

# Informal work in a flexible labour market

By Edoardo Di Porto<sup>a</sup>, Leandro Elia<sup>b</sup>, and Cristina Tealdi<sup>c</sup>

<sup>a</sup>University of Naples Federico II, CSEF, and UCFS Uppsala University

<sup>b</sup>European Commission, Joint Research Centre (JRC), Via E. Fermi 2749, I-21027 Ispra (VA) Italy;  
e-mail: leandro.elia@jrc.ec.europa.eu

<sup>c</sup>IMT, School for Advanced Studies

## Abstract

Informal employment is a pervasive and persistent feature of most developing and developed economies. Labour taxation and labour market regulations are deemed two major causes for operating in the informal sector. Using data from France, Italy, and Spain, we analyse gross job flows and gross worker flows in the formal and informal sectors in the presence of lenient employment protection legislation, and investigate the way traditional policy interventions may favour transitions from one sector to the other. We show that optimal outcomes in terms of reduction and formalisation of informal jobs across the three countries examined are achieved with the combination of lower payroll taxes for permanent contracts and higher inspection rate for firms operating in the informal sector. Coupling lower firing costs with more frequent labour inspections also reduces informality, but this comes at the cost of an increased ratio of temporary to total employment.

**JEL classifications:** J38, J63, J64, H26

## 1. Introduction

In its multifaceted forms, informal employment is an important trait of contemporary labour markets. Out of a global working population of three billion workers, nearly two-thirds are employed in the informal sector (Jutting and de Laiglesia, 2009). Informality is more frequent in emerging countries where it is mostly associated with sub-standard labour conditions and low pay occupations, and constitutes the sole alternative for a significant share of the labour force. Yet informality is also an increasing concern for more advanced economies, where it assumes the form of underreporting of income to the tax authorities and involves the use of undeclared labour. Schneider (2011) estimates that in Europe the number of individuals working in the informal economy doubled from 1978 to 1998. According to a report of the Pew Hispanic Center, the number of illegal immigrants living in the United States was 11.9 million in 2008, of which 8.3 million were part of the US labour force (Passel and Cohn, 2009).

Informal jobs are normally characterised by longer work shifts, less chance to access formal training, higher unemployment risk, as well as higher uncertainty in income stream.

This, coupled with lack of social protections and benefits, and lack of health and safety standards, makes it one of the main world-wide policy challenges.

An extensive body of literature has investigated the incidence and persistence of informal employment as well as its causes and consequences. Surveys on this respect are provided by [Schneider and Enste \(2000\)](#), [Maloney \(2004\)](#), [OECD \(2004\)](#), and [Packard \*et al.\* \(2012\)](#). The two factors that have been identified in the literature as major determinants of both a firm's and a worker's decision to operate in the informal sector are labour taxation and labour market regulations. On the one hand, the burden of tax and social contributions affects labour-leisure choices and encourages the supply of informal labour. The larger the tax wedge the greater the incentive to work in the shadow economy ([Feld and Schneider, 2010](#)). On the other hand, the set of regulations and laws that defines the legal framework of hirings and firings plays an important role in achieving labour tax compliance. Moreover, rigid employment protection legislations (EPL) are shown to have negative effects on both job creation and job destruction, reducing the overall turnover ([Bertola \*et al.\*, 1999](#); [Blanchard and Portugal, 2001](#); [Vindigni \*et al.\*, 2015](#)), and therefore creating incentives for firms to hire workers either on temporary contracts or in the informal sector. Hence, a higher flexibility in the labour market, achieved through the introduction of new employment contracts that are less costly than permanent contracts and which are associated with lower EPL, may succeed in producing the joint effect of reduced taxation and less strict labour market regulations. Yet [Cappellari \*et al.\* \(2012\)](#) point out that changes in EPL for temporary employment produces substitution between different types of temporary contracts while leaving total employment unchanged.

A number of papers have studied the dynamics of informality over the business cycle and predict informal employment to be countercyclical, that is, acting as a buffer during economic downturns ([Bosch and Maloney, 2007](#); [Fiess \*et al.\*, 2006](#); [Loayza and Rigolini, 2006](#)). Even though cyclical effects are important and transitions from the formal to the informal markets are likely to respond to the cycle, in this paper we focus on steady-state equilibria and abstract from short-run labour adjustments, which are outside the scope of our work.

This paper contributes to a very intense area of academic research by analysing the relation between flexibility and informal work. Specifically, we formalise a search and matching model in the spirit of [Diamond \(1981\)](#) and [Mortensen and Pissarides \(1994\)](#) in which the formal and informal sectors coexist. As in [Tealdi \(2011\)](#), the firms are allowed to offer different types of contracts (permanent and short-term) to the workers and are bound to pay social security fees whenever they hire a worker in the formal sector. Within this literature, our model specifically relates to studies that use the search theory to address the issue of informal work ([Bouev, 2005](#); [Basu \*et al.\* 2014](#); [Kolm and Larsen, 2003](#); [Fugazza and Jacques, 2004](#); [Albrecht \*et al.\*, 2009](#); [Boeri and Garibaldi, 2002](#)). The paper that most closely resembles our work is the one by [Bosch and Esteban-Prete \(2012\)](#), in which direct transitions from the formal to the informal sector (and vice versa) are allowed and endogenously modelled. While these authors use this set up to analyse informality in developing countries, it serves our purpose for crafting and testing effective policies and combinations thereof in advanced economies.

We calibrate the model using data from three European countries, namely France, Italy and Spain, and carry out various counterfactual exercises. The focus on these countries is primarily due to two reasons. First, they all have a significant share of underground

economy in the range of 15-25% of official GDP,<sup>1</sup> and second, since the late 1990s they have implemented several reforms to increase labour market flexibility. Our findings are consistent across all three countries and this assures us about the validity of the model. We show that optimal outcomes in terms of reduction and formalisation of informal jobs are achieved with combinations of policy instruments. Specifically, the following two combinations appear to attain the most attractive outcome:

- Policy (a): Lower payroll tax rate for permanent contracts and higher inspection rate for firms operating in the informal sector.
- Policy (b): Lower firing costs for permanent contracts and higher inspection rate for firms operating in the informal sector.

Following the implementation of Policy (a), an increase in the inspection rate leads to a higher destruction of informal jobs, which comes along with a reduction of the flow of temporary workers into the informal sector and lower job creation in the informal sector. Moreover, due to lower payroll taxes, the destruction rate of permanent employees is lower and the flows of workers from informal to formal work and from temporary to permanent positions are higher. Therefore, we observe an increase in formal employment as well as a decrease in informality across all three countries.<sup>2</sup>

In the second policy scenario, the effect on the informal sector is the same, albeit of smaller size. In addition, lower firing costs generate an increase in both job creation and job destruction of permanent positions, with a prevalence of the former, even though of different magnitude, in all three countries. This effect is accompanied by an increased flow of workers from informal to temporary work in Italy and France, which causes the incidence of temporary jobs over total employment to rise.

For both solutions a problem of financial sustainability arises due to the cost of a higher inspection rate. Therefore, a combination of policies that involves an increase of payroll taxes associated with temporary contracts and an increase of the inspection rate could be an interesting solution. In fact, not only is the informality rate lower, unemployment is also lower, and the ratio of temporary to overall employment is lower in all countries. Further, the higher revenues from taxation could be used to finance the higher inspection rate without incurring into sustainability issues.

The rest of the paper is structured as follows. Evidence of the interconnection between labour market rigidities and informality appears in Section 2. Section 3 introduces the theoretical model. Section 4 discusses the calibration. Findings are reported in Section 5, and concluding remarks are given in Section 6.

## 2. Exploratory evidence

In this section we provide preliminary evidence of a positive relationship between informal employment and EPL/labour tax burden. We concentrate on a sample of OECD countries for which there exist reliable measures of labour market regulations. The choice of the sample is also dictated by the availability of data on informality. We are not aware of any

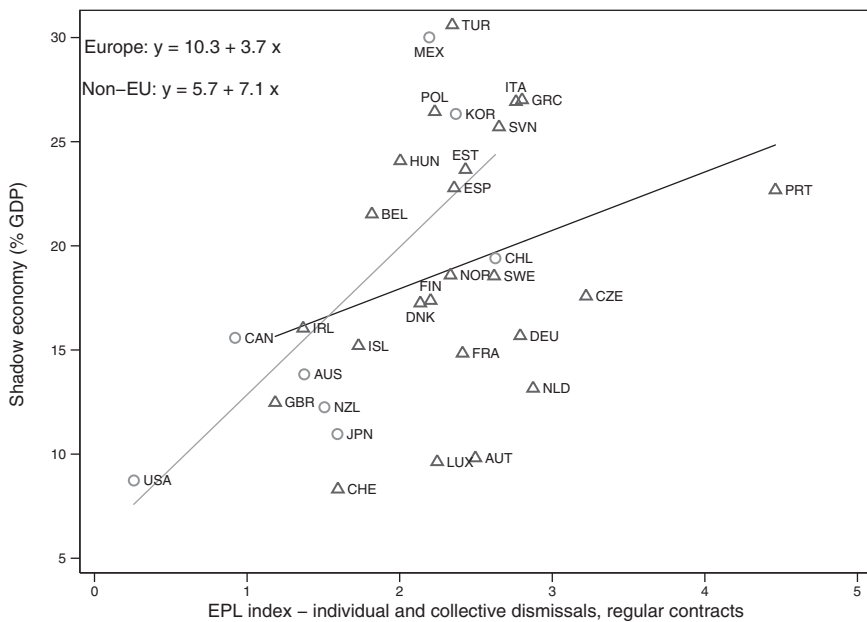
1 Estimates of the unofficial economy as provided by [Schneider and Buehn \(2012\)](#).

2 More precisely, in response to policy (a) we observe that both permanent and temporary employment grow in Italy and France, while only permanent employment seems to rise in Spain, in response to policy (a).

dataset for OECD countries that contains information on informal employment; therefore we use estimates of the unofficial economy from Schneider and Buehn (2012) to measure the incidence of informality. We use annual data over the period 1999-2010 for 20 OECD economies, of which 20 are European countries, four are from East Asia and Pacific, and three are from Central and North America.

In addition, to quantify workers' job protection we use two different indicators for EPL. The first indicator reflects the cost of various regulatory provisions incurred by employers for individual and collective dismissals of open-ended contracts. The second index considers only regulations for temporary forms of employment. This last indicator should better capture recent changes in the labour market that have primarily taken the form of reforms at the margin in various European countries. Additionally, to take into account to what extent taxation discourages formal employment, we use an estimate of the tax wedge—the ratio between the amount of taxes paid to general government and the total labour cost for the employer. In particular, we employ the tax wedge that is relevant for a single-earner married couple with two dependent children. All these indicators are from the OECD.

Figure 1 reports bivariate correlations between the unofficial economy and the EPL index for regular contracts. Country figures are averages over the period 1999-2010. We report separate correlations and linear fits for European and non-European countries. This figure is very telling, as it shows in a clear-cut way a positive and strong relationship between labour market rigidities and informality. In regard to European countries, we detect



**Fig. 1.** Shadow economy (% GDP) and EPL index of individual and collective dismissals for regular contracts

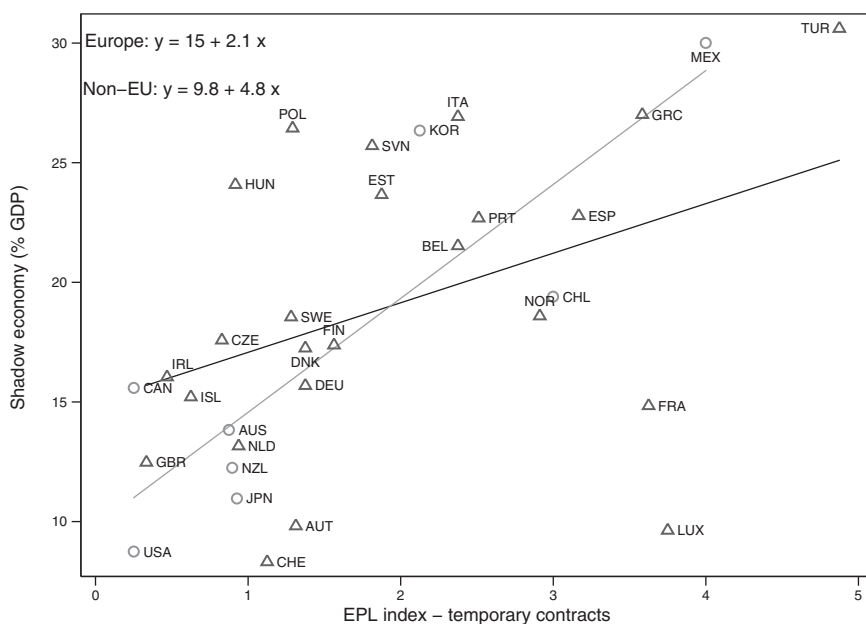
*Notes:* Figures are country averages over the period 1999-2010. European countries are marked with a triangle and non-European countries with a circle. The superimposed black and grey lines are linear fits for European and non-European countries, respectively.

that a one-point increase in the EPL index for regular contracts—similar to a shift from Spain’s to Portugal’s degree of regulations—is associated with a 3.7 percentage point surge in the unofficial economy. The association is even larger for the sample of non-European countries, although it seems to be driven by the very high level of informality of Mexico and South Korea.

The positive response of the shadow economy to labour market regulations is also confirmed in Fig. 2, where only rules on short-term contracts are factored in. We find large and positive correlations that amount to 2.1 and 4.8 for Europe and the rest of the sample, respectively.

To examine the impact of a country’s labour tax burden on the incidence of the unofficial economy, we display in Fig. 3 bivariate correlations of the tax wedge and the underground economy. Looking at Fig. 3, we find that larger incidence of labour taxes on earnings (of a hypothetical single-earner married couple with two children) is considerably related to the size of the unofficial economy. As far as European countries are concerned, a one percentage point increase in the difference between after-tax and before-tax earnings is associated with a 0.3 percentage point increment in informality. On the other hand, for non-European countries we observe a negative relationship between the tax wedge and informality, though this is imprecisely estimated.

To exclude the possibility that the positive relationship between informal employment and labour market rigidities is driven by other omitted macroeconomic factors, we complement the previous analysis with estimations of simple models for informality in which other characteristics are factored in. These are gross capital formation in percentage of GDP, trade to GDP ratio, the inflation rate, the age dependency ratio, and the rate of



**Fig. 2.** Shadow economy (% GDP) and EPL index for temporary contracts

*Notes:* Figures are country averages over the period 1999-2010. European countries are marked with a triangle and non-European countries with a circle. The superimposed black and grey lines are linear fits for European and non-European countries, respectively.



**Table 1.** Shadow economy and labour market rigidities

	(i)	(ii)	(iii)	(iv)
EPL index, regular contracts	1.899** (0.745)		1.138 (0.716)	
EPL index, temporary contracts		1.632** (0.671)	1.308* (0.731)	
Tax wedge				0.172** (0.069)
Inflation	0.117* (0.062)	0.050 (0.059)	0.053 (0.057)	0.038 (0.043)
Unemployment rate	0.517*** (0.172)	0.431** (0.168)	0.447*** (0.157)	0.305** (0.145)
Age dependency ratio	-0.077 (0.144)	0.001 (0.133)	-0.070 (0.132)	-0.184 (0.153)
Investment	0.108 (0.185)	0.149 (0.155)	0.089 (0.155)	0.230 (0.169)
Trade openness	0.015 (0.015)	0.031** (0.013)	0.026** (0.011)	0.012 (0.016)
Rule of Law	-6.060*** (1.540)	-6.056*** (1.597)	-5.617*** (1.605)	-6.730*** (1.099)
R <sup>2</sup>	0.755	0.774	0.785	0.753
RMSE	3.320	3.187	3.111	3.247
Countries	27	27	27	27
Observations	324	324	324	297

Notes: \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ . sRobust standard errors in parentheses are clustered on countries. Dummies for Latin America, East Asia and Pacific, years and a constant are included but not shown.

of one percentage point in the average tax wedge augments the extent of the underground economy by 0.2 percentage points.

From the empirical analysis, we can conclude that a rigid labour market in the form of employment protection and higher labour taxation for both open-ended and short-term contracts are, on average, associated with a sizeable share of the shadow economy. A simple implication of these findings is that higher flexibility of the labour market would encourage firms and workers to operate less in the informal sector. To understand the extent to which this policy suggestion might be truly effective requires further analysis. Moreover, it is interesting to investigate whether in an economy where permanent and temporary contracts coexist, traditional instruments to reduce informality such as lower labour taxes, higher monitoring, lower firing costs, and lower penalty fees may actually be effective. This is the issue we consider next.

### 3. A search and matching model

To rationalise the previous findings, we consider an extension of the search and matching model à la [Mortensen and Pissarides \(1994\)](#) with several innovative features. First, in order to account for the coexistence of the formal and informal markets we allow employers to hire workers in both sectors. Second, to evaluate how temporary contracts may interact with the informal economy, within the formal sector we consider both temporary and

permanent contracts. Third, we allow for endogenous transitions between formal and informal sectors and between permanent and temporary jobs.

In line with the standard search and matching model, we assume that workers and firms meet in the labour market and the outcome of their match is a non-negative surplus. Matches occur randomly and according to a matching function  $m(u, v)$ , which depends on the total number of unemployed individuals  $u$  and the total number of vacancies  $v$ . The matching function is increasing in both arguments, concave, and homogeneous of degree one. When the firm opens a vacancy, it meets an unemployed worker according to a Poisson process with arrival rate  $\lambda(\theta) = m(u, v)/v$ , where  $\theta = v/u$  is defined as the market tightness. The arrival rate of a job offer for unemployed workers is  $\gamma(\theta) = m(u, v)/u \equiv \theta\lambda(\theta)$ . Workers are ex ante homogeneous. However, when the worker–firm match is formed, the productivity is revealed and heterogeneity emerges. The productivity of the match has two components: an aggregate component  $p$ , which is common among all worker–firm pairs and an idiosyncratic component  $\epsilon$ , which is match-specific. The random component is drawn from the random distribution  $G$  with support  $[\underline{\epsilon}^G, \bar{\epsilon}^G]$ . Depending on the productivity level of the match, the firm decides the sector and the type of contract to offer to the worker.

Firms can decide to offer a formal (permanent or temporary) contract or an informal contract to the unemployed worker they meet, according to the productivity level of the match. If a formal contract is offered, the firm is required to pay payroll taxes whose marginal rate is  $\tau^k$ , where  $k \in \{P, T\}$  if the contract is permanent or temporary, respectively, for the entire length of the contract. We assume that the marginal payroll tax rate associated with temporary contracts is lower compared to the rate associated with permanent contracts, that is,  $\tau_T < \tau_P$ . In addition, the firm is charged firing costs  $F$ , when the formal permanent employee is dismissed. No firing costs are due if the formal temporary employee is laid off. If an informal contract is offered, the firm is not required to pay payroll taxes or firing costs. However, imperfect monitoring is enforced by government authorities: when the firm is caught, at rate  $\phi$ , the employment relationship is terminated and the firm incurs a penalty fee,  $\sigma$ . All the costs are paid to the government and used in activities external to the model. In this framework, we allow informal workers to search for better formal opportunities. Since it is assumed that the search efficiency of an employed worker is lower compared to the search efficiency of an unemployed worker, the rate at which an informal worker finds a formal job is  $\chi\gamma$ , where  $\chi < 1$ .

After the worker–firm match is formed, at rate  $\alpha$  a productivity shock may hit the work relationship and a new  $\epsilon$  is drawn from a sector-specific distribution  $H^j : [\underline{\epsilon}^j, \bar{\epsilon}^j] \rightarrow [0, 1]$ , where  $j = \{P, T, I\}$  (permanent, temporary, informal). The new productivity levels are i.i.d. across workers and time. The future of the worker–firm relationship depends on the new productivity level of the match: firms might decide to change contract (permanent vs temporary), to change sector (formal vs informal), to continue the ongoing match, or to dismiss the worker.

In this model, low productivity matches tend to be framed within the informal sector since it is optimal for firms to bypass formal regulations. This happens even though these matches are subject to higher turnover due to the government monitoring and to the searching for better opportunities in the formal sector by informal workers. High productivity workers tend to be hired on permanent contracts to minimise the turnover and search costs.

In order to understand the labour market dynamics in detail, in the next subsection we will analyse both the firm's and the worker's respective problems.



### 3.1 The firm's problem

Let  $V$  be the present discounted value of opening a vacancy for a firm. In addition, let  $J^j$ , where  $j = \{P, T, I\}$ , be the present discounted value for a firm of a filled position in the formal sector, which is permanent ( $P$ ) or temporary ( $T$ ), or in the informal sector ( $I$ ). The introduction of firing costs associated with permanent jobs gives rise to two different value functions for filled positions;  $J^{NP}(\epsilon)$  is the value for a firm that is forming a *new* employment relationship with idiosyncratic productivity  $\epsilon$ . These new matches differ from *existing* ones, whose value is  $J^{EP}(\epsilon)$ , in terms of wages paid. The reason for this is that new matches are not subject to firing costs should a productive relationship not be formed.<sup>3</sup> Let  $J^{sP}(\epsilon)$ , where  $s \in \{N, E\}$  represents the value of new and existing permanent jobs, respectively. Therefore, the value of posting a vacancy is:

$$rV = -c + \lambda \int_{\underline{\epsilon}}^{\bar{\epsilon}} \max[J^{NP}(\epsilon'), J^T(\epsilon'), J^I(\epsilon'), V] dG(\epsilon') - \lambda V. \quad (1)$$

Whenever a firm opens a vacancy it incurs in a cost  $c$ . At rate  $\lambda$  the firm meets a worker, the productivity of the match is revealed, and the two parties agree on the future of the relationship. According to the productivity level of the worker, the firm maximises its utility by offering a formal contract to the worker, either permanent or temporary, or an informal position. If the applicant's productivity level is too low, the firm will keep the vacancy open and look for another worker. If the firm decides to hire the worker in the formal sector, either on a permanent or temporary basis, the value functions for the firm for a filled position with idiosyncratic productivity  $\epsilon$  are:

$$rJ^{sP}(\epsilon) = p + \epsilon - (1 + \tau^P)\omega^{sP}(\epsilon) + \alpha^P \int_{\underline{\epsilon}^P}^{\bar{\epsilon}^P} \max[J^{EP}(\epsilon'), J^T(\epsilon') - F, J^I(\epsilon') - F, V - F] dH^P(\epsilon') - \alpha^P J^{sP}(\epsilon) \quad (2)$$

$$rJ^T(\epsilon) = p + \epsilon - (1 + \tau^T)\omega^T(\epsilon) + \alpha^T \int_{\underline{\epsilon}^T}^{\bar{\epsilon}^T} \max[J^{NP}(\epsilon'), J^T(\epsilon'), J^I(\epsilon'), V] dH^T(\epsilon') - \alpha^T J^T(\epsilon) + \delta(V - J^T(\epsilon)). \quad (3)$$

Whenever the worker is employed, the firm receives a productivity flow equal to  $p + \epsilon$ . According to the type of contract the worker is hired on, the firm pays a salary  $\omega^{sP}(\epsilon)$ , if permanent, or  $\omega^T(\epsilon)$  if temporary. In addition, the firm is required to pay to the government payroll taxes proportional to the wage, corresponding to a marginal rate  $\tau^P$  if the worker is permanent, or  $\tau^T$  if the worker is temporary, where  $\tau^T < \tau^P$ .<sup>4</sup> At rate  $\alpha^k$ , where  $k = \{P, T\}$  (permanent, temporary), the match is hit by a productivity shock and the relationship may change according to the new productivity level. In addition, if

3 See Chapter 9 of [Pissarides \(2000\)](#) for a discussion on the differences between new and ongoing matches in the presence of firing costs.

4 The payroll taxes associated with temporary contracts are lower compared to the payroll taxes associated with permanent contracts.

the worker is hired on a temporary job, at rate  $\delta$  the firm is left with an open vacancy (eq. (3)) either because the contract expires or because the worker finds a better job.

If the firm decides to hire the worker in the informal sector, the value function for the firm for a filled position with idiosyncratic productivity  $\epsilon$  is:

$$rJ^I(\epsilon) = p + \epsilon - \omega^I(\epsilon) + \alpha^I \int_{\underline{\epsilon}^I}^{\bar{\epsilon}^I} \max[J^{NP}(\epsilon'), J^T(\epsilon'), J^I(\epsilon'), V] dH^I(\epsilon') - \alpha^I J^I(\epsilon) \\ + \phi(V - J^I(\epsilon)) - \phi\sigma + \eta(V - J^I(\epsilon)) \quad (4)$$

If the worker is hired in the informal market, at rate  $\phi$  the firm may be caught by the government authorities, be subject to the payment of a penalty fee  $\sigma$ , and be forced to open a new vacancy.<sup>5</sup> Finally, at rate  $\eta$  the worker may find a better job and quit his current position, leaving the firm with an open vacancy (eq. (4)).

### 3.2 The worker's problem

When a worker is unemployed they receive income from non-market activities  $b$  and meet a firm at rate  $\gamma$ . According to the productivity level of the match, the worker may receive a new permanent ( $W^{NP}$ ), temporary ( $W^T$ ), or informal ( $W^I$ ) contract or keep the unemployment ( $U$ ) status (eq. (5)).

$$rU = b + \gamma \int_{\underline{\epsilon}}^{\bar{\epsilon}} \max[W^{NP}(\epsilon'), W^T(\epsilon'), W^I(\epsilon'), U] dG(\epsilon') - \gamma U. \quad (5)$$

When employed, the worker receives a salary  $\omega^j(\epsilon)$ , where  $j = \{P, T, I\}$  for permanent, temporary, and informal relationships, respectively. If permanent, the worker's salary differs whether the match is newly-formed ( $\omega^{NP}$ ) or existing ( $\omega^{EP}$ ). At rate  $\alpha^j$ , the productivity level of the match may change and as a consequence so too will the worker's employment status. The worker might keep their current contract or may switch to any of the other available options. If the worker is hired on a temporary basis (eq. (7)), at rate  $\xi\gamma$ , the worker may move to another job or into the unemployment pool if he cannot find another employment opportunity. If the worker is hired in the informal sector at rate  $\phi$ , they may lose their job because of the government authorities' intervention. Finally, at rate  $\chi\gamma$ , where  $\chi < 1$ , the worker may find a better job opportunity (eq. (8)).

$$rW^{sP}(\epsilon) = \omega^{sP}(\epsilon) + \alpha^P \int_{\underline{\epsilon}^P}^{\bar{\epsilon}^P} \max[W^{EP}(\epsilon'), W^T(\epsilon'), W^I(\epsilon'), U] dH^P(\epsilon') \\ - \alpha^P W^{sP}(\epsilon), \quad (6)$$

$$rW^T(\epsilon) = \omega^T(\epsilon) + \alpha^T \int_{\underline{\epsilon}^T}^{\bar{\epsilon}^T} \max[W^{NP}(\epsilon'), W^T(\epsilon'), W^I(\epsilon'), U] dH^T(\epsilon') \\ - \alpha^T W^T(\epsilon) + \xi\gamma \int_{\underline{\epsilon}}^{\bar{\epsilon}} \max[W^{NP}(\epsilon'), W^T(\epsilon'), W^I(\epsilon'), U] dG(\epsilon') \\ - \xi\gamma W^T(\epsilon), \quad (7)$$

5 Alternatively, one could assume that once the informal relationship is discovered by the authorities the vacancy disappears, as in Charlot *et al.* (2015).

$$\begin{aligned}
rW^I(\epsilon) &= \omega^I(\epsilon) + \alpha^I \int_{\epsilon^I}^{\bar{\epsilon}^I} \max[W^{NP}(\epsilon'), W^T(\epsilon'), W^I(\epsilon'), U] dH^I(\epsilon') - \alpha^I W^I(\epsilon) \\
&+ \phi(U - W^I(\epsilon)) + \chi\gamma \int_{\epsilon}^{\bar{\epsilon}} \max[W^{NP}(\epsilon'), W^T(\epsilon'), W^I(\epsilon'), U] dG(\epsilon') \\
&- \chi\gamma W^I(\epsilon).
\end{aligned} \tag{8}$$

### 3.3 Surplus and wage bargaining

The surplus, which is generated whenever a match is formed, is a function of the sector as well as the type of contract the worker is hired on. The existence of firing costs  $F$  associated with permanent contracts and payroll taxes  $\tau$  associated with any formal contract generates a set of equilibrium wages, which translates into a set of match surpluses that are contract- and sector-specific. We assume that wages are bargained via the standard Nash bargaining mechanism, where  $\beta^j$ ,  $j = \{P, T, I\}$  is the bargaining power of the permanent versus temporary versus informal worker, respectively. Firing costs, which are an employer liability if the job is destroyed, strengthen the worker's hand in the wage bargaining and push the negotiated wage up. On the other hand, in the presence of marginal taxation (payroll) the worker's share of the surplus falls because both the firm and the worker realise that they can pay less taxes (at the loss to the pair) by reducing the negotiated wage (Mortensen and Pissarides, 2001). As a result, firms and workers always agree on the sector as well as on the type of contract and involuntary unemployment is not contemplated.

We believe that the bargaining power of the worker in the informal sector is lower than in the formal sector. In addition, in line with the equilibria highlighted in the work of Paolini (2001), we assume that permanent workers have higher bargaining power than temporary workers. For tractability purpose, as in Bosch and Esteban-Pretel (2012), we assume that the division of the surplus across contracts and sectors is the same (eq. (9)). This assumption satisfies our belief that  $\beta^I < \beta^T < \beta^P$ .

$$\frac{\beta^P}{1 + \tau^P(1 - \beta^P)} = \frac{\beta^T}{1 + \tau^T(1 - \beta^T)} = \beta^I. \tag{9}$$

As a result of the Nash bargaining, we can compute the equilibrium wages for the four types of contracts:

$$\omega^{NP}(\epsilon) = \frac{\beta^P}{(1 + \tau^P)} \left( p + \epsilon + \frac{(r + \alpha^P)}{r} c\theta \right) + (1 - \beta^P) \left( \frac{(r + \alpha^P)}{r} \right) b - \beta^P \alpha^P F, \tag{10}$$

$$\omega^{EP}(\epsilon) = \frac{\beta^P}{(1 + \tau^P)} (p + \epsilon + c\theta + rF) + (1 - \beta^P) b, \tag{11}$$

$$\omega^T(\epsilon) = \frac{\beta^T}{(1 + \tau^T)} (p + \epsilon + (1 - \xi)c\theta) + (1 - \beta^T) b, \text{ and} \tag{12}$$

$$\omega^I(\epsilon) = \beta^I (p + \epsilon - \phi\sigma + (1 - \chi)c\theta) + (1 - \beta^I) b. \tag{13}$$

Due to the symmetric property of the Nash bargaining, workers and firms always agree on the sector (formal or informal), the type of contract (permanent or temporary), and the

decision to terminate the contract. As in [Mortensen and Pissarides \(1994\)](#), firing costs enter with a negative sign in the wage equation for new matches (eq. (10)), and with a positive sign in the wage equation for existing matches (eq. (11)). On the other hand, the wage for informal workers (eq. (13)) takes into account the fact that with a positive probability the match may terminate due to the government inspection activity.

### 3.4 Steady state

The equilibrium steady state is defined by nine equations and nine endogenous parameters that determine eight productivity thresholds and the market tightness. The equations describe the job destruction and job creation conditions for all sectors and contracts and the free entry condition  $V = 0$ .

The first set of equations describes the transformation decision of a firm whenever a permanent worker is hired. The threshold  $\epsilon_A$  defines the level of productivity by which the firm is indifferent about whether to keep the worker as a permanent employee or offer them a temporary job (and pay the firing costs  $F$ ). Therefore, the threshold determines the flow from permanent to temporary employment. The threshold  $\epsilon_S$  defines the level of productivity by which the firm is indifferent about whether to keep the worker as permanent or to transfer the worker to a job in the informal sector (and pay the firing costs  $F$ ). Therefore, this threshold regulates the job transition from permanent to informal employment. Finally, the threshold  $\epsilon_Q$  defines the level of productivity below which the firm is dismissing the worker (and pays the firing costs  $F$ ) and opens a new vacancy. Therefore, this threshold defines the job destruction condition from permanent employment to unemployment:

$$J^{EP}(\epsilon_A) + F = J^T(\epsilon_A), \quad (14)$$

$$J^{EP}(\epsilon_S) + F = J^I(\epsilon_S), \text{ and} \quad (15)$$

$$J^{EP}(\epsilon_Q) + F = 0. \quad (16)$$

The second set of equations describes the transformation decision of the firm whenever a temporary worker is employed. The threshold  $\epsilon_G$  identifies the level of productivity for which the firm is indifferent about whether to offer a permanent or a temporary job. Therefore, this threshold determines the flow from temporary to permanent employment. The threshold  $\epsilon_L$  identifies the level of productivity for which the firm is indifferent about whether to offer a temporary job in the formal sector or an informal job. Therefore, this threshold regulates the flow from temporary to informal employment. Finally, the threshold  $\epsilon_B$  defines the level of productivity below which the firm dismisses the worker and opens a new vacancy. Therefore, this threshold defines the job destruction condition from temporary employment to unemployment:

$$J^T(\epsilon_G) = J^{NP}(\epsilon_G), \quad (17)$$

$$J^T(\epsilon_L) = J^I(\epsilon_L), \text{ and} \quad (18)$$

$$J^T(\epsilon_B) = 0. \quad (19)$$

Finally, the last set of equations determines the flows from informal employment and unemployment. The threshold  $\epsilon_U$  defines the level of productivity by which the firm is hiring an informal worker formally (on a permanent or temporary basis). This threshold also

determines the hiring decision in the formal market (permanent versus temporary) for unemployed workers. The threshold  $\epsilon_L$  defines the level of productivity by which the firm is indifferent about whether to move an informal worker into a formal temporary position. This threshold also determines the productivity level by which the firm is indifferent about whether to hire an unemployed worker formally and on a temporary basis, or informally. Finally, the threshold  $\epsilon_V$  identifies the level of productivity by which the firm dismisses an informal worker. Therefore, this threshold determines the flow from informal employment to unemployment:

$$J^I(\epsilon_U) = J^{NP}(\epsilon_U), \quad (20)$$

$$J^I(\epsilon_L) = J^T(\epsilon_L), \text{ and} \quad (21)$$

$$J^I(\epsilon_V) = 0. \quad (22)$$

The set of equations that defines the steady-state equilibrium is presented in the online Appendix.

As in [Bosch and Esteban-Pretel \(2012\)](#), it can be proven that an equilibrium exists and it is unique.<sup>6</sup>

We compute the steady state value of unemployment and formal and informal employment by computing the workers' flows across sectors and contracts. In addition, we can quantify the flows of workers transiting across states.

After computing the steady state of the model, we are ready to calibrate it to match statistics (such as unemployment rate, share of formal and informal employment, and informality rate) in the data.

#### 4. Model calibration

We calibrate the model using data from France, Italy, and Spain, which have in common a large share of temporary contracts as well as a high informality rate. In order to perform the model calibration, we have chosen parameter values according to the literature on the topic, the national legislation, and the statistics provided by the Offices for National Statistics. The description of the parameters, along with the summary for common and country-specific exogenous parameters, are available in the online [Appendix, Tables A1, A2, and A3](#), respectively.

The time period for simulation is one quarter. Following [Bentolila \*et al.\* \(2012\)](#), [Ljungqvist \(2002\)](#), and [Mortensen and Pissarides \(1994\)](#), we set the interest rate  $r$  equal to 0.01. We assume that the distribution of productivity is uniform. Following [Bosch and Esteban-Pretel \(2012\)](#), we fix the upper bounds of the distributions equal to 1. We also set the lower bounds of the distributions to be equal to -1 and, therefore, we assume  $H^P$ ,  $H^T$ ,  $H^I$ , and  $G$  to be uniformly distributed in the range  $[-1, 1]$ . The productivity of a worker  $p$  is normalised to 1 for all three countries. The matching function is assumed to be Cobb-Douglas,  $m(u, v) = Au^k v^{(1-k)}$ , with an unemployment elasticity of  $k = 0.5$ , which is in the lower bound of the estimates from [Petrongolo and Pissarides \(2001\)](#). The scaling parameter is set to 0.6.

6 By looking at [eq. \(A17\)](#) in the online Appendix, one can notice that a higher  $\theta$  increases the left-hand side and lowers the right-hand side of the equation. Therefore, a unique value of  $\theta$  satisfies [eq. \(A17\)](#).

Yet, as pointed out by [Shimer \(2005\)](#), matching models of the labour market offer a degree of freedom in the choice of the scaling parameter of the matching function since infinite combinations of the scaling parameter and the vacancy cost parameter leave the labour market equilibrium unchanged. We assign a value to the worker's share of surplus ( $\beta$ ) in order to satisfy [eq. \(9\)](#). Therefore,  $\beta^P$ ,  $\beta^T$ , and  $\beta^I$  are set equal to 0.52, 0.5, and 0.445, respectively. All these parameters fit in the range suggested by [Petrongolo and Pissarides \(2001\)](#).

The probability to experience a productivity shock while employed with an open-ended contract,  $\alpha^P$ , has a value 0.08 for Italy, as in [Mortensen and Pissarides \(1994\)](#) and [Bosch and Esteban-Pretel \(2012\)](#), and a value of 0.09 for Spain and 0.04 for France, as in [Bentolila et al. \(2012\)](#). Moreover, we set the parameters  $\alpha^T$  for temporary workers and  $\alpha^B$  for informal workers equal to 0.32, as in [Bosch and Esteban-Pretel \(2012\)](#), to reflect the higher volatility of productivity among fixed-term and informal employees, and we keep it the same for all three countries. The payroll taxes for permanent jobs, represented in the model by  $\tau^P$ , are assumed to be equal to 0.35 for Italy, 0.33 for Spain, and 0.42 for France, as described in the OECD Taxing Wages report ([OECD, 2015](#)). Following [Rogers and Philippe \(2011\)](#), we set the tax rate for temporary jobs to 0.25 for Italy and Spain, and to 0.33 for France. This value is computed by averaging out the payroll tax rates across different types of temporary contracts.

The average cost of opening a vacancy  $c$  equals 0.5 for Italy and France, which corresponds to half of the productivity level, while it is equal to 0.25 for Spain, as suggested in [Bentolila et al. \(2012\)](#). The income from non-market activities  $b$  is fixed to 0.55 for Italy and France, and to 0.58 for Spain, as in [Bentolila et al. \(2012\)](#).

The parameters related to the informal market in Italy are set according to the values used in [Di Porto et al. \(2013\)](#), notably, the monitoring rate  $\phi$  is equal to 0.05 and the penalty fee represented by  $\sigma$  to 0.45. The corresponding parameters for Spain are equal to 0.16 and 0.42, and for France to 0.08 and 0.38, as reported in [ILO \(2013\)](#).

Firing costs are hard to quantify, particularly for the case of Italy, where a complicated legislation sets different rules according to company size, reason for firing the worker, and often allows the courts to decide upon such issues. Therefore, given the uncertainty associated with the length of the trial and the bias of the judges, as emphasised by [Ichino et al. \(2003\)](#), it is hard to associate a number with the firing costs to be paid by the company. We follow the approach used by [Bentolila et al. \(2012\)](#), who calibrate this value for France and Spain, and assign to  $F$  the value of 1.33 for France, 2.00 for Spain, and an average of those values, 1.60, for Italy. Finally, we assign value 0.48 to the probability of filling a vacancy,  $\lambda$ , and, since informal workers and temporary workers look for other jobs while employed, but at a lower efficiency rate, we set the search efficiency parameters  $\chi$  and  $\psi$  equal to 0.25 and 0.17 for Italy, 0.24 and 0.35 for Spain, and 0.29 and 0.38 for France. These values are selected so as to match the average unemployment rate, the informality rate and the share of temporary contracts during the period 2004-2008, that is, right before the start of the recent global economic downturn. We report the values for the country-specific endogenous variables in [Table A4](#) in the online [Appendix](#). [Table 2](#) presents the data (target values) and the steady-state value of the unemployment rate, the temporary contract share, and the informality rate. As is made clear, we are able to match the chosen target variables fairly well.<sup>7</sup>

7 The model fit has proved to be robust to changes in the two most sensitive parameters, that is, the income from non-market activities  $b$ , and the arrival rate of productivity shocks to informal jobs,  $\alpha_i$ . Results of this check are available upon request.

**Table 2.** Data vs model

	Italy		Spain		France	
	Data	Model	Data	Model	Data	Model
Unemployment rate	7.1	7.9	9.3	9.9	8.6	7.7
Temporary contracts	12.9	12.8	33.4	33.3	13.9	13.8
Informal rate	15.3	15.2	17.6	17.6	13.0	13.3

## 5. Results

We use the model to test the effects of several potential policy interventions on the equilibrium distribution of formal versus informal and permanent versus temporary employment. We are concerned with changes in the following policy variables: firing costs, the penalty fee, the inspection rate, and the level of payroll taxes associated with permanent contracts. We focus on these parameters for several reasons. First, increasing tax enforcement and/or augmenting the severity of fines for unpaid labour taxes are standard policy instruments used to tackle tax evasion. The main difference between the two interventions is the burden on the government budget: while the first policy may be quite expensive, the second one in principle would not affect public expenses. Second, we consider firing costs since they have been deemed by the literature to be one of the main determinants of EPL, and have been found to cause high unemployment and lower turnover. Finally, given that excessive tax burden on permanent employment is reckoned to be another potential barrier to formal work, we also consider shifts in the parameter for payroll taxes associated with permanent contracts. Overall, we find the results of the parameters perturbation to be consistent across the three countries examined. This assures us about the validity of the model.

For the sake of brevity, we do not present the outcome of the perturbation of single parameters but we concentrate on combinations of interventions, which are found to generate more attractive steady-state outcomes.<sup>8</sup> We carry out a number of counterfactual exercises by pairing two policy instruments at a time. In particular, we couple an increase in the inspection rate,  $\phi$ , first with a decrease in payroll taxes associated with permanent contracts,  $\tau^P$ , and later with lower firing costs,  $F$ . We also consider combinations of a higher penalty fee,  $\sigma$ , with lower payroll taxes for permanent contracts first, and with lower firing costs as an additional experiment. The policy mixes considered aim at minimising informal employment and maximising the formalisation of irregular positions. The results of these exercises

8 We refer the reader to the online Appendix for the results concerning single parameters, notably to Tables A5-A8. Indeed, we find that separate interventions do not always produce optimal outcomes. For instance, contrary to expectations, we find that a reduction of firing costs leads to lower formal employment (permanent plus temporary) and higher informal work. In line with the findings of Albrecht *et al.* (2009) we also detect an increase in unemployment as a result of lower firing costs. On the other hand, changes in the penalty fee or in the rate of inspection produce less informality but at a cost of increasing the share of temporary employment while leaving unemployment approximately constant (for Spain, we find that as the penalty fee or the inspection rate increases, informal workers get integrated into the formal sector more via permanent contracts. Since changes in temporary employment are negligible, the ratio of temporary to total employment turns out to be lower).

**Table 3.** Employment share for different values of the inspection rate ( $\phi$ ) and payroll taxes associated with permanent contracts ( $\tau^P$ )

	Italy						
	$\phi$	0.050	0.055	0.060	0.065	0.065	0.070
	$\tau^P$	0.35	0.33	0.33	0.33	0.31	0.31
Permanent		68.0	71.4	71.3	71.1	74.2	74.1
Temporary		10.0	11.0	13.1	14.9	13.0	14.3
Informal		14.1	9.9	8.5	6.5	5.5	4.3
Unemployment		7.9	7.6	7.6	7.5	7.3	7.3
Informality rate		15.2	13.5	9.1	7.0	5.9	4.6
Temps rate		12.8	13.3	15.5	17.3	14.9	16.2
	Spain						
	$\phi$	0.160	0.165	0.170	0.175	0.175	0.180
	$\tau^P$	0.33	0.31	0.31	0.31	0.29	0.29
Permanent		49.4	60.3	61.5	62.5	67.8	68.4
Temporary		24.7	18.7	18.9	19.1	15.6	15.9
Informal		15.9	12.0	10.8	9.8	8.5	7.8
Unemployment		9.9	8.9	8.7	8.6	8.1	8.0
Informality rate		17.6	13.2	11.8	10.7	9.2	4.6
Temps rate		33.3	13.3	15.5	17.3	14.9	16.2
	France						
	$\phi$	0.080	0.085	0.090	0.095	0.095	0.100
	$\tau^P$	0.42	0.40	0.40	0.40	0.38	0.38
Permanent		69.0	73.0	74.3	75.3	77.5	78.2
Temporary		11.1	11.1	12.2	13.1	11.8	12.3
Informal		12.3	8.7	6.5	4.8	4.1	2.9
Unemployment		7.7	7.2	7.0	6.8	6.6	6.4
Informality rate		13.3	9.4	7.0	5.1	4.4	3.1
Temps rate		13.8	13.2	14.1	14.8	13.2	13.6

are shown in Tables 3-6. Looking at the first two policy experiments, we find that an increase in the inspection rate leads to higher destruction of informal jobs, which comes along with a reduction of the flow of temporary workers into the informal sector and a lower level of job creation in the informal sector; therefore, the informality rate is lower. In addition, making permanent employment more attractive either through lower taxation or lower firing costs generates an increase in both job destruction and job creation of permanent positions, with a prevalence of the latter, and boosts the flow of workers from informal to formal positions. However, combinations of lower payroll taxes for permanent contracts and a higher inspection rate seem to have stronger effects on the reduction of the informality rate, as opposed to combinations of lower firing costs and a higher inspection rate. Specifically, the difference is approximately three percentage points for Italy, two for France, and nine percentage points for Spain.

In Tables 5 and 6, we report the findings of shifts in the penalty fee coupled with decreases of payroll taxes for permanent jobs or reductions in firing costs. Both policy combinations produce less informality, albeit of a smaller size compared to the previous experiments. We observe that the conjunction of lower taxation and more severe fines seems to also create relatively less temporary employment. Indeed, we find that the rate of



**Table 4.** Employment share for different values of the inspection rate ( $\phi$ ) and firing costs ( $F$ )

Italy							
$\phi$	0.050	0.055	0.060	0.065	0.065	0.070	
$F$	1.60	1.55	1.55	1.55	1.50	1.50	
Permanent	68.0	68.1	68.1	68.0	68.2	68.1	
Temporary	10.0	11.7	14.0	15.9	15.0	16.6	
Informal	14.1	12.2	10.0	8.2	8.9	7.4	
Unemployment	7.9	7.9	7.9	7.8	7.8	7.8	
Informality rate	15.2	13.3	10.9	8.9	9.7	8.0	
Temps rate	12.8	14.6	17.1	18.9	18.0	19.6	
Spain							
$\phi$	0.160	0.165	0.170	0.175	0.175	0.180	
$F$	2.00	1.95	1.95	1.95	1.90	1.90	
Permanent	49.4	51.1	53.3	55.0	54.3	55.8	
Temporary	24.7	23.9	23.6	23.5	23.1	23.1	
Informal	15.9	15.1	13.5	12.1	13.0	11.7	
Unemployment	9.9	9.9	9.6	9.3	9.6	9.4	
Informality rate	17.6	16.7	14.9	13.3	14.4	12.9	
Temps rate	33.3	31.9	30.7	30.0	29.8	29.3	
France							
$\phi$	0.080	0.085	0.090	0.095	0.095	0.100	
$F$	1.33	1.30	1.30	1.30	1.20	1.20	
Permanent	69.0	70.6	72.0	73.1	73.5	74.4	
Temporary	11.1	12.1	13.3	14.3	13.7	14.5	
Informal	12.3	9.8	7.4	5.6	5.7	4.3	
Unemployment	7.7	7.4	7.2	7.0	7.0	6.8	
Informality rate	13.3	10.6	8.0	6.0	6.1	4.6	
Temps rate	13.8	14.6	15.6	16.4	15.7	16.3	

informality is down by approximately six percentage points in Italy and France, and by almost ten percentage points in Spain; the share of temporary jobs over total formal employment reduces significantly in Spain, slightly in France, and remains approximately unchanged in Italy.

To sum up, we find that higher degrees of effectiveness in reducing informality are associated with the inspection rate rather than with the penalty fee. This result is due to the fact that while both variables affect the expected fine to be paid by the firm, the inspection rate also influences the value function of a firm with a filled informal position by increasing the job destruction of informal matches and therefore the expected duration of the match itself. Moreover, lower payroll tax rates for permanent employment turn out to be quite more appealing since they redirect more informal workers towards permanent jobs, as compared to lower firing restrictions.

Combinations of such interventions, however, may be very onerous from a fiscal budget perspective and financially unsustainable in the long run. As such, an alternative solution would be the one that couples an intensification of inspections with an increase in the payroll tax rates for temporary employment. Besides the intended reduction in informality, this policy mix could also mitigate the problem of duality of the labour market

**Table 5.** Employment share for different values of the penalty fee ( $\sigma$ ) and payroll taxes associated with permanent contracts ( $\tau^P$ )

	Italy						
	$\sigma$	0.45	0.50	0.55	0.60	0.60	0.65
	$\tau^P$	0.35	0.33	0.33	0.33	0.31	0.31
Permanent		68.0	71.4	71.5	71.5	74.5	74.5
Temporary		10.0	9.4	10.2	10.9	9.6	10.3
Informal		14.1	11.5	10.7	9.9	8.5	7.8
Unemployment		7.9	7.6	7.6	7.5	7.3	7.3
Informality rate		15.2	12.4	11.6	10.7	9.2	8.4
Temps rate		12.8	11.6	12.5	13.2	11.4	12.1
	Spain						
	$\sigma$	0.42	0.45	0.50	0.55	0.55	0.60
	$\tau^P$	0.33	0.31	0.31	0.31	0.29	0.29
Permanent		49.4	60.2	62.1	63.5	68.6	69.4
Temporary		24.7	18.5	18.5	18.6	15.2	15.5
Informal		15.9	12.4	10.8	9.5	8.3	7.3
Unemployment		9.9	8.9	8.6	8.3	7.9	7.7
Informality rate		17.6	13.6	11.8	10.3	9.0	7.9
Temps rate		33.3	23.5	22.9	22.6	18.1	18.2
	France						
	$\sigma$	1.38	1.45	1.50	1.55	1.55	1.60
	$\tau^P$	0.42	0.40	0.40	0.40	0.38	0.38
Permanent		69.0	72.6	73.2	73.8	76.0	76.5
Temporary		11.1	10.4	10.7	11.0	9.9	10.2
Informal		12.3	9.7	8.9	8.1	7.2	6.5
Unemployment		7.7	7.3	7.2	7.1	6.9	6.8
Informality rate		13.3	10.5	9.6	8.7	7.7	7.0
Temps rate		13.8	12.5	12.7	13.0	11.5	11.8

(Saint-Paul, 1997). The results of this exercise are shown in Table 7. We find that, as the inspection and payroll tax rates increase, informal employment is lower and permanent employment is higher, while temporary employment declines. In this scenario, we identify a substitution effect between temporary and permanent employment: both the job creation of permanent employment and the flow of workers from temporary to permanent positions increase. Overall, the share of temporary employment is lower, while permanent employment is significantly higher. This scenario is particularly interesting given that revenues from higher taxation on temporary employment could fund the intensification of labour inspections.

## 6. Conclusions

World-wide, 1.8 billion workers are employed in the informal economy. Informal jobs are excluded from the protection of existing legal and regulatory frameworks and are generally associated with scarce security, worse conditions as well as low productivity and low earnings. While it is very persistent in developing countries, informality is also pervasive in more advanced economies. In fact, estimates for some European countries are in the range

**Table 6.** Employment share for different values of the penalty fee ( $\sigma$ ) and firing costs ( $F$ )

	Italy						
	$\sigma$	0.45	0.50	0.55	0.60	0.60	0.65
	$F$	1.60	1.55	1.55	1.55	1.50	1.50
Permanent		68.0	68.1	68.3	68.4	68.5	68.6
Temporary		10.0	9.7	10.5	11.3	10.2	11.0
Informal		14.1	14.2	13.3	12.4	13.4	12.5
Unemployment		7.9	8.0	7.9	7.9	7.9	7.9
Informality rate		15.2	15.4	14.4	13.5	14.5	13.6
Temps rate		12.8	12.5	13.3	14.2	13.0	13.8
	Spain						
	$\sigma$	0.42	0.45	0.50	0.55	0.55	0.60
	$F$	2.00	1.95	1.95	1.95	1.90	1.90
Permanent		49.4	50.7	54.1	56.4	55.8	57.7
Temporary		24.7	23.7	23.0	22.7	22.2	22.1
Informal		15.9	15.6	13.5	11.8	12.7	11.1
Unemployment		9.9	9.9	9.4	9.1	9.3	8.9
Informality rate		17.6	17.3	14.9	13.0	14.0	12.2
Temps rate		33.3	31.8	29.8	28.7	28.5	27.7
	France						
	$\sigma$	1.38	1.45	1.50	1.55	1.55	1.60
	$F$	1.33	1.30	1.30	1.30	1.20	1.20
Permanent		69.0	70.1	70.8	71.4	71.8	72.3
Temporary		11.1	11.4	11.7	12.0	11.4	11.8
Informal		12.3	11.0	10.1	9.2	9.4	8.6
Unemployment		7.7	7.5	7.4	7.3	7.3	7.2
Informality rate		13.3	11.9	10.9	9.9	10.1	9.3
Temps rate		13.8	14.0	14.2	14.4	13.7	14.0

of 10% to 27% of total GDP. The extent of these figures calls for strong countermeasures. Therefore, deciphering the interplay between formal and informal work and investigating policy actions to contrast informal labour is of primary importance. These are the issues considered in the present paper.

We develop an extension of the search and matching model of [Diamond \(1981\)](#) and [Mortensen and Pissarides \(1994\)](#), where open-ended, short-term, and informal jobs coexist and we calibrate it to the labour market and institutional characteristics of France, Italy and Spain, three countries that exhibit a high share of informality and temporary employment. The model is then used to investigate whether combinations of traditional policy interventions could narrow down informal work and favour transitions from the informal to the formal sector. First, we find similar results across the three countries under investigation. Second, we observe that individual instruments such as lower taxation, less stringent firing restrictions, higher penalty fees and higher monitoring rate, though effective, do not always produce optimal outcomes. More importantly, we identify combinations of policy interventions such as lower labour taxation and stronger enforcement, which are successful in enhancing the formalisation of irregular jobs while not worsening unemployment. In particular, we show that by lowering the payroll taxes associated with permanent contracts

**Table 7.** Employment share for different values of the inspection rate ( $\phi$ ) and payroll taxes associated with temporary contracts ( $\tau^T$ )

	Italy						
	$\phi$	0.05	0.055	0.060	0.065	0.065	0.070
	$\tau^T$	0.25	0.28	0.28	0.28	0.30	0.30
Permanent		68.0	73.6	73.8	73.9	77.0	77.2
Temporary		10.0	5.6	8.3	10.2	6.6	8.2
Informal		14.1	12.8	10.3	8.4	8.9	7.2
Unemployment		7.9	7.7	7.6	7.5	7.5	7.4
Informality rate		15.2	13.9	11.1	9.1	9.6	7.8
Temps rate		12.8	7.0	10.1	12.1	7.9	9.6
	Spain						
	$\phi$	0.160	0.165	0.170	0.175	0.175	0.180
	$\tau^T$	0.25	0.27	0.27	0.27	0.29	0.29
Permanent		49.4	58.2	60.0	61.5	66.7	67.7
Temporary		24.7	16.6	16.7	17.0	12.3	12.7
Informal		15.9	15.5	13.8	12.4	12.0	10.8
Unemployment		9.9	9.7	9.4	9.2	8.9	8.7
Informality rate		17.6	17.2	15.2	13.6	13.2	11.8
Temps rate		33.3	22.2	21.8	21.6	15.6	15.8
	France						
	$\phi$	0.080	0.085	0.090	0.095	0.095	0.100
	$\tau^T$	0.35	0.35	0.35	0.35	0.40	0.40
Permanent		69.0	73.8	75.4	76.5	83.0	84.2
Temporary		11.1	9.2	10.4	11.3	5.7	6.3
Informal		12.3	9.7	7.2	5.3	4.7	3.1
Unemployment		7.7	7.3	7.1	6.8	6.6	6.3
Informality rate		13.3	10.5	7.7	5.7	5.0	3.3
Temps rate		13.8	11.1	12.1	12.9	6.4	7.0

and increasing the inspection rate, informality is significantly lower, and both the unemployment rate and the share of temporary jobs are non-increasing in all countries considered. We obtain similar results for informality when lower firing costs and a higher inspection rate are combined, though this comes at the cost of increasing the share of temporary contracts in Italy and France. Finally, in a time of fiscal constraints an interesting policy mix would seem to be one that combines increases in payroll taxes for temporary contracts and more intense inspections. In fact, not only informality, unemployment, and the ratio of temporary to overall employment are lower, but also higher tax revenues can be used to finance the intensification of the inspections, without incurring problems of sustainability.

## Supplementary material

[Supplementary material](#) (the Appendix) is available online at the OUP website.

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