DUAL LABOR MARKETS AND PRODUCTIVITY

Rocío Madera Holgado

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CEMFI
Casado del Alisal 5; 28014 Madrid
Tel. (34) 914 290 551. Fax (34) 914 291 056
Internet: www.cemfi.es

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Abstract

The present study analyzes cross-country and sectoral differences in productivity levels and growth in eleven European Union-15 countries and the United States and twenty-two sectors from 1995 to 2007. The aim of this paper is to evaluate the role of dual labor markets as a result of the proliferation of two-tier reforms in recent years in explaining the big differentials in productivity observed especially in Europe. This is done by computing both sectoral and aggregate cross-country estimates which verify whether this increase in duality has any detrimental effect on productivity outcomes. Estimates show that segmented labor markets have a negative and significant effect on labor productivity growth, while the result is not conclusive for total factor productivity growth and absent in labor productivity level. By contrast, the role of these two-tier reforms is not necessarily different in industries with a higher propensity to make adjustments through dismissals (high-reallocation industries) in any of the cases.

Rocío Madera Holgado
University of Minnesota
rocio.madera.holgado@gmail.com

1 Introduction

During the last two decades, European countries have experienced both an important slowdown in productivity with respect to the United States and an increase in productivity cross-country heterogeneity. At the same time, from the early 1990s, large-scale liberalizations of labor markets have taken place all around the European Union in order to promote job creation and decrease the high unemployment rates. These reforms, in most cases, did not change employment protection for regular contracts but mainly introduced new types of fixed-term contracts and expanded the scope of existing ones. The immediate consequence has been a segmented labor market in which highly protected workers (under open-ended contracts) coexist with almost completely unprotected ones (under fixed-term contracts), reaching the latter group an extremely high share of the active population in some countries.

Structural labor market reforms are usually backed on the grounds of efficiency. However, the reasons behind these dual reforms are political rather than economic. When the share of workers under permanent contracts (insiders) is sufficiently high in relation to the share of workers who are either under fixed-term contracts or unemployed (outsiders), governments may find a strong opposition against the relaxation of protection for permanent contracts and prefer to implement two-tier reforms. Saint-Paul (2002) analyzes in detail the political economy of employment protection reforms and shows that two-tier reforms offer a mechanism to obtain the political support of insiders. Even though they are not designed in order to increase efficiency, marginal reforms may influence productivity in different ways. This paper analyzes the role of these labor market policies in explaining the increase in productivity differences across countries.

The way in which employment protection legislation (EPL hereafter) and, in particular, two-tier reforms affect productivity is *a priori* ambiguous. High firing costs constrain firms by making it more difficult to react quickly to changes in technology or demand that require adjustments of the labor force and especially those firms characterized by rapid technological change (Samaniego 2006). There is thus a possible negative effect on total factor productivity (TFP hereafter) growth. Moreover, there is a potential detrimental effect on labor productivity level, through the lower requirements from firms in order to hire a worker under an almost dismissal-costs-free contract.

On the other hand, few positive implications have been have been suggested.

A scenario characterized by high protection for permanent contracts encourages long-term relationships between employers and workers that favors specific investments and learning-by-doing. Furthermore, temporary contracts may serve as stepping-stones for better matches in the future when transformed to permanent, which may even foster the effect of later specific investments. However, due to the two-tier reforms, the increased gap between regulations of both types of contracts makes the conversion-to-permanent rate very low, blocking these potential positive effects of the liberalization of fixed-term contracts. Low constraints on hiring under fixed-term contracts, while keeping those for permanent contracts high, promote substitution of temporary for permanent workers.

The two types of policies (high protection of permanent and low protection of temporary contracts) are therefore not necessarily harmful alone, but, when implemented together, they incentivize firms to take advantage at the margin and execute most new hirings on a temporary basis, yielding a process of inefficient turnover in which all hirings and separations are done almost exclusively through fixed-term contracts. Due to the unenforceable nature of specific investments, when training cannot be contracted given the temporary nature of the job, economies are characterized by under-investment in human capital, with lower labor productivity (LP hereafter) both in levels and growth.

While theory provides some predictions about the expected effects of EPL on labor flows, it is more difficult to find such clear conclusions on the effect on stocks or productivity. An increasing theoretical interest on the behavior of different employment outcomes and productivity in countries characterized by segmented labor markets has recently manifested in the literature. Blanchard and Landier (2002) and Cahuc and Postel-Vinay (2002) discuss the macroeconomic effects of flexibility obtained through marginal reforms and conclude that they increase both job turnover and unemployment. A new recent theoretical evidence uses models à la Mortensen-Pissarides and allow for different types of contracts, this is the case of Bentolila, Cahuc, Dolado and Le Barbanchon (2010) or Costain, Jimeno and Thomas (2010), which conclude that two-tier reforms have detrimental effects for unemployment and labor market volatility, respectively.

The difficulty to model employment protection institutions without treating them as a mere adjustment cost for the firm and capturing possible complementarity with other policies makes it a promising ground for empirical analysis. Few studies have estimated the influence of measures of employment protection

on productivity. Cross-country analyses have tried to explain differences in productivity based on differences on labor market policies and institutions, either by means of aggregate regression (Nickell and Layard 1999) or using difference-in-differences and exploiting cross-industry variation (Bassanini, Nunziata and Venn 2009, Micco and Pagés 2008). They find different results, the former paper finds a positive effect of EPL on productivity while the latter group of studies find depressing effects, especially on industries with higher turnover, though not completely contradictory as they are measuring different concepts, as will be argued below.

Results based only on the analysis of the effects of regulations on permanent contracts have to be interpreted taking into account two effects: while a high degree of stringency may be interpreted only as a constraint in the ability of firms to make adjustments and, thus, as a limitation to their potential efficiency; it can also be the case that strict legislations on permanent contracts incentivize a substitution effect that make firms hire workers on a temporary basis when they are able to do so. Thus, the negative effect on productivity we observe in many empirical studies may reflect both the restrictions to free labor adjustments and this increase in hirings on temporary contracts in countries where regulations for the latter are lax. This close relationship between both types of legislations suggests that they cannot be studied in isolation. Analyzing the effects of EPL without taking into account dual labor market structures may yield misleading results by ignoring possible interactions between fixed-term contracts and permanent ones and their respective regulations.

The aim of this paper is thus to evaluate the role of these institutional changes in explaining the big differentials in productivity seen especially in European Union economies. This is done by computing both industry-level and aggregate cross-country estimates which verify whether this proliferation of dual labor market structures has any detrimental effect on productivity outcomes, namely labor productivity levels, labor productivity growth and TFP growth.

I find that, by estimating the effects of both restrictions on regular contracts alone and in relation to low constraints on temporary forms of employment, there is a significant and negative effect of dual labor markets on labor productivity growth. By contrast, results for labor productivity levels and TFP growth are rather inconclusive. The intuitive explanation for these conclusions is that two-tier reforms yield a process of inefficient turnover as explained above, decreasing

incentives for specific-investments and learning-by-doing, and thus labor productivity growth. The effect is not necessarily different in industries with a higher propensity to make adjustments through dismissals (high-reallocation industries) in almost all cases.

The main improvement of this paper with respect to previous empirical investigations is the estimation of a measure of duality in the labor market in order to later analyze the effects of the existence of dual structures. By providing a way to include interactions between EPL for temporary and permanent contracts in addition to the standard practice of including only the latter, I will be able to disentangle the consequences of high firing costs alone and in combination with lax regulations on the use of temporary contracts, capturing the possible spillovers between both. This is the first time that a proxy for duality has been provided based on cross-country information.

The rest of the paper is organized as follows: Section 2 reviews cross-country differences and previous theoretical and empirical findings on the effects of employment protection institutions on productivity outcomes. Section 3 looks for a measure of the presence and degree of duality in each country given the problems associated to the construction of EPL indices, especially in the case of temporary contracts. Section 4 presents the data and the empirical approach for the baseline specification. Section 5 discusses the estimates and results for the different dependent variables. Section 6 proposes different specifications to obtain further results and a sensitivity analysis. Section 7 concludes.

2 Dual labor markets and productivity: facts and literature review

2.1 Theory and previous empirical evidence

Many studies have looked at the influence of labor market protection policies on employment and unemployment but have devoted less efforts to the analysis of their implications of welfare-related outcomes like productivity.

Theory provides some predictions about the expected effects of EPL on labor flows, but it is more difficult to find such clear conclusions on the effect on stocks or productivity. Bentolila and Bertola (1990) show that high firing costs discourage both hirings and firings, with a later decrease in job turnover but an ambiguous overall effect on employment. Mortensen and Pissarides (1999) obtain similar

conclusions by concluding that firing costs depress job mobility. Garibaldi (1998) and Hopenhayn and Rogerson (1993) argue that employment protection reforms on permanent contracts distort reallocation of resources from declining to more productive firms and sectors, yielding a negative effect on innovative activities.

However, in all of the cases so far EPL is taken as being a mere adjustment cost and does not allow for possible positive effects derived from human capital accumulation in the case of legislation on permanent contracts. Wasmer (2006) shows that when workers expect to form a long-term relationship with the firm, their incentives to invest in firm-specific skills increase. Furthermore, since these specific investments are unenforceable, firing costs may help reducing hold-up problems (Belot, Boone and Van Ours 2007).

In the studies mentioned so far EPL is identified with firing costs. An increasing theoretical interest on the behavior of different employment outcomes and productivity in countries characterized by segmented labor markets has recently manifested in the literature. Blanchard and Landier (2002) and Cahuc and Postel-Vinay (2002) discuss the macroeconomic effects of flexibility obtained through marginal reforms and conclude that they increase both job turnover and unemployment. Boeri and Garibaldi (2007) argue that marginal reforms have a transitional honeymoon effect in which a short-run increase in job creation takes place. By means of a dynamic model of labor demand under uncertainty, they conclude that after this transitional period there should be a reduction in employment and a decrease in the marginal product of labor.

A new recent theoretical evidence allow models à la Mortensen-Pissarides to have two types of contracts: permanent and temporary, this is the case of Bentolila et al. (2010) or Costain et al. (2010), which conclude that two-tier reforms have detrimental effects for unemployment and labor market volatility, respectively.

The problems to allow for both positive and negative effects of EPL and to include possible complementarities with other policies in a model explains the increasing empirical evidence on the subject, which can be classified in two groups: cross-country (or cross-country/cross-industry) and country-specific studies.

Cross-country analyses have tried to explain differences in productivity based on differences on labor market policies and institutions. Nickell and Layard (1999) compute aggregate cross-country estimates of labor productivity growth for the period 1976-1992 and find a positive effect of employment protection in OECD countries. The intuition is that productivity growth depends strongly on learning-

by-doing and workers' cooperation, which are increased by higher firing costs. By contrast, most recent evidence have relied on Rajan and Zingales (1998) methodology to overcome a possible problem of omitted variable in cross-country analysis. Using difference-in-differences and exploiting cross-industry variation Bassanini et al. (2009) and Micco and Pagés (2008) and Cingano, Leonardi, Messina and Pica (2010) find depressing effects of higher regulation on permanent contracts on productivity, especially in those industries with higher reallocation rate, where dismissal restrictions tend to be more binding.

Notice that the apparently opposite results in previous cross-country studies are not contradictory. While aggregate regression estimates identify an homogeneous relationship across industries, capturing spillovers from human capital accumulation that are not a consequence of the partial-equilibrium responses of firms; difference-in-differences estimates are relegated to explain only reactions to EPL from the point of view of employers' reactions when they see their optimal strategies constrained, with a stronger effect for those that present higher turnover. Thus, a positive aggregate and a negative partial-equilibrium results are perfectly conciliable.

The introduction of the two-tier reforms has been better analyzed by country-specific studies, mainly taking advantage of exemptions and gradual or regional implementation of EPL policies. Boeri and Jimeno (2005) assess the differential effect on firms that are exempted from EPL (below 15 employees) and find that in Italy the firing probabilities of permanent workers increase with respect to those of temporary workers in those firms. Dolado and Stucchi (2008) first develop a simple model to show that workers' effort positively depends on their expectation of firms converting them to permanent. They analyze empirically this result using firm-level data for Spain and find that, in line with the predictions of the model, high shares of temporary contracts decrease TFP while high conversion-to-permanent rates increase it.

Despite the increasing concern on marginal reforms, vary few cross-country analyses have been performed to establish a relationship between dual labor markets and productivity. Only some references to temporary contracts legislation appear in recent papers (e.g. Bassanini et al. (2009)). With this thesis I will try to fill this gap by using cross-country differences in EPL to estimate to what extent dual labor structures are important for productivity.

2.2 Cross-country differences in EPL and two-tier reforms

This section is a review of cross-country differences in EPL institutions and policies, paying special attention to those reforms in some countries that have liberalized the use of temporary contracts while keeping constraints on permanent ones unchanged, and may have strongly influenced their productivity.

EPL refers to the set of mandatory restrictions governing the dismissals and recruitment of employees. In the case of protection for workers under permanent contracts (EPLR hereafter), these include both monetary (severance payments) and procedural costs derived from dismissals. When talking about legislation on temporary contracts (EPLT hereafter), it covers hiring rather than firing restrictions, concretely the cases under which a fixed-term contract can be offered and the maximum length and number of renewals allowed before the employee is either converted to permanent or dismissed. Additionally, a set of provisions are specified in the case of collective dismissals in the form of extra procedural inconveniences for the employer.

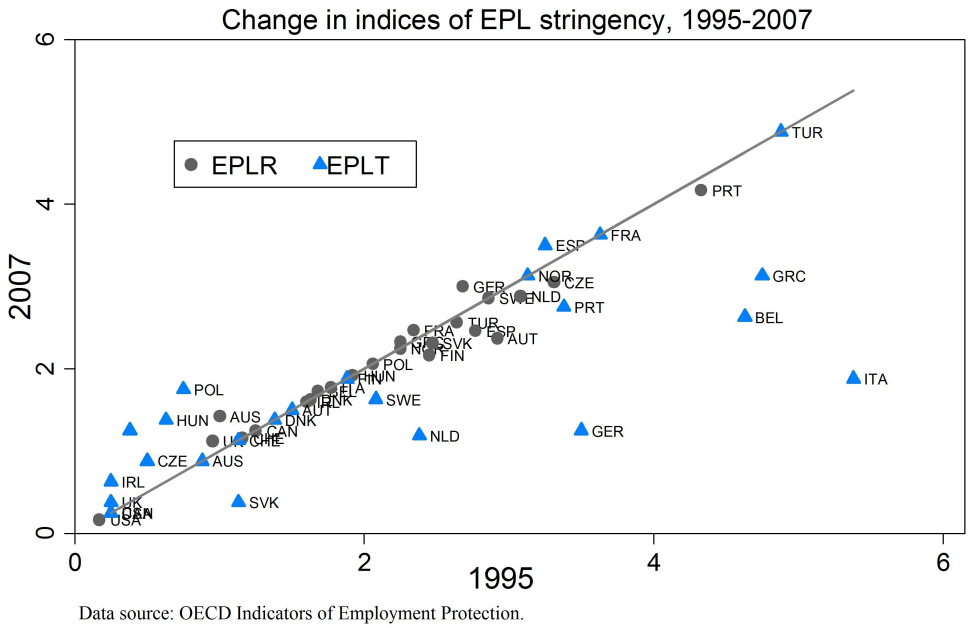
All these concepts are going to be measured by the OECD indicators of employment protection, which range from 0 to 6. It is important though to bear in mind that these represent a *legal minima* in the sense that they can later be strongly affected by collective agreements and by the degree of regulation enforcement, which might vary a lot between countries and with the state of the economy. Both the construction of the OECD indicators and the difficulties derived from the lack of a measure of enforcement related to EPL policies will be extensively discussed in the next section.

Although European Union members have experienced a convergence in terms of institutions, labor market policies remain considerably heterogeneous. While English speaking countries are characterized by flexible labor regulations in all types of hirings, Southern European countries share a long tradition of very high firing costs and stringent regulations in general. In an attempt to decrease the high structural unemployment, the latter have implemented a set of liberalization reforms in the last two decades. These reforms usually did not change EPL for regular contracts but introduced new types of fixed-term contracts and expanded the scope of existing ones. According to the World Economic Outlook (2010)[1] , only four of the 26 OECD members did not change regulations on temporary contracts in the last 20 years and 92% of EPL regulatory changes involving a

[1]Chapter 3, Box 3.1.

change in the level of overall legislation did not apply to workers with permanent contracts[2].

Figure 1: Two-tier reforms



Data source: OECD Indicators of Employment Protection.

Figure 1 is a simple graphical representation of the extended liberalizations targeted almost exclusively to fixed-term contracts restrictions. A broad picture of cross-country differences shows that both countries with stringent and lax regulations in permanent contracts have kept it almost unchanged, given that most points corresponding to regular contracts lie on the 45-degree line. The highest reform is recorded in Austria, which has decreased EPLR by 0.5. Conversely, Germany has slightly increased protection for permanent workers (by 0.32).

Constraints on the use of temporary contracts, however, have suffered important changes in the period. As it will be argued in the next section, the level of this index can be misleading, and especially in those countries of our interest. Thus, when referring to the EPLT index, only those pictures and related comments that apply to its changes and variations rather than levels are considered. Most of the countries that have eased EPLT are above the mean on EPLR, indicating that these refer mainly to two-tier reforms. The most important case is that of Italy, which adopted a large-scale liberalization for temporary employ-

[2]Fondazione Rodolfo Debenedetti in cooperation with the Institute for the Study of Labor (IZA).

ment, introducing new forms of atypical contracts, with a subsequent decrease of the EPLT index of 3.5 points. Among those countries that increased constraints on fixed-term contracts (Hungary, Ireland, the Czech Republic, Spain, Poland and the UK), all of them with the exception of Spain are countries characterized by flexible labor markets. The case of Spain is special, since this picture is showing the "second part" of a reform that had previously strongly liberalized the use of these contracts and was now trying to somehow manage the out-of-control share of temporary workers.

2.3 Duality, temporary contracts and worker flows

Many countries in Europe have seen their shares of temporary work increased dramatically in the last two decades as a result of the marginal reforms. By contrast, in other countries a flexible labor market and a stable and low share of temporary contracts coexist by keeping their stringency in EPL low in both types of contract. The theoretical predictions of the effect of regulation on the number of temporary contracts is somehow straightforward. If constraints on their use are diminished while keeping those for regular contracts high, firms will substitute temporary for permanent workers if costs of dismissal of fixed-term contracts are low (Boeri and Garibaldi 2007). This implies that the effect of regulation on temporary forms of employment cannot be analyzed in isolation, but it is conditional to the degree of stringency of EPL for permanent contracts.

Costain et al. (2010) analyze the cyclical consequences of allowing hiring under two different types of contracts, temporary and permanent, by means of a model à la Mortensen-Pissarides. They find that an important share of *fragile* jobs are created during expansions which are then destroyed in recessions, increasing volatility in the labor market. While theory suggests that the effect of EPL on employment stocks is ambiguous, there is an agreement on the fact that countries with high firing costs experience in principle lower rates of worker flows. Spain is a country characterized by very costly labor adjustments, and still it has one of the highest rates of reallocation of workers, even higher than countries that have very low EPL, such as Ireland or the US. Most of this turnover is due to the accumulation of *fragile* temporary jobs. Since the productivity threshold at which firms are willing to convert fixed-term to permanent contracts is above that required to keep a permanent worker, lower productivity workers under permanent contracts will be kept in dual labor markets while dismissing more productive

temporary jobs. This is, duality induces a process of excessive and inefficient turnover.

These two facts, the proliferation of workers under temporary contracts and the process of inefficient turnover, are the most important immediate consequences of two-tier reforms. However, they are likely to affect many other labor market outcomes: the higher is this gap between regulation for the two types of contracts, the larger the effect of both events and the stronger the adverse impact on both flows and stocks. Bentolila et al. (2010) analyze the different response of unemployment to the Great Recession in France and Spain. Using a search and matching model, they estimate that about 45% of the increase in Spanish unemployment is due to this gap between the dismissal costs of permanent and temporary contracts, which is larger in Spain.

In order to proceed to the empirical analysis, the next step is to provide a way of measuring the degree of duality.

3 Measuring Duality

3.1 Measuring EPL: OECD indices

Giving a numerical interpretation to a set of legislation aspects in different countries and making them comparable is not an easy task. There have been several attempts (OECD, World Bank Doing Business and Heckman and Pagés)[3] but subjectivity remains an important part in all of them. Here I am going to use the "OECD Indicators of Employment Protection" given that they cover both regular and temporary contracts based on a wider set of legislation variables that are described transparently and available for a longer period.

The OECD indices summarize EPL along 21 items that quantify the costs (both monetary and procedural) involved in firing workers under permanent contracts and in hiring workers under fixed-term or temporary work agency contracts. They are measured on a 0-6 scale, from least to most restrictive. These indices can be classified in three main blocks:

1. Protection of regular workers against individual dismissal (EPLR). The EPLR index is constructed by aggregating eight different items as described below. There are indeed two key components of EPL for open-ended con-

[3]See Venn (2009) for a comparison and an extensive analysis of the OECD indicators.

tracts[4]: a tax (payment to a third party) and a transfer (monetary transfer from the employer to the worker):

- Transfer component[5]:
  - Severance payments (item 3): a monetary transfer from the firm to the worker in case of dismissal.
  - Advance notice period (item4): a mandatory period of time given to the worker before the dismissal is actually implemented.
- Tax component:
  - Administrative procedures (items 1 and 2) followed by the employer when starting the dismissal process, usually notifications and consultation with a third party (workers' representatives).
  - Trial costs in case of unfair dismissal (items 4 to 8), determined by the circumstances in which it is possible to dismiss workers and the consequences if a dismissal is found to be unfair (compensation and reinstatement).

2. Regulation of temporary forms of employment (EPLT). The EPLT index includes both regulations for fixed-term contracts and temporary work agency employment (FTC and TWA hereafter[6]). For both types of contract, the sub-indices include the following information:
   - Types of work for which these contracts are allowed.
   - Scope: maximum number of successive contracts and maximum cumulated duration of FTC/TWA contracts.
3. Specific requirements for collective dismissals (EPLC), which contains additional costs or notification procedures when an employer dismisses a large number of workers at one time. Notice that this is in addition to individual dismissal costs and notification requirements.

[4]See Boeri (2011).

[5]Both elements in this component vary by workers' tenure

[6]These two different forms of temporary employment have been found to yield different results in some cases (see for example Nunziata and Staffolani (2007)). However, for the purpose of my study and following previous empirical evidence I will consider both of them as being the same type of contract. Thus, in general I will use FTC for both forms of employment hereafter unless otherwise specified.

My baseline specification will not include this last indicator as it is only available from 1998 and not for all countries. In any case, a subsection in the sensitivity analysis will be devoted to this issue.

3.2 Problems to estimate the effect of duality from OECD indicators

As explained in the previous point, the items upon which the OECD indicators are constructed are different and non-comparable. This is, EPLT being greater than EPLR does not mean that temporary contracts are more protected that regular ones. As a result, duality can't be obtained as the gap between these two indices.

The main problems at the time of measuring the presence of a dual labor market structure though concern the construction of the OECD indicators themselves. In the same way as other indices of regulatory practices in the literature, they are based on legislation and not on actual implementation. Venn (2009) addresses some of the criticisms of the OECD indicators by examining the role of collective bargaining, the extent and impact of exemptions from employment protection rules, and discusses the effectiveness of enforcement of employment protection policies. The problem here is that while some measure of control practices can be incorporated in the case of regular contracts protection (such as judicial interpretation in the case of unfair dismissal), monitoring is much more difficult to be included in the case of EPLT. *De Facto* and measured protection can vary a lot depending on the country, especially in the case of temporary contracts.

Bentolila et al. (2010) highlight this problem in the case of Spain, where the proliferation of jobs of uncertain completion (quite frequent in the construction industry) can make temporary contracts last for an indeterminate period, even though the law establishes a maximum of 24 months in the standard case[7]. This is the reason why previous papers (Bassanini et al. 2009, Jaumotte 2011) characterize Spain as a country with high protection for both types of contracts, while *de facto* restrictions on FTC are almost zero.

[7]In the nonstandard cases the period may be longer (e.g. 3 years for workers with disabilities, 5 years for replacement of workers near retirement and no limit on duration if the objective reasons continue to exist such as in the case where a given task in unfinished.

3.3 Proposed measure of labor market duality

The construction of a variable that could capture the presence and the degree of dual labor markets has not been easy. First, as explained above, measuring EPL is not trivial either and the OECD indicators present some caveats that prevent them to fully cover the level of employment protection. Second, the concept is sufficiently complex *per se* to establish a rule relating restrictions on permanent and temporary forms of employment because it depends on many different economic variables and on the state of the economy.

The measure I am going to propose in this section is thus constructed upon two ideas. The first element is simply a formalization of the definition of a dual labor market: low protection for temporary forms of employment given that stringency in the rules governing firings of workers under permanent contracts were high. This concept is modeled including institutional information, for which I will use the OECD indicators, as an interaction between stringency in permanent contracts and flexibility in temporary contracts. The purpose is to capture that an increase in the interaction term means an increase in labor market duality, and that the latter is likely to matter more in countries where the former is higher. This is:

$$EPLR * EPLTflex,$$

where $EPLTflex$ is an index computed in the same way as the one provided by the OECD (same weights) but where "$itemsflex = 6 - items$" according to the definition of items explained above. This is, an equivalent index that measures flexibility instead of stringency. Actually, according to the indicators methodology, some of the items are originally computed to measure precisely flexibility and then transformed by subtracting the given number to 6, so in this case I would be just undoing that change to keep the original number.

The second element has to do with the problems highlighted above concerning the differences in legislation and actual restrictions in the use on FTC, under which the measure above would not reflect the presence of a dual market structure properly. My argument is that high firing costs will yield a substitution effect of temporary for permanent workers in firms only if protection on temporary forms of employment is sufficiently low. Thus, a very high share of workers under temporary contracts in a country with a high EPLT cannot be explained alone by a high EPLR, and so enforcement and other country-specific characteristics have to play a role in determining that high percentage.

I then define this extra element as the differences between the share of workers under fixed-term contracts that are left unexplained after taking into account characteristics that may contribute to its increase exogenously (*i.e.* demographic, educational and age characteristics), EPL policies including the interaction term described in the first point representing duality according to the indicators, and other policies and institutions. Formally:

$$Temp_{ict} = \beta_R EPLR_{ct} + \beta_D EPLR_{ct} * EPLTflex_{ct} + X_{ict}\gamma + X_{ct}\phi + \eta_{ct} + \eta_i + \epsilon_{ict}, \quad (1)$$

where X_{ict} includes the share of workers aged 15-24, aged 25-34, with lower than secondary education, with secondary education and the share of female workers and X_{ct} includes unemployment benefits (average gross replacement rate), union density, product market regulation (PMR hereafter) and the tax wedge.

The fixed-effect η_{ct} stands for country-period. Ideally, we would like to control for country-year and use it as a time-varying country-specific measure of the *unexplained* component. However, given that the principal regressors in equation (1) (*i.e.* those based on the OECD indicators) are measured at the country-year level and the level of variability is very low, this results in a collinearity problem. Thus, I define three different periods in the thirteen years that conform my sample: 1995-1999, 2000-2004 and 2005-2007, and later estimate the country-period fixed effects.

In order to define the three periods I have considered first the fact that during the years 2005-2007 there is an average increase in the share of temporary workers due to the decrease in the total working population as a result of the beginning of the crisis. This is reflected in Figure 2. There is also a decrease in the number of temporary contracts finished, but smaller than the total employment destruction. Thus, to control for this general decrease in employment as a result of the crisis, I consider the last period to be composed by only three years.

For the rest of the period, I have split the first ten years in two halves. Looking at Figure 2, we can observe a decreasing and stable trend in general from 2000 on; while there is an increasing trend, in general, from 1995 and, especially, the share of temporary workers is much more unstable before 2000.

Figure 2: Periods thresholds

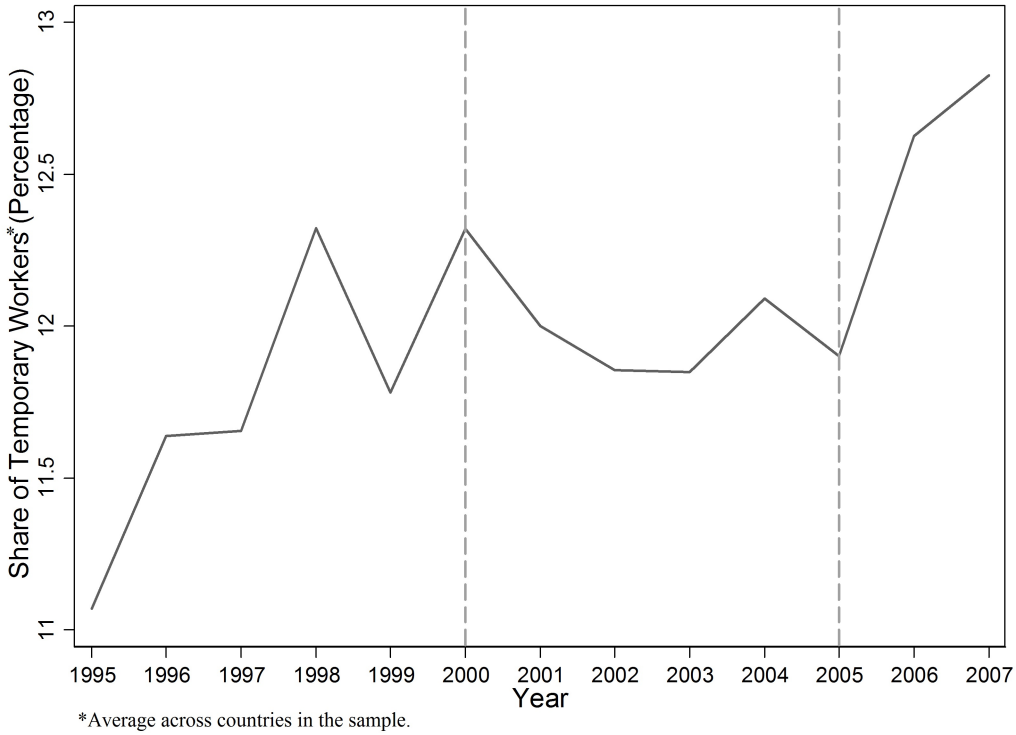


Table 1 reports the estimates for equation (1). Apart from measuring duality, it is worth commenting the results obtained. First, notice that the coefficient for the interaction term is always positive and highly significant: an increase in the interaction results in an increase in the share of workers under temporary contracts. This confirms that it is, in principle, a valid proxy for dual labor structures. Second, it is striking that the coefficient for EPLR becomes insignificant when including the interaction with FTC flexibility. This does not mean that high EPL on permanent contracts does not incentivize hirings under temporary ones, simply that this effect is conditional on the restrictions for the latter being low enough, otherwise it would not compensate for the distortions imposed by high firing costs.

Table 2 evaluates the behavior of the new measure at the time of explaining worker flows. It is important to notice that this time the inclusion of duality does not decrease the effect of EPLR alone in reducing the flow of labor resources in the economy. On the contrary, both coefficients are highly significant. The results then suggest that high dismissal costs decrease turnover, as predicted by most theoretical evidence (Bentolila and Bertola 1990). Notice that the estimates

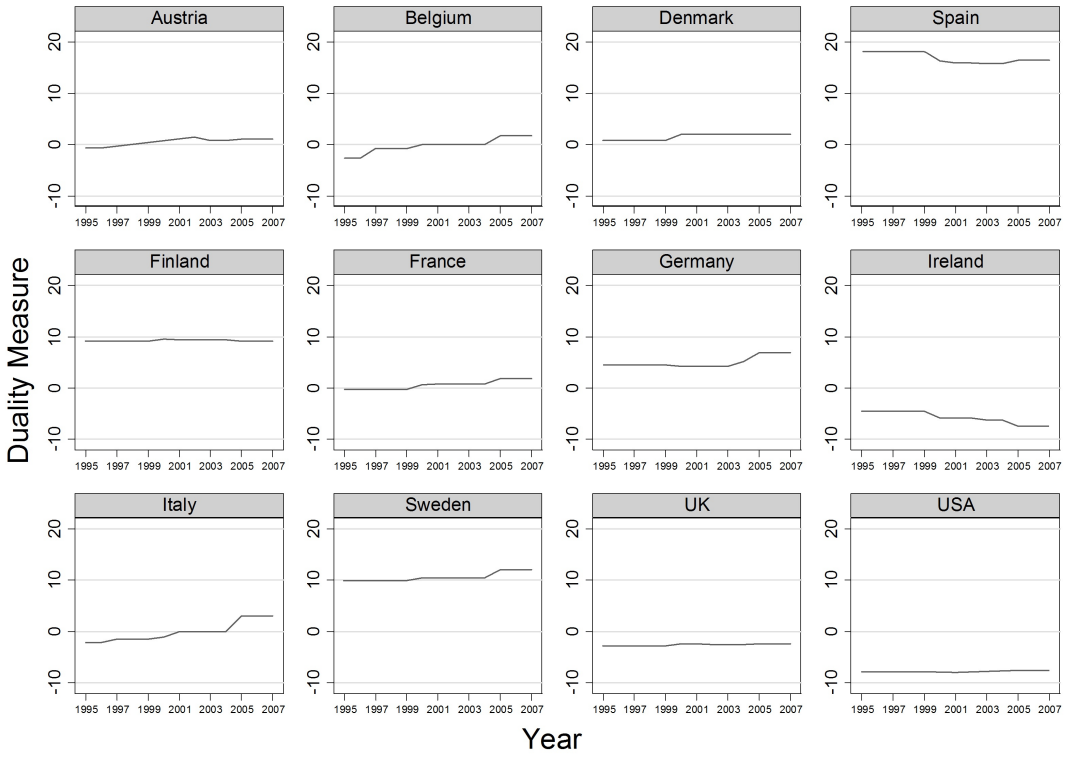
corresponding to the duality measure being highly significant and positive is evidence that *Dual* is capturing the inefficient turnover originated as a result of the two-tier reforms.

The final duality measure is made of the two elements described above: the part of the share of temporary workers predicted by the interaction $EPLR * EPLTflex$ and the part left unpredicted in each country and each period after controlling for the set of regressors described above $\hat{\eta_{ct}}$. This is:

$$Dual_{ct} = \hat{\beta}_D EPLR_{ct} * EPLTflex_{ct} + \hat{\eta}_{cp} \tag{2}$$

Figure 3 provides a graphical intuition of this duality measure across countries. Notice that by including the country-period dummies I have been able to obtain some time variation and capture important changes in legislation, such as the Italian reforms. The same picture is included by groups (low, intermediate and high duality measure) in the appendix C in order to observe changes without the scale being affected by countries with too high or two low measure.

Figure 3: Duality measure across countries



4 Data and Empirical Strategy

4.1 Data

In order to estimate the final specification, I am going to use three different sources: EUKLEMS, a harmonized dataset on worker flows from Bassanini et al. (2010) and the OECD indicators of employment protection legislation. The final panel consists of 12 countries (11 EU-15 members and the US) and 22 sectors for the period 1995-2007. The initial dataset contained more countries and sectors but, due to the common availability of data of the three datasets, the panel was adjusted to be as balanced as possible. All definitions, sources and relevant changes are described in Appendix A.

Data on productivity comes from the public version of the November 2009 release of the EUKLEMS database, which contains industry-level data on TFP growth as well as data on value added, capital service growth, employment, hours worked and labor composition by skills, age and gender. No data on TFP level are available in the public release of EUKLEMS. The baseline level of industry aggregation is an intermediate level between one and two digits of the ISIC rev. 3 classification.

The different variables understood by productivity that will be used as dependent variable in the different specifications below are labor productivity level, as measured by gross value added per hour worked (in logs); labor productivity growth, as measured by the first difference of the previous variable; and TFP (value added based) growth in percentage points.

Data on flows and other industry-level variables are from Bassanini, Garnero, Marianna and Martin (2010), who estimate gross worker flows among dependent employees using data from different Labor Force Surveys (LFS hereafter) and national accounts data at the industry-level from EUKLEMS and OECD STAN. These data include the European LFS, the Displaced workers supplement of the US Current Population Surveys, and the Canadian LFS.

Shares of temporary workers, self-employed workers, specific age classes, women and educational classes at the industry-level are directly derived from LFS. In all cases they are obtained as the ratio of the specified group of employees divided by total employees in the same country, industry and year.

The main variable of interest is worker reallocation, as defined by Davis and Haltiwanger (1999). This is, for a given industry i at time t:

$$Reallocation_{it} = \frac{Hirings_{it}+Separations_{it}}{(Employment_{it}+Employment_{it-1})/2}$$

Hirings and separations are collected at the firm level and later aggregated by adding up their values over all firms in the same industry. Industry-level hirings and separations will be simply the number of workers in the same industry who were with one employer in year t but not with the same employer in t-1 and workers with given characteristics who were with one employer at time t-1, but not at t, respectively.

EPL indicators come from the OECD Indicators of Employment Protection[8] as explained in section 2. The baseline estimation only uses the summary indices for regular and temporary contracts -EPLR and EPLT-. The sensitivity analysis includes collective dismissals regulations (EPLC).

Other institutional variables are taken from Bassanini and Duval (2006) and updated by the OECD statistics, as described in the appendix. These variables are unemployment benefits, union density, the tax wedge, product market regulation and the output gap.

4.2 Identification Strategy

The idea is to estimate the effects of employment protection on productivity using a difference-in-difference model on industry-level data in the spirit of Rajan and Zingales (1998). This methodology has the advantage that it controls for policies or institutions that influence productivity in the same way in all industries.

The pioneering work of Nickell and Layard (1999) attempted to explain the role of institutions on productivity at the aggregate level. Recent literature on the topic have exploited the increasing availability of data at the industry level (even firm level in some cases) on productivity and the fact that most policies, albeit not industry-specific, are likely to vary across industries. This way, Bassanini et al. (2009), Cingano et al. (2010) and Micco and Pagés (2008) made use of this methodology to test the hypothesis that if EPL has a direct impact on firms' -partial equilibrium- responses (like investing on workers' training or taking innovative strategies) then the effect of this policy has to be larger in industries where it is likely to be more binding due to industry-idiosyncratic technological factors. By averaging over time and including country and industry fixed effects they control for policies that influence productivity in the same way in all industries, overcoming a possible omitted-variable problem.

[8] www.oecd.org/employment/protection

However, as highlighted by Bassanini et al. (2010), by omitting the time-series dimension it might be difficult to derive general equilibrium effects that are homogeneous across industries. In the case of dual labor structures we may be interested on aggregate effects. Inspired in the cross-country/time-series specification proposed by Bassanini et al. (2010) and Cingano et al. (2010). My final specification is the following:

$$Productivity_{cit} = \beta_R EPLR_{ct} + \beta_D Dual_{ct} + \delta_R(\Lambda_i - \bar{\Lambda}) * EPLR_{ct} + \\ + \delta_D(\Lambda_i - \bar{\Lambda}) * Dual_{ct} + X_{cit}\gamma + X_{ct}\phi + \eta_{it} + \eta_c + \varepsilon_{cit}, \qquad (3)$$

where EPLR refers to the OECD index for employment protection of regular contracts, Dual is the measure of duality explained in section 2 and Λ is the benchmark measure for the intrinsic level of reallocation in each industry -demeaned when interacted with institution variables so that β coefficients capture the actual aggregate effects of the policy for the average industry-. Country fixed-effects are always included and modeled through deterministic dummy variables in order to control for country-specific averages of omitted policies. I am further including few extra controls of other policies at the country level that have been found to complement EPL institutions (Bassanini and Duval 2006), namely unemployment benefits, the tax wedge, union density, product market regulation and the output gap.

In the specification above I thus have four different effects: two partial-equilibrium/ industry-specific (β_R and β_D) and two aggregate/ country-specific effects (δ_R and δ_D). The main effect of interest for this paper is actually the latter, for two reasons. First, the combination of high EPLR-low EPLT has been found to present spillovers on other economic outcomes. For example, as argued above, Costain et al. (2010) find that it stimulates volatility in the labor market both of employment and unemployment due to the accumulation of *fragile* jobs. And second, unlike EPLR the differential effect that duality might have on industries that tend to rely more on hirings and firings in order to make adjustments is not clear. In markets where firing costs are very hight, temporary jobs can also act as a *buffer stock* for firms in the presence of high dismissal costs, and this effect would be larger the higher the reallocation rate in the industry.

There is no reason to believe that the impact of aggregate institutions on productivity varies across industries with different reallocation rates. However, the estimation of aggregate coefficients makes it desirable to include further policies

as controls that may behave as confounding variables in the baseline regression. Bassanini and Duval (2006) represents an excellent review of the effect of different policies and institutions on different employment outcomes. They identify a set of institutional determinants at the country level that have been found to influence different labor market outcomes based on labor economic theory and on past empirical studies. Similar to Bassanini et al. (2009), I have selected the following policies: unemployment benefits, the tax wedge, union density, product market regulation and the output gap. Definitions and sources are described in Appendix A.

4.3 *Natural* reallocation rate across industries

Most cross-country/cross-industry studies have relied on different US features to obtain a measure of the natural propensity of industries to be affected by cross-country differences in institutions or policies in the spirit of Rajan and Zingales (1998). The argument usually lies on the positive, high and statistically significant rank correlations of industry job flows across countries, which suggest important and persistent technological characteristics that determine the relative volatility of employment in an industry. Institutions in the United States are the laxest among OECD countries and thus it can be understood as a close-to-frictionless environment. This, together with the fact that most data are easily available, makes it a convenient benchmark country for different industry-specific variables such as external financial dependence or worker turnover.

This standard way of choosing Λ on the basis of the job turnover across industries in a benchmark country, where EPL is assumed to be close to zero, can be problematic. Ciccone and Papaioannou (2006) and Ciccone and Papaioannou (2010) argue that using US proxies may yield inconsistent estimates as a result of benchmarking bias. This bias can go in either direction: an attenuation bias due to the classical measurement error problem, and an amplification bias due to the fact that industry characteristics in the benchmark country can be a better proxy for industry characteristics of some of the countries in the sample than others. For instance, if patterns of worker reallocation across industries in the US are more closely related to actual industries reallocation patterns in countries with laxer EPL and that have not experienced any two-tier reform (similar to the US) for reasons unrelated to employment protection, then one may incorrectly attribute the cross-country differences in the inter-industry distribution of reallocation rates

to an effect of EPL on productivity.

In order to find the intrinsic degree of turnover in an industry they propose computing industry worker reallocation in a hypothetical frictionless country with no employment regulation that faces world-average reallocation shocks on the basis of available data for all countries. I will follow Cingano et al. (2010) in order to compute this global measure in the following way:

$$Real_{ict} = \eta_i + \eta_{ct} + \theta_i EPL_{ct} + \varepsilon_{ict} \tag{4}$$

The third term in the right hand side absorbs the marginal effect of employment protection on job reallocation in each industry, while the estimated industry fixed effect η_i captures the extent of industry worker reallocation in a country not subject to firing restrictions which is subject to world average supply and demand shocks, this $\hat{\eta}_i$ is thus going to be taken as the benchmark measure for the intrinsic level of worker reallocation in each industry for all countries.

I adopt this latter alternative in my baseline specification but confirm the results using other benchmarks based on reallocation in countries with low levels of employment protection, namely the United States and the United Kingdom, in the sensitivity analysis.

5 Results and Discussion

Table 3 reports the results for the baseline specification, allowing for different combinations of fixed-effects and different regressors. There are three differentiated parts, depending on the regressor. The full estimation corresponds to column (6).

The different regressors correspond to the different measures of productivity, *i.e.* TFP and LP. The latter is considered both in levels and in growth, while the former is only included in growth rates due, mainly, to the lack of data in TFP levels.

There seems to be a negative and significant effect of duality on labor productivity growth, while the results are weaker in the case of the growth rate of TFP and absent in the case of LP level.

As argued above, the hypothetical causes of the results concerning TFP point to the constrained flexibility to react quickly to changes in technology or demand of firms characterized by rapid technological change (Samaniego 2006). LP level

is affected through the lower requirements from firms in order to hire a worker under an almost dismissal-costs-free contract. Finally, and most important, I argue that it is a process of inefficient reallocation originated by the interaction between the two types of policies the responsible for most of the negative effects on LP, especially on LP growth.

This concept of inefficient turnover is closely related to employment volatility, as analyzed in Costain et al. (2010). The increased gap between regulations of both types of contracts makes firms reluctant to hire under permanent contracts for the first time, so most new hirings are done under FTC. These temporary workers are converted to permanent only if their productivity is high enough, but the conversion threshold is increasing in the two contracts protection gap. The conversion-to-permanent rate is thus very low. Thus temporary workers are fired at the end of the contract and new jobs are created, again on a fixed-term basis. Basically, the higher the gap, the larger the share of new contracts being fixed-term, the lower the conversion rate and the more important the substitution of temporary for permanent workers. These three features characterize what I called above inefficient turnover.

The strong effect on LP growth suggests that, given the results seen in table 2, the process of inefficient turnover generated by the dual labor market makes firms lose incentives to invest in human capital. Learning-by-doing decreases both from the lower specific-investments and the progressive decrease in long-term relationships as firms use temporary contracts in sequence.

This negative effect on LP growth is however not significantly translated in less TFP growth. Samaniego (2006) highlights the detrimental effects of high firing costs on the innovative efforts of firms characterized by high technological change. Marginal reforms serve as a way to relax the distortions imposed by high restrictions on dismissals. In this sense, firms may somehow benefit from them by obtaining flexibility to allocate resources and so the decrease in human capital is not completely translated into lower efficiency.

According to Nunziata and Staffolani (2007), FTC may serve as stepping-stones towards better matches in the future, which may increase the productivity level of those workers that are finally converted to permanent. Looking at the results, it looks like this effect plays a role at least to compensate for the negative effect due to the inefficient turnover. There is further a positive aggregate effect of EPLR to LP level, pointing to a possible selection effect of firms, that now have

more facilities to substitute nonproductive workers and keep those that are more productive.

Furthermore, there is not enough evidence that duality affects differently industries with different rates of *natural* reallocation, and EPLR only seems to affect stronger more volatile industries in the case of LP Growth. The differential effect that duality might have on industries that tend to rely more on hirings and firings in order to make adjustments is not clear. In markets where firing costs are very high, a decrease in the restrictions to hire on a temporary basis might be a way of compensating for the distortions created by the high EPLR. As a result, industries with higher reallocation rate might be positively affected by the two-tier strategy from the extra-flexibility they get to allocate resources efficiently. On the other hand, this effect may turn negative when firms take "too much" advantage of this increased flexibility and start accumulating workers under temporary contracts, with the subsequent decrease in human capital investment and incentives for innovation. In most of the regressions above it seems that both effects compensate.

As an economic interpretation, using column (6) of the regression with LP growth as dependent variable, my results would mean that an increase by one point the duality measure would result in a decrease of around 0.4% in LP growth. Furthermore, in that specification, a one point increase in the EPLR index would be translated into a LP growth decrease of 0.019% in industries that are 1% apart in terms of *natural* reallocation.

Rajan and Zingales (1998) methodology controls for all kind of policies at the country level that may affect industries differently as long as this difference has nothing to do with their *natural* reallocation rate. However, given that in this paper the main effect of interest was the aggregate effect of duality on different productivity outcomes, a special attention should be given to a possible endogeneity problem. In any case, since most heterogeneity in institutions is across countries, by including the country fixed-effects and the set of other policies as controls, the problem of confounding factors is likely to be very small. Furthermore, by using the reallocation measure proposed by Ciccone and Papaioannou (2010), an extra possible source of bias that was present in most previous empirical evidence is eliminated, as will be further analyzed in the next section.

There is, though, a final endogeneity concern if liberalization reforms such as the two-tier reforms are implemented during years of bad economic performance

in order to promote job creation and decrease unemployment rates. In such case, the negative and significant effect observed and commented above might reflect the reverse direction: that during low-productivity-growth times governments are more likely to implement two-tier reforms. On the other hand, as I have argued at the beginning, these marginal reforms are not implemented due to economic but political reasons. In this sense, it may also be the case that in times of low economic growth, when the ratio insiders-outsiders decreases, there is less political pressure that could justify the implementation of a two-tier reform. As a result, there is, in principle, no reason to think that governments are more likely to implement two-tier reforms in recessions than in expansions, nor the opposite. However, further tests and analysis are required in this sense to fully identify the different effects and to correct for this sort of endogeneity.

It is important to bear in mind that the aim of this paper is to propose a measure of duality based on cross-country data and to identify the sign of its relationship with productivity. No formal analysis is performed to find the channels through which this effect takes place. As a result, all the analysis above are conclusions based on the regressions reported throughout this paper and intuitions based on facts and previous empirical evidence on the topic.

6 Sensitivity Analysis

6.1 Sensitivity to the natural reallocation benchmark

As explained in the last section, there are some caveats derived from country-benchmarking in cross-country/cross-industry studies. To overcome these problems, Ciccone and Papaioannou (2006) and Ciccone and Papaioannou (2010) proposed a global measure of the intrinsic level of reallocation across industries. It was computed using data for all countries so that there are no biases associated to the fact that a country which is taken as benchmark is similar to other groups of countries in the sample. However, I am going to check whether the obtained results are robust to a change in this global measure.

Concerning alternative measures, the standard practice consists in using data from the US or the UK, since they are countries with relatively lax regulations for all types of contracts, to proxy for certain industry-specific characteristics in a hypothetical frictionless world. Given that the policy of interest concerns employment legislation, I am here going to use two different measures of turnover,

namely worker reallocation and excess reallocation both in the UK and the US. Moreover, I am including the benchmark measure explained above in the baseline specification, global worker reallocation together with the equivalent global excess reallocation.

Excess reallocation is defined as the difference between total worker reallocation and the industry's net change in employment. It provides a useful measure of the number of matches that are created and destroyed over the minimum necessary to cover net employment growth. This is, for a given industry i at time t:

$$Excess_{it} = \frac{Reallocation_{it} - |\Delta E_{it}|}{(Employment_{it} + Employment_{it-1})/2}$$

Before looking at the results under these different proxies, Table 4 reports cross-correlations between the six of them and shows the high level of correlation between all of them. Furthermore, in Table 5, I include the results only for labor productivity growth as dependent variable, given that it is the only result that proved to be significant in all the different specifications in Table 3. The reported estimates correspond to column (6) in that table.

The final effect obtained for labor productivity growth is thus robust to a change in the proxy used as *natural* reallocation rate. Notice that all significant estimates are lower (further from zero) under the proxies that are computed using a country as benchmark. This suggests that, as expected, there exists an amplification bias by using these measures and thus the one proposed by Ciccone and Papaioannou (2010) is helping us reduce endogeneity problems.

6.2 Collective dismissals

As I explained above, my baseline estimation does not use the index that considers additional restrictions on collective dismissals since it is only available since 1998. Following Bassanini et al. (2009), I create an indicator for EPL on regular contracts that takes into account these extra constraints by averaging EPLR (5/7) and EPLC (2/7), and perform the baseline regression for the period 1998-2007. This is important as in some countries EPLR and EPLRC can be very different[9].

The results in Table 6 show that, even though the estimates lose some significance, the effect on LP growth is still present when provisions for collective dismissals are considered.

[9]See Appendix B for summary statistics

7 Conclusions

Labor market rigidities in continental Europe has often been pointed to be a determinant of the high unemployment rates and growth slowdown experienced by many European Union countries. Apparently, they have failed to establish a sufficient level of flexibility to adapt to modern economy changes and achieve their potential efficiency level. An important driver of economic growth is productivity. Previous theoretical and empirical evidence have found depressing effects of strict labor market protection on different productivity outcomes, but also some sources of efficiency growth as a result of the higher incentives to perform specific-investments in human capital both by the employer and the worker. The ambiguity of the results obtained by previous studies suggests that they key point here is to analyze which policies and institutions are depressing growth and which are not. Given the recent liberalization trend in European labor markets characterized by two-tier strategies motivated by political reasons, it is important to asses the implications in terms of efficiency to evaluate their convenience.

I have analyzed both country and country-industry productivity heterogeneity in 11 EU economies and the US. The main source of variation identified in order to explain these divergences has been employment protection legislation, both in the form of firing costs and in relation to the stringency in regulations governing hirings under temporary contracts. This latter complementarity is important because during the last two decades most labor market reforms has been targeted at increasing the types of contracts of fixed-term duration rather than affecting dismissal costs, in an attempt to decrease the high structural unemployment without losing political support of those workers already employed.

In a first step, I have estimated a measure of the degree of duality in the labor market at the country-year level. This has been done through an interaction the OECD indicators for EPL stringency on open-ended contracts and flexibility on fixed-term contracts. Furthermore, I have commented on the lack of reliability on these indices in the case of measuring constraints on the use of temporary forms of employment, and presented a way to complement the previous proxy in order to capture dual structures based not only on legislation but also on implementation. Tables 1 and 2 report the estimation of this duality measure and its evaluation in terms of explaining worker flows, respectively.

Next, I have estimated both sectoral and aggregate cross-country estimates and find that segmented labor markets have a negative and significant effect on

labor productivity growth, while the result is not conclusive for TFP growth and absent in labor productivity level. The interpretation given to the statistical results in relation to the strong effect on LP growth suggests that the process of inefficient turnover generated by the dual labor market disincentivizes firms to invest in human capital. Learning-by-doing decreases both from the lower specific-investments and the progressive decrease in long-term relationships as firms use temporary contracts in sequence. This negative effect on LP growth is however not significantly translated in less technological efficiency. A possible reason for this to happen is that both positive and negative consequences of EPL on productivity highlighted throughout this paper and in previous evidence compensate each other.

By contrast, the role of these two-tier reforms is not necessarily different in industries with a higher propensity to make adjustments through dismissals (high-reallocation industries) in any of the cases. In markets where firing costs are very high, a decrease in the restrictions to hire on a temporary basis might be a way of obtaining extra-flexibility to allocate resources efficiently. On the other hand, when firms start accumulating workers under temporary contracts human capital investment and incentives for innovation decrease. This is, dual labor market policies are not necessarily more binding in higher reallocation firms.

The purpose of this paper was to provide a way of measuring duality in cross-country studies and to find the sign of its relationship with different productivity variables. In order to properly identify channels through which this final results affect productivity further research would be needed.

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Appendices

A Definitions and Sources

- TFP Growth:
  - Definition: TFP (value added based) growth, 1995=100.
  - Notes and data treatment: variable TFPva_I (in the EUKLEMS database).
  - Source: EUKLEMS growth and productivity accounts[10].
- Labor Productivity Level:
  - Definition: Gross value added per hour worked, volume indices, 1995=100.
  - Notes and data treatment: variable LP_I in logs.
  - Source: EUKLEMS growth and productivity accounts.
- Labor Productivity Growth:
  - Definition: first differences of the previous variable (logLP).
- Worker reallocation:
  - Definition:
  - Notes and data treatment: there are no data for Austria between 1997-2001, data for Spain starts in 1999, for Finland in 1998 and data for Ireland is only available until 2006.
  - Source: Bassanini et al. (2010)
- Average unemployment benefit replacement rate:
  - Definition: average unemployment benefit replacement rate across two earnings levels (100% and 67% of APW earnings), three family situations (single, with dependent spouse, with spouse in work) and three durations of unemployment (1st year, 2nd and 3rd years, and 4th and 5th years of unemployment). Net benefits are net of taxes and transfers, but exclude means-tested social assistance.[11]

[10] See O'Mahony and Timmer (2009) for detailed methodology.

[11] For further details, see OECD (1994), The OECD Jobs Study (chapter 8) and Martin J. (1996), Measures of Replacement Rates for the Purpose of International Comparisons: A Note, OECD Economic Studies, No. 26.

  - Notes and data treatment: Pre-2003 data have been revised in this version with respect to Bassanini and Duval (2006), but values are similar. Original data are available only for odd years. Data for even years are obtained by linear interpolation (in the same way as (Bassanini and Duval 2006)).
  - Source: OECD, Benefits and Wages Database.

- Labor tax wedge:
  - Definition: tax wedge between the labor cost to the employer and the corresponding net take-home pay of the employee for a single-earner couple with two children earning 100% of APW earnings. The tax wedge expresses the sum of personal income tax and all social security contributions as a percentage of total labor cost.
  - Source: OECD, Taxing Wages.

- Product market regulation
  - Definition: OECD summary indicator of regulatory impediments to product market competition in seven non-manufacturing industries, including gas, electricity, post, telecoms, passenger air transport, railways, and road freight.
  - Notes and data treatment: This PMR indicator is used here because is available over the whole period 1975-2003 for most OECD countries, unlike the economy-wide indicator which covers only the period 1998-2003.The problem is that PMR for non-manufacturing industries do not incorporate all aspects of regulatory reforms affecting all sectors.
  - Source: Online OECD Homepage for Indicators of Product Market Regulation[12].

- Union Density
  - Definition: trade union density rate, *i.e.* the share of workers affiliated to a trade union, in percent.
  - Notes and data treatment: Data for missing years are obtained by linear interpolation.

[12]See Conway and Nicoletti (2006) for more information.

  - Source: Online OECD Employment Database.

- Output Gap:
  - Definition: OECD measure of the gap between actual and potential output as a percentage of potential output.
  - Source: World Economic Outlook (WEO) data, IMF.

Table A.1: Industry codes description

ISIC Rev.3 code	Industry
15t16	Food Products, bevarages and tabaco
17t19	Textiles, textile products, leather and footwear
20	Wood and products of wood and cork
21t22	Pulp, paper, paper products, printing and publishing
24	Chemicals and chemical products
25	Rubber and plastics
26	Other non-metallic Mineral
27t28	Basic metals and fabricated metal products
29	Machinery, n.e.c.
30t33	Electrical and optical equipment
34t35	Transport equipment
36t37	Manufactutring, n.e.c.
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles
52	Retail trade, except of motor vehicles and motorcycles; repair of household goods
60t63	Transport and storage
64	Post and telecommunications
70	Real estate activities
E	Electricity, gas and water supply
F	Construction
H	Hotels and Restaurants
J	Financial intermediation

B Summary Statistics

Table B.1: Summary statistics

	Mean	Sd	Max	Min	N
EPLR	1.89	0.78	3.00	0.17	3049
EPLRC	2.31	0.61	3.21	0.94	2431
EPLT	1.89	1.43	5.25	0.00	3049
Real.(%)	34.55	14.10	109.11	3.13	2761
TFP Growth(%)	1.98	9.72	274.42	-46.42	3410
LP Growth(%)	2.66	6.24	59.05	-32.60	3432
LP(logs)	4.76	0.24	7.06	3.80	3432

C Duality measure by groups

Figure C.1: Low

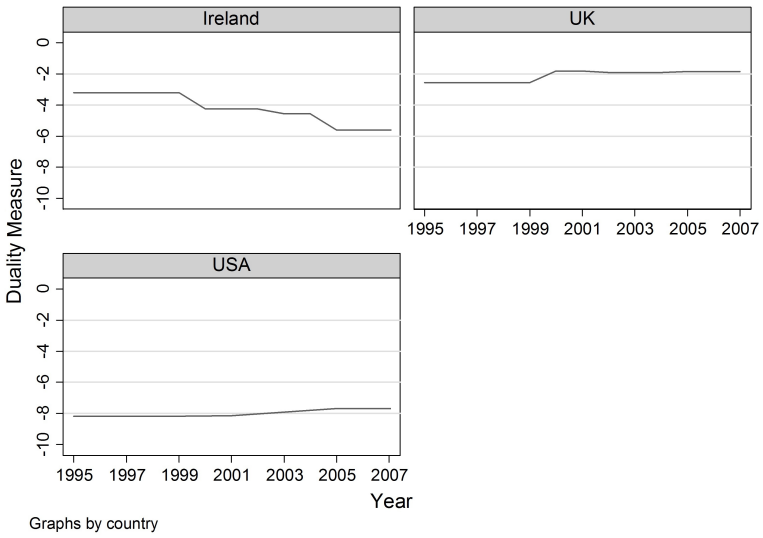


Figure C.2: High

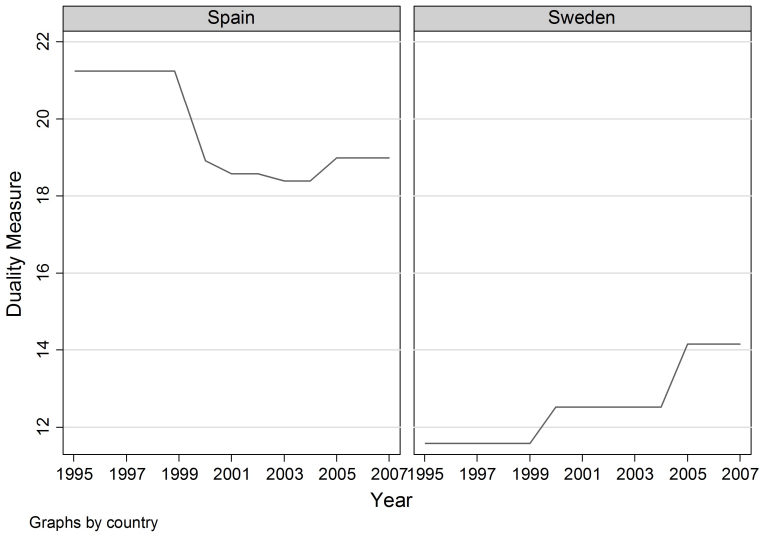
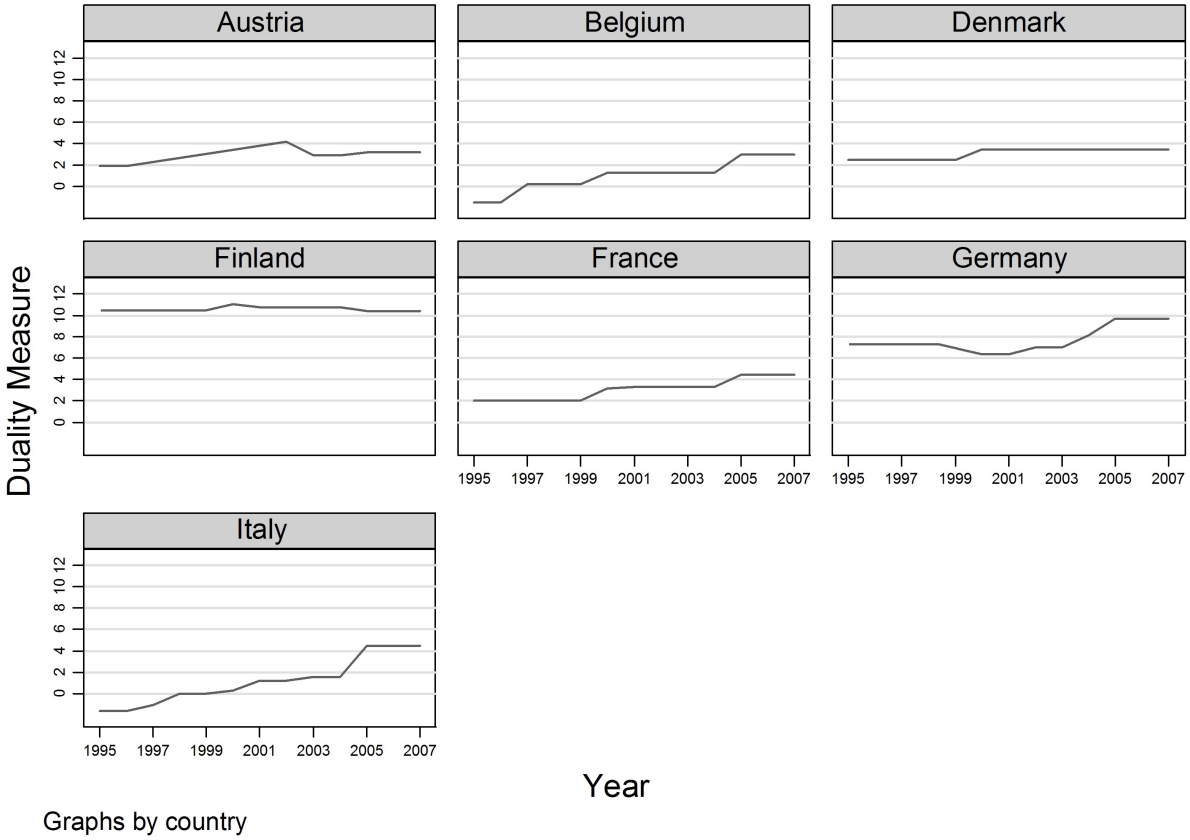


Figure C.3: Intermediate



Tables

Table 1: Duality as a determinant of the share of temporary workers

Dep.variable	Share of Temporary Workers			
	(1)	(2)	(3)	(4)
EPLR			0.029	-0.026
			(1.581)	(1.046)
EPLR*EPLTflex	0.444***	0.509***	0.443***	0.509***
	(0.055)	(0.115)	(0.051)	(0.119)
Controls				
X_{ict}	no	yes	no	yes
X_{ct}	no	yes	no	yes
Observations	2835	2684	2835	2684

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. Controls at the industry level: Share of workers aged 15-24, Share of workers aged 25-34, Share of workers with less than secondary education, Share of workers with secondary education, Share of women. Controls at the country level: average gross replacement rate, tax wedge and union density. All specifications include industry and country-period fixed effects in order to obtain the measure for duality as described in section 3.

Table 2: Duality and worker reallocation (Inefficient turnover)

Dep.variable	Worker Reallocation			
	(1)	(2)	(3)	(4)
EPLR			-10.699***	-7.803***
			(0.686)	(0.859)
Dual	0.320***	0.181***	0.935***	0.752***
	(0.056)	(0.045)	(0.067)	(0.079)
Controls				
X_{ict}	no	yes	no	yes
X_{ct}	no	yes	no	yes
Observations	2440	2440	2440	2440

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors in parentheses. All specifications include country and industry-year fixed-effects. Controls at the industry level: Share of workers aged 15-24, Share of workers aged 25-34, Share of workers with less than secondary education, Share of workers with secondary education, Share of women. Controls at the country level: average gross replacement rate, tax wedge and union density.

Table 3: Duality and Productivity

	(1)	(2)	(3)	(4)	(5)	(6)
			Dependent Variable: LP Level			
EPLR					0.023	0.128**
					(0.047)	(0.053)
EPLR*Λ					0.000	-0.001
					(0.002)	(0.001)
Dual	0.007	0.006	0.007	0.006	0.006	-0.002
	(0.006)	(0.005)	(0.006)	(0.004)	(0.007)	(0.006)
Dual*Λ			-0.014	-0.016*	-0.015	-0.008
			(0.013)	(0.008)	(0.017)	(0.013)
Observations	2684	2684	2440	2440	2440	2440
			Dependent Variable: LP Growth			
EPLR					-0.547	0.293
					(1.259)	(1.376)
EPLR*Λ					-0.018	-0.019**
					(0.022)	(0.009)
Dual	-0.779***	-0.540***	-0.575***	-0.372**	-0.536***	-0.401**
	(0.173)	(0.159)	(0.169)	(0.164)	(0.188)	(0.191)
Dual*Λ			-0.112	-0.255	0.002	-0.024
			(0.112)	(0.157)	(0.245)	(0.209)
Observations	2487	2487	2352	2352	2352	2352
			Dependent Variable: TFP Growth			
EPLR					-1.556	0.761
					(2.210)	(2.270)
EPLR*Λ					-0.041	-0.001
					(0.035)	(0.018)
Dual	-0.560**	-0.461*	-0.336*	-0.320	-0.225	-0.368
	(0.244)	(0.245)	(0.185)	(0.239)	(0.237)	(0.292)
Dual*Λ			-0.157	-0.183	0.108	-0.167
			(0.239)	(0.251)	(0.322)	(0.265)
Observations	2465	2465	2330	2330	2330	2330
Fixed effects						
Country	yes	yes	yes	yes	yes	yes
Year	yes	no	yes	no	yes	no
Industry	yes	no	yes	no	yes	no
Industry-Year	no	yes	no	yes	no	yes
Controls						
X_{ict}	yes	yes	yes	yes	yes	yes
X_{ct}	yes	yes	yes	yes	yes	yes

Standard errors computed using bootstrap in parentheses. EPLR: index of employment protection for regular contracts. Λ: *natural* rate of reallocation across industries. Dual: duality measure explained in section 3. Dual*Λ has been rescaled divided over 100. Controls at the industry level: Share of workers aged 15-24, Share of workers aged 25-34, Share of workers with less than secondary education, Share of workers with secondary education, Share of women. Controls at the country level: Average gross replacement rate, Tax Wedge, PMR, Union Density and Output Gap. All regressors are lagged one year.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Cross-correlations between different policy-bidingness measures

Variables	Real. US	Real. UK	Global Real	Excess US	Excess UK	Global Excess
Real. US	1.000					
Real. UK	0.927	1.000				
Global Real	0.933	0.946	1.000			
Excess US	0.995	0.916	0.921	1.000		
Excess UK	0.938	0.986	0.932	0.940	1.000	
Global Excess	0.942	0.939	0.991	0.941	0.945	1.000

Table 5: Duality and LPgrowth

	US Real	UK Real	Global Real	US Excess	UK Excess	Global Excess
EPLR	1.091	1.140	0.293	1.101	1.140	0.290
	(1.256)	(1.203)	(1.164)	(1.028)	(1.233)	(1.400)
EPLR*Λ	-0.028***	-0.021***	-0.019**	-0.029***	-0.027***	-0.023**
	(0.006)	(0.008)	(0.008)	(0.006)	(0.007)	(0.010)
Dual	-0.620***	-0.613***	-0.401**	-0.620***	-0.615***	-0.402**
	(0.223)	(0.216)	(0.190)	(0.214)	(0.193)	(0.205)
Dual*Λ	0.118	0.032	-0.024	0.139	0.098	0.001
	(0.116)	(0.170)	(0.155)	(0.128)	(0.188)	(0.247)
Observations	2487	2487	2352	2487	2487	2352

Standard errors computed using bootstrap in parentheses. Dependent variable: LPgrowth. All specifications include country and industry-year fixed-effects and controls. EPLR: index of employment protection for regular contracts. Λ: *natural* rate of reallocation across industries. Dual: duality measure explained in section 3. Dual*Λ has been rescaled divided over 100. Controls at the industry level: Share of workers aged 15-24, Share of workers aged 25-34, Share of workers with less than secondary education, Share of workers with secondary education, Share of women. Controls at the country level: Average gross replacement rate, Tax Wedge, Product market regulation, Union Density and Output Gap. All regressors are lagged one year.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Including collective dismissals

	(1) LP Level	(2) LP Level	(3) LP Growth	(4) LP Growth	(5) TFP Growth	(6) TFP Growth
EPLRC		0.083		-0.483		-2.816
		(0.080)		(2.437)		(4.619)
EPLRC*Λ		0.000		-0.037		-0.065
		(0.001)		(0.029)		(0.055)
Dual	0.009	0.006	-0.499**	-0.469*	-0.042	0.092
	(0.007)	(0.008)	(0.228)	(0.249)	(0.432)	(0.471)
Dual*Λ	-0.006	-0.006	-0.036	0.133	-0.112	0.185
	(0.004)	(0.006)	(0.131)	(0.186)	(0.248)	(0.352)
Observations	1992	1992	1904	1904	1882	1882

Standard errors computed using bootstrap in parentheses. All specifications include country and industry-year fixed-effects. EPLRC: index of employment protection for regular contracts, including provisions for collective dismissals, i.e. $EPLRC = (2/7) * EPLC + (5/7) * EPLR$. Λ: *natural* rate of reallocation across industries. Dual: duality measure explained in section 3. Dual*Λ has been rescaled divided over 100. Controls at the industry level: Share of workers aged 15-24, Share of workers aged 25-34, Share of workers with less than secondary education, Share of workers with secondary education, Share of women. Controls at the country level: Average gross replacement rate, Tax Wedge, Product market regulation, Union Density and Output Gap.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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