

# Flexible employment, job flows and labour productivity

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## Abstract

In this paper we provide evidence on the effects of temporary employment on job flows, labour productivity and investment. As a source of identification, we exploit reforms in the legislation of fixed-term and apprenticeships contracts whose implementation varied over regions and industries. Results indicate that the reform of apprenticeship contracts has increased the turnover of workers and has induced capital-labor substitution in favour of labour, with an overall productivity-enhancing effect. The reform of fixed-term contracts instead does not seem to have had the intended results and may have made the use of these contracts more costly rather than less costly. Ineffectiveness of the reform may also depend on firms substituting across different types of labour: we estimate elasticities of substitution that are consistent with this interpretation.

Keywords: employment contracts, productivity, institutional changes

JEL code: J24, J41

## 1 Introduction

In the past two decades the major policy response to high unemployment rates in Europe has been the reduction of employment protection legislation through the liberalization of temporary contracts.<sup>1</sup> A large literature has established the importance of temporary contracts in affecting job flows by increasing both workers’

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<sup>1</sup>Among the countries in the European Union, France, Italy, Germany, Spain and Portugal liberalized temporary contracts over the 1980s.

hiring and firing. Although much less researched in theory and in practice, it is plausible that temporary contracts also have a bearing on firms' capital investment decisions, on the capital-labour ratio and, eventually, on productivity.<sup>2</sup>

The purpose of this paper is to evaluate the effects of the institutional changes of two different types of temporary contracts which constitute the core of recent labour market policy in Italy. We analyze the effects of these changes on capital investment, capital-labour substitution, labour productivity and job reallocation. The first institutional change has to do with the implementation of a national law (legislated in 2001) which eased the use of fixed-term contracts by cancelling the need of giving a justification for the use of these contracts. While the law set out nationally a general framework for the use of fixed-term contracts, the actual implementation of its provisions required their approval through the rounds of collective bargaining that took place sector-wise in the subsequent years (starting in 2005, much later than the national law). The actual way in which each sector of the economy implemented the law was therefore different, and the timing of the implementation varied according to the staggered structure of collective bargaining rounds. This feature generates variation across sector and over time in firms' exposure to the new provisions, which we exploit in estimation. The second reform has to do with apprenticeship contracts for young workers. It was meant to stimulate the use of these contractual arrangements mainly by weakening the need of training certification and extending the scope of their applicability up to 30 years old individuals. The relevant law was legislated in 2003 but required regional governments to issue implementation guidelines, which happened differentially by region in the subsequent years (also starting in 2005). This feature of

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<sup>2</sup>A literature exists in the evaluation of the effects Employment Protection Legislation on productivity: Autor et al. (2007), Bassanini et al. (2009) and Cingano et al. (2009), discussed in the next section. Temporary workers may affect productivity also through human capital investment, in this paper we focus only on the less researched effect on capital investment and productivity.

the legislative process generates variation across regions and time in firms' ability to use the new contracts.

A further contribution of this paper is that we estimate an elasticity of substitution between different types of temporary contracts. Economic models necessarily simplify the actual use of temporary and permanent contracts and consider one single type of temporary contract. However in practice in all countries there exist different types of temporary contracts typically the result of repeated attempts at making the labour market more flexible leaving the open-end contracts untouched. Italian employers can use four types of temporary contracts with different characteristics: apprenticeships contracts (*apprendistato*), fixed-term (*tempo determinato*), collaboration workers (*co.co.co* i.e. a sort of consultants hired on a temporary basis) and temporary agency jobs (*interinali*). We have firm level data on the demand of the four different types of labour contracts and we show that reforms intended to ease the use of one specific type of contract can have unintended consequences due to partial substitutability of various types of contracts. This is the first paper to our knowledge which studies the substitutability across different types of temporary contracts and highlights the potential consequence of a high elasticity of substitution which makes ineffectual the reform of only one type of contract.

Using four waves of Excelsior-ASIA data, we find that the reform of apprenticeship contracts has been successful because it actually increased turnover of workers, induced capital-labour substitution in favour of labour and increased productivity. The reform of fixed-term contracts, instead, does not seem to have had the intended results. The fact that the implementation of the national law required the approval through collective bargaining rounds may have altered the original spirit of the law and made the use of fixed-term contracts more costly rather than less costly. It reduced job turnover of other types of contracts and of open-ended

contracts (as shown by high estimates of substitution elasticities) and induced the use of more capital per worker. The higher capital intensity did not suffice to avoid a fall in productivity.

The paper proceeds as follows: in Section 2 we review the literature, in Section 3 we describe the institutional changes, in Section 4 we describe the data, in Section 5 and 6 we present respectively the estimating framework and the results and we conclude in Section 7.

## 2 Related literature

There is overwhelming evidence that fixed-term contracts and lower Employment Protection Legislation (henceforth EPL) increase the volatility of employment by raising both the hiring and firing rates (Bentolila and Bertola, 1990).<sup>3</sup> In the following we do not review the huge literature on EPL and job flows and we concentrate on the literature that looks at the relationship between EPL and investment and between EPL and productivity which is the core of the paper.

The effect of EPL on productivity is ambiguous and Ljungqvist (2002) has shown that existing quantitative results on productivity (and on the employment level) depend crucially on different modelling choices. On the one hand there are multiple mechanisms that may induce a negative effect of an increase in EPL (or equivalently of restrictions to the use of temporary contracts) on productivity. High EPL hampers the reallocation of workers and jobs across industries and firms, therefore when the importance of reallocation for productivity is large,

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<sup>3</sup>Temporary contracts and EPL are related because, although regulations vary, a general feature of fixed-term contracts is that severance payments and dismissal protection are low and many countries reduced EPL relaxing the rules about the use of temporary contracts while leaving open-ended contracts protected. OECD produced different indices of employment protection, including one related to the regulation of temporary contracts only. When the index is built considering only the legal treatment of fixed-term contracts, the negative correlation between EPL and job flows is significantly stronger.

productivity falls (Samaniego, 2006). Wasmer (2006) suggests that by inducing substitution of specific for general skills, firing restrictions may have a negative effect on productivity when workers need to be reallocated across industries. Other examples of high EPL that reduces productivity are Ichino and Riphahn (2005) and Riphahn and Engellandt (2005) who show that layoff protection might also affect productivity by reducing worker effort. Some studies emphasize the obstacle of EPL to undertake highly productive but risky activities (Bartelsman and Hinloopen, 2005). Blanchard and Landier (2002) and Cahuc and Postel-Vinay (2002) model temporary contracts as churning policies that affect negatively wage setting. In this scenario two-tier reforms create a dual labour market with higher unemployment and lower productivity. Finally temporary contracts constitute in many countries a second tier labour market where workers may be stuck in dead-end jobs or unemployment for long before finding a permanent job thus reducing productivity (see Booth et al. (2002) for the U.K., Güell and Petrongolo (2007) for Spain, and Holmlund and Storrie (2002) for Sweden).

On the other hand other mechanisms indicate a positive relationship between EPL and productivity. More stringent EPL may promote specific investments and result in more learning-by-doing and an increase in productivity. EPL also provides insurance against uninsurable labour income risk, and this may allow for better search of jobs. Belot et al. (2007) propose a framework where, by providing additional job security, protection against dismissal may increase workers' incentives to invest in firm-specific human capital, therefore enhancing productivity. Other papers emphasize the effects of EPL on reallocation via entry and exit of firms. Poschke (2007) emphasises the role of firing costs in the selection of the most efficient firms. Lagos (2006) claims that if stringent EPL raises reservation wages, average productivity can increase simply because firms become more selective and less productive matches are not realised. If fixed-term contracts are

used as buffer-stock to boost the number of hirings in a boom, employment and productivity may go up at least temporarily (Bentolila and Saint-Paul, 1992 and Boeri and Garibaldi, 2007). Some papers show that being assigned to a temporary contract has a causal effect on the probability of finding a permanent match (for example Ichino et al. 2008). The bottom line of this research is that temporary contracts are good screening devices and stepping stones into permanent jobs and therefore increase productivity.

There are theoretical reasons to expect also an ambiguous effect of temporary contracts and EPL on the capital-labour ratio. The restriction on the use of temporary contracts (or an equivalent increase in EPL) entails higher costs for firms assuming that they cannot fully transfer the increase in costs onto lower wages (Leonardi and Pica, 2008). In labour markets with no frictions an increase in the cost of labour will in general imply substitution of labour with more capital and therefore a positive relationship between EPL can capital-labour ratios. A related case arises in the longer run when firms are not held up by irreversible investments and technology adoption becomes an issue. More EPL means that labour is more costly and when adopting new technologies firms will choose more capital intensive technologies (see among others Caballero and Hammour, 1998, Alesina and Zeira, 2006 and Koeniger and Leonardi, 2007).

Models with wage bargaining between workers and firms instead point to a negative relationship between EPL and capital-labor ratios. When there is wage bargaining, workers will use the protection of EPL to claim higher wages (Bentolila and Dolado 1994, and Garibaldi and Violante 2005). EPL will strengthen the outside option of workers and worsen the outside option of firms in the wage bargain. As a result, EPL may result in a higher bargained wage and a reduction of firms investment to avoid workers capturing part of the investment returns (the so called "hold up" problem).

The empirical part of most of the existing papers on EPL and productivity is based on cross-country and/or cross-industry regressions. Scarpetta et al. (2002) use data for 17 manufacturing industries in 18 countries and find that strict EPL has a significant negative impact on productivity only in countries with an intermediate degree of centralisation/coordination in wage bargaining. Micco and Pagés (2004) analyse the difference in the effects of EPL across sectors. Using data for 18 countries during the 1980s and 1990s, they find a negative relationship between layoff costs and the level of labour productivity especially in those sectors with higher needs for flexibility. Bassanini et al. (2009), use sectoral harmonized data from EUKLEMS for 17 industries in 18 industrial economies over the past two decades and find a negative effect of EPL on total factor productivity (TFP) thus concluding that reforms of overly strict dismissal regulation in many OECD countries can be justified on the grounds of fostering TFP growth. A similar result is obtained in Cingano et al. (2010).

Our contribution to the literature is based on the empirical evidence from a firm-level dataset, however we do not take a stand on a particular mechanism which links EPL to capital investment and productivity. The approach based on country or industry data potentially suffers from well-known severe problems. First of all, reverse causality: the strictness of EPL may depend on labour market conditions. Second, omitted variables may bias the results: EPL may pick up the effect of other factors unobserved by the econometrician that drive the cross-country differences in labour market performance. Third, most studies focus on overall EPL, without distinguishing between EPL provisions for fixed-term and permanent contracts. Using firm-level data and a difference in difference approach we improve on all three accounts, provided the identification hypotheses are valid (see Section 5).

In using firm-level data, our work is close to Autor et al. (2007) who study the impact of adoption of wrongful-discharge protection norms in the US using

cross-state differences in the timing of adoption. They find that capital deepening is increased while TFP is reduced. Quantitatively, they calculate a drop in productivity, with an average elasticity in the order of 0.03 to 0.04. Similar findings are provided by Cingano et al. (2008) using Italian data to examine a 1990 reform that raised dismissal costs only for firms with fewer than 15 employees.

### **3 Institutional background**

Similarly to other European countries, labour market flexibility has increased in Italy over the last ten years as a result of a series of measures which introduced various types of temporary contracts without changing the legislation on permanent, open-ended, contracts. The most important legislation was:

1. the "Treu-Package" (named after the then minister of labour) which in 1997 legalised temporary work agencies and liberalised both apprenticeship and fixed-term contracts;
2. Decree-Law No. 368/2001 which eased restrictions on fixed-term contracts further;
3. the "Biagi Law" (named after the legal expert killed by terrorists) which in 2003 introduced a number of new contracts in the national legislation and reformed the apprenticeship contract.

Our analysis, which considers the period 2004-2007, focuses on the second and third of these reforms. These two measures were implemented at different times in different regions and in different sectors of the economy and this variation in the institutional setting allows us to use a difference-in-difference approach. Both measures -although approved nation wide in 2001 and 2003- were implemented only starting in 2005 and therefore can be evaluated using the available data from 2004 to 2007. We discuss each of the two measures in turn.



### **3.1 The "new" fixed-term contract**

Legislative Decree No. 368/2001 introduced important changes to fixed-term employment contracts. They included two changes of particular importance for the purposes of this study. The first and definitely most important modification concerned what are termed the "reasons", i.e. the specific circumstances in which this type of contract may be used. Prior to 2001 these were very specific with full details given (e.g. peaks in production, replacement of workers on sick leave, etc.). The new law liberalised the contract by abolishing the detailed list of specific reasons and introducing the following single general reason: "reasons of a technical, organisational, production or replacement nature". While this part of the governmental decree was intended to allow employers greater flexibility in the use of fixed-term contracts, in practice it made the requirements for the use of these contracts too generic, which inevitably produced uncertainty over the contents of the legislation and how to apply it (Aimo, 2006). Uncertainty over the contents has generated different interpretations of the law, in particular on whether or not employers could recruit workers on fixed-term contracts without necessarily demonstrating the temporary nature of the work performed by those employed on those contracts. Finally, it is far from easy for employers to demonstrate the temporary nature of the job and at the same time to comply with this general "reason" clause. They are forced to deal with an inevitable degree of uncertainty in the use of this type of contract, which may have reversed the originally intended effect of the reform.

The second change introduced by the law, which is of particular interest here, is that it has restrained the scope for unions to affect the implementation of national law provisions through collective bargaining that takes place at the industry level. Under the previous legislation, collective bargaining agreements could list additional "reasons" for the use of fixed-term contracts over and above those con-

tained in the national legislation. Given that unions enjoy broad powers within collective bargaining agreements, they could –and actually did– make the application of fixed-term contracts within a given industry more restrictive than what was established at the national level. The new law abolished the possibility of including additional "reasons" through collective bargaining, thereby reducing union power and increasing the freedom of employers to use fixed-term contracts.

We evaluate the effects of this reform using a difference-in-difference research design. The case of the new fixed-term contracts lends itself to this type of analysis since in order to become applicable in a given industry, the new decree needed to be implemented through the national contracts for that industry. Therefore, only industries with national contracts negotiated after the decree was legislated, could apply the new fixed-term contracts. In Italy, collective bargaining is staggered by industry, so that not all industries bargain at the same time. In particular, after 2001 the renegotiation of collective bargaining agreements only occurred in some industries (with contracts signed mostly in 2005 and 2006) and our analysis exploits such variation across industries over time.

While trade unions generally proposed different solutions in the various national collective bargaining agreements, they did not fully relinquish their regulatory functions in compliance with the law (Zappalà, 2004). In many cases trade unions postponed detailed regulation until the negotiation of later collective bargaining agreements. This occurred in two important cases: mechanical engineering and banking. In other cases, as in the commerce and construction sectors, the "reasons" clauses of the national collective bargaining agreements were based on those contained in article one of the law with no significant additions made to it. Finally, a number of other collective bargaining agreements did in fact introduce "reasons" clauses. They did not and could not counteract the law, but on the one hand they underlined the normal and standard nature of open-ended

contracts and on the other they listed, by way of a non limiting example, a series of circumstances in which it could be assumed that a fixed-term contract was of a temporary nature. According to some, in practice collective bargaining in these cases has even produced the effect of facilitating and not restricting the use of fixed-term employment contracts. It is difficult to say with precision whether the final effect in these cases of national collective bargaining agreements which have further regulated the "reasons" has been that of greater flexibility or greater rigidity.

### **3.2 The "new" apprenticeship contract.**

Legislation to regulate apprenticeship contracts has existed for a long time and has also been reformed several times. This type of contract is widely used because it is convenient for employers for various reasons. Firstly, they have lower labour costs for apprentices and pay a wage that is set by national collective bargaining agreements at a level that is significantly lower than the norm. Also they pay social security contributions at a lower rate. Finally, firms pay no dismissal costs when contracts expire and this is why they are attracted to it as a useful substitute for fixed-term contracts.

The lower labour costs are intended to compensate firms for the training costs that they incur. However the training content of this type of employment is usually low, even if it is regulated by labour laws. Firms are required to share training costs by giving apprentices time off work (for a minimum number of paid hours) to attend external training courses that are provided by local authorities or accredited training institutes (and sponsored by the regions) outside the premises of the firm. At the end of the training periods, each apprentice should receive a certificate for the qualification they have acquired in their field of work.

There are, nevertheless, limitations on this training activity: lack of public

funding for training, a lack of infrastructures for training courses and little control over compliance with compulsory training obligations by firms using these contracts. These are some of the reasons which explain the low level of formal training that is provided. As a consequence most of the training is in the form of the on-the-job type.

The "Biagi Law" liberalised this contract further. A new form of apprenticeship was introduced (*apprendistato professionalizzante*, literally "apprenticeship leading to a job") with the same reduced labour costs as before. The new legislation abolished the certification of qualifications and extended the scope of the contract to include persons under the age of 30 (the previous age limit was 25). A further change designed to make the contract easier to use was the introduction of an option to perform training at the workplace as a substitute, at least in part, for external training courses provided by local authorities and accredited training institutes. This last amendment made it even more difficult to monitor compliance with this obligation by firms.

However, before the new law could be implemented, it required sets of regulations to be issued by the regional governments. The regions have exclusive power to legislate over vocational training and should therefore have issued regulations to govern the training content of the new apprenticeship contracts based on the guidelines set by national law.

The regions were, nevertheless, very slow in issuing these regulations, partly because they lacked the funds needed to organise the external training for apprentices (despite the reduction in the quantity of this type of training by the national legislation). Although slow to act, some regions passed legislation earlier than others. Some regions also enacted regional legislation which at least initially was incomplete, consisting of administrative measures to start experimental projects for the new contract in specific economic sectors (mainly commerce, banking and

tourism). These experimental projects were implemented in 2005.

In the meantime, in regions and sectors in which regulations for the new type of contract had not been introduced, firms continued to use the former apprenticeship contract, even though the conditions were less attractive than those of the legislation for the new "apprendistato professionalizzante" contract.

No regions passed any measures in 2003 and 2004. In addition to those regions which introduced experimental schemes in specific sectors already mentioned, in 2005 two regions, Emilia Romagna and Tuscany, enacted regional laws to enable the use of the new contract by all firms. Another four regions followed suit in 2006: Friuli, Marche, Sardinia and the autonomous province of Bolzano. We exploit this variation over regions and time in a difference-in-difference framework.

In order to overcome this legal confusion the government enacted a new law towards the end of 2005 whereby the training content of the new contracts could be established on the basis of national collective bargaining agreements to substitute those regulations which regions had until then failed to issue. Trade unions were also in favour of the use of the new apprenticeship contract and national agreements were signed accordingly in 2006. While agreements were not reached in all sectors, they were definitely concluded in the most important: foodstuffs, chemicals, energy, commerce, banking, construction, wood, textiles, transport and mechanical engineering. This generates additional variation that we exploit in estimation.

## **4 Data and descriptive statistics**

The data set used in this paper is a balanced panel of about 13,000 firms in the private sector observed over the years 2004-2007. Firm-level information on the types of employment contracts used within the firm is derived from the Excelsior data-

base, a survey conducted by Unioncamere (the Association of Italian Chambers of Commerce) with the aim of providing information on firms' occupational needs, in particular the skill requirement of prospective hires. It contains information on five types of employment contracts: permanent, fixed-term, apprenticeships, agency workers and "collaborators". For all types of contracts except the latter there are corresponding forms of employment in other countries outside Italy. The collaboration contract, instead, is peculiar of the Italian labour market and is a relevant form with which Italian firms can use labour inputs.<sup>4</sup> Excelsior data also provide details on the industry (3-digit) and geographical location of the firm, which is essential in constructing the treatment indicators discussed in the institutional section.

The other relevant piece of information used in the paper is the balance sheet information which is derived from the ASIA database, the archive of firm data maintained by the National Statistical Institute. In particular, ASIA provides information on firms' value added and capital stock.

In Table 1 we provide a description of firms workforce composition by type of employment contract. The average proportion of permanent contracts is 88 percent. The most utilised form of temporary employment is given by fixed-term contracts, whereas apprentices, agency workers and collaborators absorb on average 2 percent of firm employment each. There is some variation in this distribution. Permanent contracts are more frequent in the mining, energy and transports sectors, and are particularly under-utilised in the (private) education sector. Fixed-term contracts

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<sup>4</sup>Collaboration contracts (also called *co.co.co Collaborazioni Coordinate e Continuitive*) were introduced in 1998 to provide a contractual framework for individuals who were not employed by the firm but individually provided their working services to the firm, either immaterial (consultants) or material. The labour costs associated with these contracts were low thanks to a reduced regime of compulsory pension contributions, which induced many firms to adopt them even in cases in which the worker was actually an employee of the firm. In later years, the pension wedge was slightly increased and the requirements for using these contractual forms became stricter, imposing to use them only if the tasks to be performed had a fixed term themselves (*Contratti a Progetto*).

are more frequently used in the hotel, education and "other services" sectors. Apprenticeships are more frequent in the hotel sector, whereas education is the sector that by far employs collaboration workers more extensively. Besides industries and time, the other relevant variable that we use for assessing firms' exposure to the institutional reforms is location; the data in Table 1, however, do not reveal any evident pattern in contract type workforce composition by geographical area. The last rows of the table look at contract type workforce composition by exposure to institutional reforms and, again, do not show any clear pattern.

## 5 Estimating framework

We are interested in assessing the impact of the reforms to fixed-term contracts and apprenticeship contracts on measures of workers flows and productivity. Let  $d_{it}^F$  and  $d_{it}^A$  be dummy variables indicating whether in year  $t = 2004, \dots, 2007$  firm  $i$  was exposed to the reform of fixed-term (F) or apprenticeship (A) contracts. As explained in the institutional section, variation in the first dummy variable occurs over industries and time, whereas the reform of apprenticeships varies over regions, industries and time.<sup>5</sup>

We start by looking at the impact on job flows. Specifically, we consider the year to year percentage employment change defined as in Davis et al. (1996):  $EC_{it} = \frac{E_{it} - E_{it-1}}{\frac{1}{2}(E_{it} + E_{it-1})}$  where  $E_{it}$  is firm  $i$  employment in year  $t$ .

Our estimating equation is:

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<sup>5</sup>More precisely:  $d^F = 1$  from 2005 onwards in textiles, wood production, chemicals, construction, transportation and food production; from 2006 in telecommunications.  $d^A = 1$  from 2005 onwards in Emilia Romagna and Toscana; from 2006 onwards in Trentino-Alto Adige, Friuli-Venezia Giulia, Marche, Sardegna and Puglia; from 2007 onwards in Lazio. Furthermore  $d^A = 1$  from 2006 onwards in the following sectors: food production, chemicals, energy, retail, banking, construction, wood production, machinery, textiles and transportation.

$$EC_{it} = \beta' X_{it} + \gamma_F d_{it}^F + \gamma_A d_{it}^A + \varepsilon_{it} \quad (1)$$

where  $X_{it}$  is a vector containing year, region and industry dummies plus a constant, while the  $\gamma$ s coefficients pick up the effect of the two reforms on employment flows at the firm level. Essentially, we identify the effects of interest via a difference-in-difference framework, with the source of identification being provided by the exogenous variation in the reforms (we further discuss exogeneity of the reforms in Section 5.1). In all tables  $d_{it}^F$  is indicated as *fixed\_reform* and  $d_{it}^A$  as *app\_reform*.

Since we have detailed information on the type of employment contracts, we are able to estimate the reforms' impact on employment flows considering either total employment and employment in each contract type (agency workers, collaborators, apprentices, fixed-term). This exercise enables an indirect assessment of the degree of substitutability between different types of employment contracts. In other words, the effectiveness of reforms in one type of employment contract greatly depends on the extent with which firms are able to substitute across contract types. Estimating the impact of reforming one type of contract on job flows of another contract type is a way to assess the existence of substitution effects across contracts.

Next, we investigate the impact of the reforms on labour productivity and investments. We define productivity as the ratio between value added and total employment, including all types of temporary employment contracts. We investigate variations in productivity and investments when firms are exposed to the reforms using the same estimating framework laid out in equation 1.

Our specifications include two estimations of greater stringency. The first includes year, region and industry dummies; the second adds region- and industry-specific trends. Region-specific time trends require that identification comes from



the discontinuity surrounding the passage of the reforms. These specifications can provide reassurance that our coefficients are not reflecting smoothly trending omitted variables that are potentially correlated with the adoption of the reforms. We also control for industry-specific trends that allow us to control for employment shifts due to national trends in region's industries, again providing confidence in the identification strategy.

## 5.1 Assessing the validity of identification

The validity of the identification of equation 1 rests on the exogeneity of the reforms. In the ideal case the reform adoption decisions (by the regions and the sectoral bargaining rounds) would be independent random events that varied in timing and had no spillover effects to non-adopting regions or sectors. While firm migration across sectors and regions to take advantage of the rules is highly unlikely, one possible concern is that the regions which had higher or lower than average employment growth in temporary contracts were also the same to adopt the reforms of the apprenticeship contract. Equivalently the sectors with relatively higher or lower employment growth in temporary contracts could be those which adopted the fixed-term contract reform. To dispel this doubt we use data from the Italian Labour Force Survey (LFS) from 1996-2007. We cannot use our firm-level data because we need data prior to the reforms to control for pre-dating trends in employment in temporary contracts, therefore we use LFS data which, although based on individuals and not on firms, are a representative sample of the Italian labour market.

Figure 1 top panel compares log employment in (all types of) temporary contracts in the regions adopting the apprenticeship contract reform (treated sample) and in the non-adopting regions (control sample). The bottom panel does the same for adopting and non-adopting sectors of the fixed-term contract reform.

Both panels show a similar movement in the two series before the adoption of the two reforms in 2005 thus supporting the validity of our identification strategy which is based on the assumption that the outcomes of interest would have otherwise evolved similarly in adopting and non-adopting regions and sectors.

To further prove that preceding trends in temporary employment do not predict the adoption of the reforms, using the LFS in Table 2 we regress the two reform dummies on leads (2 leads) and lags (4 lags) of log employment in temporary contracts (inclusive of all types of contracts). These coefficients are relative to the period four years prior to the reform, and their pattern indicates whether the pre-post results in the following Tables 3 to 5 are consistent with a causal interpretation. In particular, we would be concerned if there are large and statistically significant coefficients on the lag indicators, regardless of whether they are positive or negative. The first two columns of Table 2 show the effect of log temporary employment on the share of workers affected by the adoption of the apprenticeship contract reform by region (20 regions\*11 years). The results show that past temporary employment has no significant effect on the adoption of the reform. In the same way the third and fourth columns show that past temporary employment has no effect on the adoption of the fixed-term contract reform (12 sectors\*11 years).

## 6 Results

In this section we first assess whether employment protection legislation affects the level of job reallocation. If the reforms decrease the costs of using temporary contracts, this should lead to an increase in hiring and dismissals of workers with those same contracts, resulting in an overall increase of employment fluctuations.

We next look at the effects on labour productivity and on capital and invest-

ment normalized by unit of labour, a margin along which theory does not give clear predictions and prior research has obtained mixed results. Lastly, we use information on the various contract types to estimate the substitution elasticities within temporary workers and between temporary and permanent workers, which we argue may have played a relevant role in mediating the effects of the reforms on firms' allocative decisions.

## 6.1 Job reallocation, labour productivity and investments

Regarding job reallocation, the reform designed to make the use of apprentices easier had a positive effect on job flows of apprentices and agency workers which is reflected in a positive effect on job reallocation at the aggregate level i.e. considering both permanent and temporary contracts of all types (Table 3 column 1) but had no effects on the use of other types of temporary contracts. It suggests an increase in employment fluctuations of around 4% for apprentices and of 2.5% for agency workers. The reform of the fixed-term contract instead has a negative effect on job reallocation both at the aggregate level (column 1) and on permanent contracts (column 2). Contrary to expectations, the reform of fixed term contracts, designed to make their use easier, has a negative effect on aggregate job reallocation and has no effect on job reallocation of fixed-term contracts (column 3).<sup>6</sup>

In panel A of the Table all columns includes region, year and sector dummies to absorb institutional, technological and time-specific effects. In panel B we also include industry-by-time dummies to control for differential trends by industry in the outcome variable. For example some industries may experience faster (e.g. the computer industry) or lower-than-average (e.g. manufacturing) capital adjustment

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<sup>6</sup>The low R-squared in this table reflects the high variability that is typically present in firm-level data on job reallocation (Davis et al., 1996).

or job reallocation or productivity growth in all regions. In the same column we also include region-by-time dummies to control for all region-specific time-varying characteristics (for example all regional-level institutions) which have the same effects across industries. Notice that we cannot introduce firm fixed effects because they would absorb the main effect of the reform variable which varies by region and time (apprenticeship contract reform) or by sector-time (fixed-term contract reform). However in order to control for firm characteristics, the regressions of panel B also include additional controls for firm's capital stock and value added. The two panels of Table 3 do not differ substantially indicating that the results are robust to the introduction of both sector and region-specific trends.

In Table 4 we explore the effect of the reforms on labour productivity finding strong and significantly positive coefficients of around 2% for the reform of apprenticeship contracts and insignificant (or marginally negative significant) results for the reform of the fixed-term contract. Once again the results are substantially unchanged if we control for the level of capital and for region- and sector-specific time trends (column 2).

In Table 5 we look at the effects of the reforms on log investment per capita and the log capital-labour ratio. The reform of apprenticeship contracts reduces the capital-labour ratio by 8 to 9% and the investment-labour ratio at the firm level by 14 to 18% (if we control for region and sector-specific trends). The reform of fixed-term contracts increases the capital-labour by 18-19% and the investment-labour ratio by 8 to 9%. The results on  $K/L$  and  $I/L$  are consistent: Negative (positive) results on the capital-labour ratio are consistent with results on  $I/L$  that show that investment is actually falling (increasing) relative to the units of labour employed.

## 6.2 Substitution effects

The reform of fixed-term contracts had an insignificant effect on job flows of fixed-term contracts but reduced significantly total turnover and turnover in permanent employment. This suggests substitutability between contracts of various types, which is something that has always been known among employers but has never been investigated by economists.

In order to provide a direct assessment of substitution effects across different types of contracts, we also estimate the parameters of a production function. We assume that production occurs according to a Cobb-Douglas technology in capital and labour, and that labour is of multiple types. We allow labour inputs to differ according to the contract type, distinguishing between permanent and temporary employment contracts and, within temporary contracts, among the four types of temporary contracts that were available to firms. In other words we estimate a simple production function where the four types of temporary contracts are partial substitutes and the entire group of temporary contracts is substitute with permanent contracts. We model the substitution across type of labour contracts using a nested CES technology:

$$Y_{it} = K_{it}^{\alpha} [L_{pit}^{\sigma} + (\sum_{\tau} L_{\tau it}^{\rho})^{\frac{\sigma}{\rho}}]^{\frac{(1-\alpha)}{\sigma}} \quad (2)$$

where  $Y$  is value added,  $K$  is capital,  $L_p$  is permanent labour and  $L_{\tau}$  represents four types of flexible labour (agency workers, collaborators, apprentices, fixed-term). Using this nested CES specification, parameters  $\sigma$  and  $\rho$  govern the substitution process across labour inputs. In particular  $\eta_{\rho} = \frac{1}{1-\rho}$  defines the substitution elasticity between varieties of temporary labour, while  $\eta_{\sigma} = \frac{1}{1-\sigma}$  defines the substitution elasticity between permanent and temporary labour.

Table 6 shows that the elasticity of substitution across various types of tem-

porary contracts is high and significant, higher than the elasticity of substitution between permanent contracts and temporary contracts. Pooling all years between 2004 and 2007 the elasticity of substitution between temporary contracts is of 1.4 (with some variation across years) while the elasticity of substitution between permanent and temporary contracts is stable at around the unit value. In year 2007 the elasticity of substitution across the four types of temporary contracts is insignificantly estimated.

## 7 Conclusions

The overall picture shows that the reform of apprenticeship contracts seems to have been successful because it actually increased turnover of apprentices and induced capital-labour substitution in favour of labour. These results suggest that the reform actually reduced the cost of apprenticeship contracts; therefore among the effects highlighted in the theoretical literature the substitution effect is prevailing over the "hold up" effect. Although the capital-labour ratio went down, the reform increased labour productivity possibly through one of the mechanisms suggested in the literature (for example increasing workers effort). We are not able to establish long-run effects operating through technology adoption because our data cover a relatively short period.

The reform of fixed-term contracts instead does not seem to have had the intended results: The reform reduced labour turnover, increased the capital-labour ratio and had a small negative effect productivity. This suggests that the reform may have made the use of fixed-term contracts more costly rather than less costly as already pointed out by some literature in labour law. If reallocation of labour is important and the reform of fixed-term contracts hampers job reallocation across and within firms (for example because it raises costs of consultancy for fear of

the courts), then productivity falls. Indeed, finding a negative effect of fixed-term contracts on job reallocation is a pre-requisite to claim that higher costs hamper the optimization of resources and allocative efficiency (Bertola, 1990). We also find that capital intensity is increased after the reform of fixed-term contracts which may be interpreted as another piece of evidence that the reform made the use of labour more costly relative to capital. In conclusion this paper shows that the a reform aimed at one type of contract may spillover onto other contracts due to substitution effects. This interpretation is supported by estimates of substitution elasticities across different types of temporary contracts.

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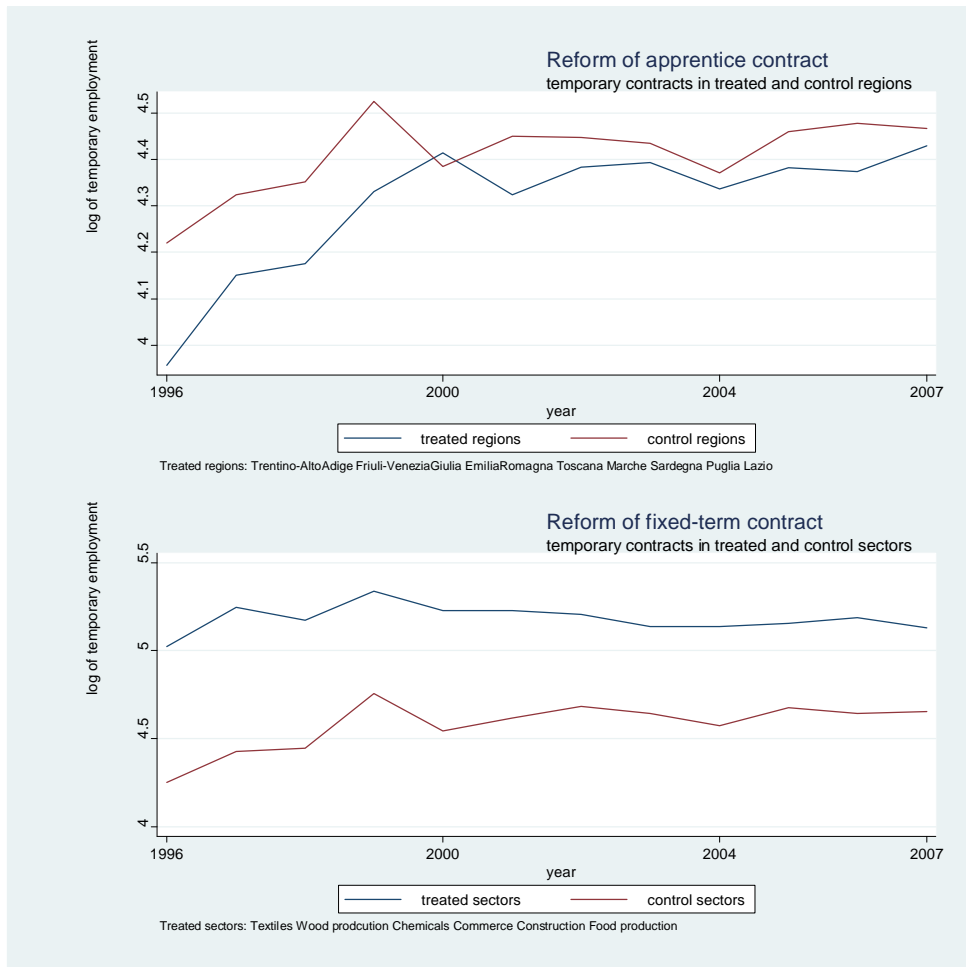


Figure 1: Log employment in temporary contracts in treated and control samples.

Table 1: Descriptive statistics: composition by type of contract

	Permanent	Fixed term	Apprentices	Agency	Collaborators
Overall	0.88	0.06	0.02	0.02	0.02
2004	0.87	0.05	0.02	0.02	0.03
2005	0.88	0.06	0.02	0.02	0.02
2006	0.88	0.06	0.02	0.02	0.02
2007	0.88	0.06	0.02	0.02	0.02
Manufacturing	0.89	0.05	0.02	0.03	0.02
Energy	0.91	0.04	0.01	0.01	0.03
Construction	0.88	0.06	0.03	0.01	0.02
Retail trade	0.88	0.05	0.03	0.02	0.02
Hotel and restaurant	0.79	0.14	0.04	0.02	0.01
Transports	0.9	0.06	0.01	0.01	0.02
Real estate	0.86	0.06	0.02	0.01	0.05
Private education	0.7	0.15	0.01	0.01	0.14
Private health	0.86	0.09	0	0	0.04
Other services	0.83	0.11	0.02	0.01	0.04
North west	0.89	0.05	0.02	0.03	0.02
North east	0.87	0.06	0.02	0.02	0.02
Centre	0.86	0.06	0.03	0.02	0.03
South and Islands	0.88	0.06	0.02	0.01	0.03
Reform of fixed contracts					
No	0.87	0.06	0.02	0.02	0.03
Yes	0.89	0.05	0.02	0.02	0.02
Reform of apprentices					
No	0.88	0.05	0.02	0.02	0.03
Yes	0.88	0.06	0.02	0.02	0.02

Source: Excelsion database 2004-2007, total number of observations 53,197.

Table 2: Preceding trends in temporary employment do not affect adoption

Dep.var.	app_reform	app_reform	fixed_reform	fixed_reform
% female		-0.497 (1.174)		-0.372 (2.529)
% university graduates		-0.839 (1.023)		-1.622 (2.403)
log temp empl	0.0776 (0.0879)	0.0591 (0.0930)	0.383 (0.308)	0.414 (0.325)
log temp empl t-1	0.0189 (0.0858)	0.0125 (0.0914)	-0.213 (0.332)	-0.210 (0.344)
log temp empl t-2	0.132 (0.0897)	0.120 (0.0952)	-0.336 (0.235)	-0.336 (0.252)
log temp empl t-3	0.00340 (0.0841)	0.00577 (0.0852)	0.0961 (0.312)	0.146 (0.354)
log temp empl t-4	0.0560 (0.0877)	0.0511 (0.0893)	0.0324 (0.288)	0.0619 (0.310)
log temp empl t+1	0.0485 (0.0809)	0.0308 (0.0840)	0.108 (0.246)	0.107 (0.258)
log temp empl t+2	0.0932 (0.0915)	0.0822 (0.0933)	-0.322 (0.301)	-0.351 (0.320)
Constant	-1.952 (1.612)	-1.219 (2.018)	-2.939 (9.084)	-2.385 (9.729)
Region trends	NO	YES	NO	YES
Sector trends	NO	YES	NO	YES
Observations	95	95	60	60
R-squared	0.387	0.397	0.567	0.584

Notes: Source LFS 1996-2007 collapsed by region (app\_reform) and by sector (fixed\_reform). Dependent variable is reform dummy, additional controls include year, region and sector dummies. Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 3: The effect of reforms on job reallocation by type of contract

<i>PANEL A</i>						
Dep. var.	All contracts	Permanent	Fixed-term	Apprentices	Agency	Collaborators
app_reform	0.00246 (0.00284)	0.00497 (0.00460)	0.0143 (0.0156)	0.0390*** (0.0130)	0.0251* (0.0134)	0.0132 (0.0152)
fixed_reform	-0.00928*** (0.00246)	-0.0139*** (0.00323)	0.00937 (0.0115)	-0.00653 (0.0103)	-0.0166 (0.0110)	0.0225* (0.0117)
Constant	-0.0182 (0.0118)	0.00521 (0.0178)	0.0286 (0.0495)	0.0100 (0.0385)	-0.0969*** (0.0283)	-0.184*** (0.0431)
Observations	39857	39857	39857	39857	39857	39857
R-squared	0.006	0.003	0.001	0.001	0.002	0.002
<i>PANEL B</i>						
Dep. var.	All contracts	Permanent	Fixed-term	Apprentices	Agency	Collaborators
app_reform	0.00357 (0.00326)	0.00116 (0.00495)	0.00808 (0.0172)	0.0510*** (0.0143)	0.0311** (0.0150)	0.00883 (0.0166)
fixed_reform	-0.00961*** (0.00248)	-0.0134*** (0.00324)	0.0102 (0.0116)	-0.00850 (0.0103)	-0.0176 (0.0111)	0.0226* (0.0118)
Constant	-0.00768 (0.0214)	0.0210 (0.0314)	0.164* (0.0858)	-0.00500 (0.0656)	-0.0962* (0.0577)	-0.0791 (0.0944)
Observations	39857	39857	39857	39857	39857	39857
R-squared	0.008	0.007	0.003	0.003	0.003	0.003

Note: The dependent variable is the measure of workers flow defined in the text, applied to the overall firm labour force and by type of employment contract. All regressions include controls for time, region and industry. Models in Panel B include additional controls for capital stock, value added, region- and sector-specific trends. Robust variance estimates account for repeated observation on the same firm over time. Standard errors in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Table 4: The effect of reforms on labor productivity

Dep. var.	log labor prod	log labor prod
app_reform	0.0216** (0.00843)	0.0200** (0.00915)
fixed_reform	-0.0185 (0.0117)	-0.0224* (0.0129)
Constant	11.05*** (0.0476)	11.08*** (0.0549)
Region trends	NO	YES
Sector trends	NO	YES
Observations	52840	52840
R-squared	0.115	0.124

Notes: The dependent variable is the log of value added divided by the total number of employees. All regressions include controls for time, region and industry. Robust variance estimates account for repeated observation on the same firm over time. Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.



Table 5: The effect of reforms on capital intensity and investment

Dep. var.	log K/L	log K/L	log I/L	log I/L
app_reform	-0.0872*** (0.0221)	-0.0929*** (0.0242)	-0.144*** (0.0464)	-0.179*** (0.0540)
fixed_reform	0.180*** (0.0271)	0.195*** (0.0300)	0.0864* (0.0524)	0.0912* (0.0526)
Constant	10.99*** (0.0992)	10.98*** (0.116)	8.896*** (0.162)	8.894*** (0.164)
Region trends	NO	YES	NO	YES
Sector trends	NO	YES	NO	YES
Observations	52970	52970	15440	15440
R-squared	0.168	0.168	0.089	0.091

Note: Investment has 39,857 observations but many zeros. All regressions include controls for time, region and industry. Robust variance estimates account for repeated observation on the same firm over time. Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 6: Elasticity of substitution between temporary contracts and with open-ended contracts

Year	2004-2007	2004	2005	2006	2007
$\eta_\rho$ (across temp contracts)	1.392*** (0.148)	1.215*** (0.113)	1.802* (1.023)	1.478*** (0.223)	-0.780 (6.898)
$\eta_\sigma$ (betw. temp and perm contracts)	1.062*** (0.254)	1.070*** (0.0851)	1.058*** (0.0400)	1.060*** (0.220)	1.056*** (0.0924)
Observations	53145	13287	13286	13286	13286

Notes: Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.