%
legislation				0.000	-0.121***	0.000*	
contribution (%)				0.02%	-14.86%	0.04%	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Quadros de Pessoal, 2002-2009. Note: Threefold decomposition with normalized results and converted fixed-term contracts as the reference group.

contributes significantly to explaining the wage growth gap. If converted fixed-term matches had the characteristics of non-converted matches, they would experience a decrease of approximately 0.42 pp. in their wage growth rate, ceteris paribus.

Finally, we focus on the specific contribution of the variable accounting for the change in legislation to the wage growth differential. As expected, the endowment effect of the change in legislation does not significantly contribute to the wage growth differential since the reform applies to all fixed-term contracts. Instead, the change in legislation contributes to increase the wage growth differential through the coefficient effect ($\overline{D}'_{gt}(\widehat{\delta}_b - \widehat{\delta}_g)$). We estimate that almost 18% of the gap in the sample period is attributed to the way both groups were affected by the reform that eased the regulations on fixed-term contracts. This contribution slightly drops to approximately 15% when the selectivity effect is taken into account.

5.5. Robustness Analysis

The first robustness check consists of assessing the sensitivity of the results to different wage definitions and we therefore re-estimate the second stage of the model and the threefold decomposition using alternative and stricter wage definitions.

In Table B3, we present results in which overtime pay is excluded and the wage is defined as the sum of base wages and regular benefits. The results seem to be robust to this alternative wage definition since not only do good matches experience an increase in wage growth of approximately 1.2 pp. at the time of conversion but, when the change in legislation was in force, converted fixed-term contracts seem to have experienced a non-significant and lower wage growth penalisation (-0.007 pp.) than non-converted fixed-term contracts (-0.47 pp.)[22]. When the overtime pay component is excluded from the wage definition, this wage growth penalisation associated with the increase in the protection gap between the two types of contract is slightly lower, which may

[22] The p-value of the Wald test of the equality of coefficients is equal to 0.0000.

indicate that workers are also penalised by the payment for these hours or may reduce the amount of overtime hours worked when their employment protection level decreases. The results of the wage growth decomposition are also robust: the selectivity effect and the coefficient effect of the change in legislation contribute to increase the wage growth differential between non-converted and converted fixed-term contracts and are statistically significant at a 5% and 1% significance levels, respectively[23].

Further, we repeat the analysis considering only the growth of the hourly base wages (Table B4). We find that the results are not robust to this wage definition, since the wage growth penalty associated with the change in legislation does not seem to differ significantly between converted and non-converted fixed-term contracts[24]. However, this stricter wage definition still allows us to conclude that workers in good matches are rewarded with a higher growth rate of base wages, especially female workers. We also find that the selectivity effect and the change in legislation no longer contribute significantly to explain the wage growth differential between both types of matches[25]. This result is not surprising since base wages are more restricted by institutions such as minimum wage and collective bargaining and, thus, there is less scope to the effect of the change in legislation to be heterogeneous according to match quality.

Since the construction sector is strongly influenced by seasonality and where the share of non-converted fixed-term contracts is higher than that of converted fixed-term contracts, the sensitivity of the results to the exclusion of this sector should also be assessed[26]. The results were quite similar to those discussed in Subsection 5.3, with the exception that when construction is not included in the estimation not only do workers experience an increase in wage growth when the contract is converted (1.56 pp.), but also a wage growth penalisation when the contract is not converted (-0.26 pp.); both are statistically significant at a 1% significance level. Workers in good matches are significantly less affected by the change in legislation than workers with non-converted contracts, although its impact becomes slightly more negative for both groups. The contribution of the selectivity effect and the change in legislation to the wage growth differential remains negative and statistically significant at standard levels.

The employment protection gap between fixed-term and open-ended contracts increased more in firms with 11 to 20 employees, since the 2004 change in legislation also increased the employment protection of open-ended contracts for this cohort (Centeno & Novo (2012) and Centeno & Novo (2014) study the impact of this change in excess worker turnover and wages, respectively). By excluding these firms from the sample, we find that the results discussed in the previous subsections are robust and not exclusively driven by them[27].

Finally, the 2004 Labour Code revision introducing the change in legislation under study also introduced a penalisation in the social security contribution for firms that have more than 15% of the total employees on a fixed-term contract with more than four years' duration. After

[23] Results available upon request.
[24] The p-value of the Wald test of the equality of coefficients is equal to 0.5580.
[25] Results available upon request.
[26] Results available upon request.
[27] Results available upon request.

converting the contract to a permanent one, the firm can benefit from a reduction in the social security contribution. Since firms with a higher proportion of these contracts may also have had an incentive to convert them, in Table B5, we present the results of the Probit model estimation considering the interaction between the one period lagged value of the proportion of fixed-term contracts and the legislation dummy. In firms with a higher proportion of fixed-term contracts, the probability of converting the contract was less penalised by the legislation that facilitated their use. However, this effect is negligible which may indicate that this type of measure promoting the conversion of fixed-term contracts is less effective when accompanied by measures increasing the flexibility on their use. The impact of the change in legislation on the wage growth of non-converted contracts remains statistically significant at standard levels and is more negative in firms with a higher proportion of fixed-term contracts (Table B6). As expected, in these firms the legislation contributes more to increase the wage growth differential between both types of match[28].

6. CONCLUSIONS AND POLICY IMPLICATIONS

Fixed-term contracts can play different roles in the labour market and therefore be unequally affected by asymmetric reforms that increase the employment protection gap between fixed-term and open-ended contracts. Our results show that it is relevant to consider match quality to assess how a reform that facilitates the use of fixed-term contracts affects their wage growth.

By estimating an endogenous regime switching model, we find that the 2004 change in the Portuguese employment protection legislation that eased the regulations on fixed-term contracts had a negative impact on match quality, measured by the probability of conversion of fixed-term contracts. However, we find evidence that not all fixed-term contracts are evenly affected by this type of reform. Not only is the conversion of the contract associated with a non-negligible increase in wage growth, but the wage growth experienced by workers in good matches, i.e., with converted fixed-term contracts, also seems to be less penalised by the asymmetric reform. In fact, in the years when the change in legislation was in force, workers on converted fixed-term contracts seem to have experienced a lower wage growth penalisation (-0.16 pp.), than those on non-converted fixed-term contracts (-0.55 pp.). Moreover, the change in legislation also had an indirect negative impact on the wage growth of both types of match, especially for non-converted fixed-term contracts, through the link between the conversion of the contract and the wage growth; this draws attention to the potential negative externalities of this type of employment protection reform. On average, we find that the change in legislation contributed to increase the wage growth differential between non-converted and converted fixed-term contracts in approximately 15%, ceteris paribus.

This paper aims to contribute to the ongoing discussion about the role of fixed-term contracts in the labour market and the impact of reforms that ease regulations on their use. We argue

[28] Results available upon request.

that the burden of the adjustment of this type of reform is not spread homogeneously among workers on fixed-term contracts. On average, less than one fourth of fixed-term contracts are converted in open-ended contracts in the Portuguese labour market and employment protection reforms that facilitate their use generate potential inefficiencies by penalising and delaying the access of workers on fixed-term contracts to a more stable employment relationship. This may entail negative effects on labour productivity and human capital acquisition, since workers on this type of contract experience higher turnover rates (Centeno & Novo (2012)) and participate less in training activities (Booth *et al.* (2002)) than workers on open-ended contracts. Our results also show that this type of reform contributes to increase the wage inequality between workers on converted fixed-term contracts and those who were not able to exit temporary employment. Tackling labour market segmentation may help to reduce inequality among workers. The future research agenda should assess the impact of the introduction of a single contract with increasing severance payments (Bentolila *et al.* (2011)), which could contribute to increase employment duration and decrease unemployment (Pérez & Osuna (2014)). Futher research also needs to be conducted in order to conclude about the impact of employment protection reforms, namely on employment level and non-pecuniary aspects of the employment relationship, such as the likelihood of promotion to a higher occupational level within the firm. Indeed, conversion to an open-ended contract may also be associated with access to career ladders, which would further amplify the negative impact of asymmetric reforms that increase the employment protection gap between fixed-term and open-ended contracts.

7. APPENDIX

7.1. Appendix A-Description of variables

Worker's characteristics:

- Nationality: 1 dummy variable- immigrant (1 if immigrant and 0 if native),
- Gender: 1 dummy variable- female (1 if female and 0 if male),
- Education: 7 dummy variables- less than 4 years of schooling; 4 years of schooling; 6 years of schooling; 9 years of schooling; 12 years of schooling; Bachelor degree and University education,
- Age: continuous variable measured in years,
- Tenure: 7 dummy variables- $tenure_1$ (1 year), $tenure_2$ (2 years), $tenure_3$ (3 years), $tenure_4$ (4 years), $tenure_5$ (5 years), $tenure_6$ (6/7 years),
- Occupation (Portuguese Classification of Occupations 2010): 8 dummy variables- managers, experts, technicians, administrative staff, salespeople, craftsmen, plant and machine operators, unqualified workers.

Firm's characteristics:

- Dimension: 5 dummy variables- $dimension_0$ (1-10 employees), $dimension_1$ (11-20 employees), $dimension_2$ (21-100 employees), $dimension_3$ (101-400 employees), $dimension_4$ (>400 employees),
- Region: 7 dummy variables- North, Lisbon, Algarve, Centre, Alentejo, Azores, Madeira,
- Sector of activity: 6 dummy variables- extractive industries, manufacturing, electricity production and distribution, construction, public administration, services,
- Share of fixed-term contracts: 1 continuous lagged variable ($proportion_{t-1}$) in percentage of total number of employees,
- Capital Ownership: 2 continuous variables- share of foreign capital in percentage and share of public capital in percentage.

7.2. Appendix B-Tables

Table B1
Descriptive Statistics

Variables	Non-converted FTC	Converted FTC	Whole Sample
Female (%)	45.04	46.00	45.26
Immigrant (%)	8.15	5.98	7.65
age (years)	34.10	33.03	33.86
	(9.83)	(9.27)	(9.71)
Education (%)			
<= 1st cycle	17.51	13.85	16.67
2nd cycle	19.69	17.14	19.11
3rd cycle	26.05	25.74	25.98
secondary education	23.32	26.62	24.07
bachelor degree	2.33	2.79	2.43
college	11.11	13.84	11.73
Tenure (%)			
1	47.30	28.99	43.13
2	26.43	33.74	28.10
3	12.60	22.97	14.96
4	7.13	7.72	7.26
5	3.87	3.63	3.82
6	1.94	1.92	1.94
7	0.73	1.03	0.80
Occupation (%)			
Managers	1.20	1.34	1.23
Experts	8.68	9.52	8.87
Intermediate-level technicians	10.59	11.05	10.70
Administrative staff	13.86	16.29	14.42
Sellers	22.59	24.99	23.14
Craftsmen	17.08	14.26	16.44
Plant and Machine Operators	12.22	11.71	12.10
Unqualified workers	13.77	10.84	13.10
Sector of Activity (%)			
Extractive Industries	0.38	0.36	0.38
Manufacturing	20.04	21.06	20.28
Electricity	0.40	0.54	0.43
Construction	14.12	9.59	13.08
Public Administration	2.22	0.37	1.80
Services	62.84	68.09	64.03
Region (%)			
North	28.61	27.42	28.34
Lisbon	36.36	42.12	37.68
Algarve	6.39	4.27	5.90
Alentejo	4.78	4.22	4.65
Centre	19.31	17.11	18.81
Azores	1.70	1.85	1.74
Madeira	2.85	3.01	2.88
Firm's Dimension (%)			
<=10	26.47	17.56	24.44
11 to 20	12.04	9.43	11.45
21 to 100	31.21	27.25	30.31
101 to 400	17.52	21.68	18.47
>=401	12.76	24.07	15.34
real wage (log)	1.50	1.59	1.52
	(0.41)	(0.43)	(0.42)
wage growth (%)	3.20	4.02	3.39
	(11.10)	(11.92)	(11.29)
overtime (hours)	2.09	2.33	2.15
	(9.26)	(9.66)	(9.36)
Observations	906,442	267,827	1,174,269

Source: Quadros de Pessoal, 2002-2009. Note: FTC stands for fixed-term contract. Standard deviations in parentheses.

Table B2
Distribution of Open-ended and Fixed-term Contracts by Wage and Wage Growth Decile (%)

Wage Decile	OEC	FTC
1	9.48	12.74
2	9.43	13.04
3	9.32	13.55
4	9.55	12.40
5	9.74	11.38
6	9.89	10.58
7	10.11	9.44
8	10.21	8.91
9	10.83	5.62
10	11.45	2.33

Wage Growth Decile	OEC	FTC
1	9.84	10.85
2	10.93	9.20
3	9.52	8.43
4	10.18	9.07
5	10.32	8.33
6	10.19	8.97
7	10.10	9.50
8	9.86	10.73
9	9.80	11.08
10	9.27	13.84
Observations	6,211,944	1,174,269

Source: Quadros de Pessoal, 2002-2009. Note: OEC stands for open-ended contract and FTC stands for fixed-term contract (converted and non-converted).

Table B3: Determinants of the Growth Rate of Base Wages and Regular Benefits of Converted and Non-converted Fixed-term Contracts

	(1)			(2)			(3)		
	Whole Sample		Wald Tests	Males		Wald Tests	Females		Wald Tests
VARIABLES	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value
inverse mills ratio	0.260	0.997***	0.0437	0.614*	2.066***	0.0161	-0.294	-0.271	0.9575
	(0.202)	(0.281)		(0.317)	(0.467)		(0.251)	(0.331)	
legislation	-0.465***	-0.00721	0.0000	-0.320***	-0.0831	0.0488	-0.653***	0.0882	0.0000
	(0.0382)	(0.0752)		(0.0538)	(0.109)		(0.0537)	(0.103)	
Constant	-2.178***			-0.0712			-4.763***		
	(0.229)			(0.338)			(0.308)		
Observations	1,174,269			642,813			531,456		
Adjusted R-squared	0.035			0.032			0.042		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Quadros de Pessoal, 2002-2009. Note: GLS regression with standard errors clustered in nmatch. The dependent variable is the growth rate of base wages plus regular benefits. 4 years school, 6 years school, dimension_4 and electricity excluded for identification purposes. The control variables included are immigrant, female, education dummies, tenure dummies, occupation dummies, age, agesq, firm's dimension dummies, region dummies, unemployment rate, capital ownership, lagged share of FTC, sector dummies and year dummies. Wald test of equality of the coefficients between converted and non-converted fixed-term contracts.

Table B4: Determinants of the Growth Rate of Base Wages of Converted and Non-converted Fixed-term Contracts

	(1)			(2)			(3)		
	Whole Sample		Wald Tests	Males		Wald Tests	Females		Wald Tests
VARIABLES	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value
inverse mills ratio	-0.352	2.295***	0.0000	0.971***	2.301***	0.1044	-1.395***	2.666***	0.0000
	(0.255)	(0.441)		(0.358)	(0.615)		(0.346)	(0.593)	
legislation	-0.964***	-1.009***	0.5580	-0.803***	-0.734***	0.5157	-1.185***	-1.361***	0.1002
	(0.0305)	(0.0678)		(0.0422)	(0.0946)		(0.0436)	(0.0953)	
Constant	-4.395***			-1.374***			-7.614***		
	(0.235)			(0.329)			(0.320)		
Observations	1,174,269			642,813			531,456		
Adjusted R-squared	0.068			0.063			0.080		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Quadros de Pessoal, 2002-2009. Note: GLS regression with standard errors clustered in nmatch. Dependent variable is the growth rate of base wages. Immigrant, 4 years school, 6 years school, 9 years school and lisbon excluded for identification purposes. The control variables included are immigrant, female, education dummies, tenure dummies, occupation dummies, age, agesq, firm's dimension dummies, region dummies, unemployment rate, capital ownership, lagged share of FTC, sector dummies and year dummies. Wald test of equality of the coefficients between converted and non-converted fixed-term contracts.

Table B5
Impact of the change in legislation on probability of conversion of the contract for firms with a higher proportion of fixed-term contracts

	Whole Sample		Males		Females	
VARIABLES	Estimates	AME	Estimates	AME	Estimates	AME
legislation	-0.122***	-0.0301	-0.131***	-0.0290	-0.114***	-0.0315
	(0.00659)		(0.00890)		(0.00983)	
proportion_{t-1}	-0.00630***	-0.0017	-0.00659***	-0.0017	-0.00595***	-0.0017
	(9.11e-05)		(0.000125)		(0.000134)	
$\text{proportion}_{t-1} \times leg$	0.000320***		0.000588***		6.18e-05	
	(0.000104)		(0.000143)		(0.000153)	
Constant	0.132***		0.139***		0.110**	
	(0.0280)		(0.0371)		(0.0429)	
Observations	1,174,269		642,813		531,456	
ll	-581250		-316550		-263983	
$r2_p$	0.0781		0.0763		0.0827	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Quadros de Pessoal, 2002-2009. Note: Probit regression with standard errors clustered in nmatch. The control variables included are immigrant, female, education dummies, tenure dummies, occupation dummies, age, agesq, firm's dimension dummies, region dummies, unemployment rate, capital ownership, industry dummies and year dummies. AME stands for Average Marginal Effects

Table B6: Impact of the change in legislation on wage growth for firms with a higher proportion of fixed-term contracts

	(1)			(2)			(3)		
	Whole Sample		Wald Tests	Males		Wald Tests	Females		Wald Tests
VARIABLES	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value	Non-converted FTC	Converted FTC	p-value
inverse mills ratio	0.319	1.076***	0.0403	0.561*	1.953***	0.0230	-0.162	-0.0246	0.7551
	(0.205)	(0.284)		(0.323)	(0.474)		(0.254)	(0.334)	
legislation	-0.200***	-0.103	0.4251	-0.125	-0.118	0.9688	-0.362***	-0.154	0.2190
	(0.0595)	(0.108)		(0.0847)	(0.155)		(0.0822)	(0.150)	
proportion_{t-1}	0.00234**	-0.0169***	0.0000	0.000125	-0.0205***	0.0000	0.00516***	-0.0124***	0.0000
	(0.000922)	(0.00228)		(0.00137)	(0.00354)		(0.00122)	(0.00298)	
$\text{proportion}_{t-1} \times leg$	-0.00629***	-0.00123	0.0115	-0.00535***	-0.00343	0.4982	-0.00632***	0.00294	0.0009
	(0.000850)	(0.00182)		(0.00121)	(0.00257)		(0.00117)	(0.00255)	
Constant		-2.208***			0.0223			-4.893***	
		(0.233)			(0.344)			(0.312)	
Observations		1,174,269			642,813			531,456	
Adjusted R-squared		0.033			0.030			0.041	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Quadros de Pessoal, 2002-2009. Note: GLS regression with standard errors clustered in nmatch. 4 years school, 6 years school, dimension_4 and electricity excluded for identification purposes. The control variables included are immigrant, female, education dummies, tenure dummies, occupation dummies, age, agesq, firm's dimension dummies, region dummies, unemployment rate, capital ownership, lagged share of FTC, sector dummies and year dummies. Wald test of equality of the coefficients between converted and non-converted fixed-term contracts.

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