Shadow Activity and Unemployment in a Depressed Labor Market*

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Abstract

This paper studies the border between shadow employment and unemployment. It argues that the two macroeconomic phenomena are two faces of the same coin: any policy aimed at reducing the former will increase the latter. Theoretically, it proposes and solves a matching model of the labor market, where shadow employment emerges in equilibrium as the endogenous response of firms and workers who fell overburdened by taxes and regulations. While the model we propose neatly rationalize the labor market trade off implied by "shadow reducing policies", it suggests that economies with low unemployment turnover should be characterized also by low turnover along the shadow margins. Since existing estimates of shadow employment are silent on labor market flows and on the relation between shadow activity and the main labor market aggregates, we perform original empirical work on the border between employment, unemployment and inactivity, and we find that Italian shadow employment has longer duration in regions with lower unemployment turnover. We also find support to the substantive assumptions of the model.

- Key Words: Unemployment, Matching, Shadow Activity.
- JEL classification: J30

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1 Introduction

Modern information technologies and improvements in tax collection make it relatively easy to detect and repress shadow activity. However, this is not done and governments' statements of "tolerance zero" vis-á-vis the informal sector do not seem to be taken too seriously by firms and workers who continue to go underground. Indeed, the informal sector is still flourishing. Available estimates of the size of the informal sector in European countries range from a low 10 per cent of GDP in the Nordics, UK and Switzerland to peaks of 20 to 30 per cent in Southern Europe and Ireland.

Why is the informal sector so much tolerated? A possible explanation is that Governments fear that the repression of shadow activity may simply rise unemployment, with undesirable political consequences. Further, shadow employment produces positive value added, so that some tolerance should be expected from an efficiency standpoint. Starting from this simple observation, the paper studies the border between shadow employment and unemployment, and argues that the two macroeconomic phenomena are two faces of the same coin, in the sense that any policy aimed at reducing the former will increase the latter. Theoretically, it proposes and solves a matching model of the labor market, where shadow employment emerges in equilibrium as the endogenous response of firms and workers who fell overburdened by taxes and regulations. While the model we propose neatly rationalize the labor market trade off implied by "shadow reducing policies", it suggests that economies with low unemployment turnover should be characterized also by low turnover along the shadow margins.

Available theories of the informal sector – recently reviewed by Schneider and Enste (2000) – do not seem to capture the labor market trade-off involved by the repression of shadow activity. This is because such theories take a partial equilibrium approach, focus almost entirely on labour demand, and do not work with "equilibrium unemployment" models. In this paper we provide a framework enabling to capture pros and cons of measures aimed at repressing shadow activity. More precisely, we propose and solve an equilibrium model of the labour market which sheds fresh light on the effects of the repression of the shadow economy on job creation, job destruction, and on the endogenous decision to go idle. Contrary to much literature on this issue, the size of the informal sector is not given, and the decision to go idle is jointly made by firms and workers.

In the model we study, shadow employment is more productive than open unemployment, and shadow activity generates positive value added. We also characterize the optimal level of enforcement in an economy in which taxes have to be levied, so that maximizing net output requires some tolerance in equilibrium.

The main implication of the model is that shadow employment and unemployment are two sides of the same coin. In other words, any unemployment reducing policy will endogenously reduce shadow employment, while it is very difficult to reduce shadow employment without increasing unemployment. For this reason, total repression of the shadow sector is not a credible threat. However, Governments will always find it optimal to have some positive degree of enforcement of sanctions against the informal sector in order to make sure that legal jobs exist, hence that a tax base is in place for the financing of public spending. Thus

Governments cannot be expected by workers and employers to have no enforcement at all either.

Testing the substantive hypotheses and the empirical implications of the model is dauntingly difficult given that we are dealing with a phenomenon which is, almost by definition, unrecorded. Yet, by using a variety of data sources, we produce evidence which is valuable in assessing the empirical relevance of the model. First, individual records from a survey of the shadow sector in Sicily, one of the Italian regions, with the largest "shadow rate", suggests that shadow jobs involve mainly workers at the lower end of the skill distribution. This is consistent with our characterisation of shadow employment as a set of low-productivity jobs. Second, macro data provide support to the link established by the model between shadow activity and unemployment. A positive correlation between non-employment and the informal sector holds over a cross-section of OECD countries – as well as across Italian regions – and is consistent with the simultaneous rise in unemployment and shadow activity observed in Europe since the beginning of the 1980s. Third, we find, consistently with the predictions of our model, that Italian shadow employment has longer duration in regions with lower unemployment turnover. Since existing estimates of shadow employment are silent on labor market flows, we have to rely on changes in regional and sectoral estimates of shadow employment to make inferences on the duration of shadow employment in different regions.

Finally, we assess the nature of the statistical bias induced by the presence of the shadow sector on LFS statistics. This is relevant in evaluating the potential effects of the repression of the shadow sector on unemployment statistics. Available estimates of the underground economy do not reveal how large is the fraction of shadow employment which is wrongly classified as unemployment or inactivity. We perform original empirical work in establishing the borderline between shadow employment, unemployment and inactivity. Our empirical results suggest that a significant component of the informal sector lies outside LFS employment. Due to these measurement problems, the increase in unemployment associated with the repression of shadow employment could be underestimated by available unemployment statistics.

The paper proceeds as follows. Section 2 presents few empirical regularities on shadow employment. Section 3 presents and solves the model, and derives the decentralized equilibrium for given policy package. Section 4 characterizes the optimal policy package from the standpoint of a policy maker who needs to raise taxes and tries to maximize net output. Section 5 discusses the empirical relevance of our theoretical model, looking at the micro and macro evidence, and performing empirical work on the borders between employment, unemployment, inactivity and shadow employment. It also presents estimates of labor market flows over the shadow margin. Section 6 summarizes and draws the policy implications of the paper.

2 A Few Facts about Shadow Economies

The most common definition of the shadow economy is "all economic activities which contribute to the officially calculated (or observed) gross national product, but are currently

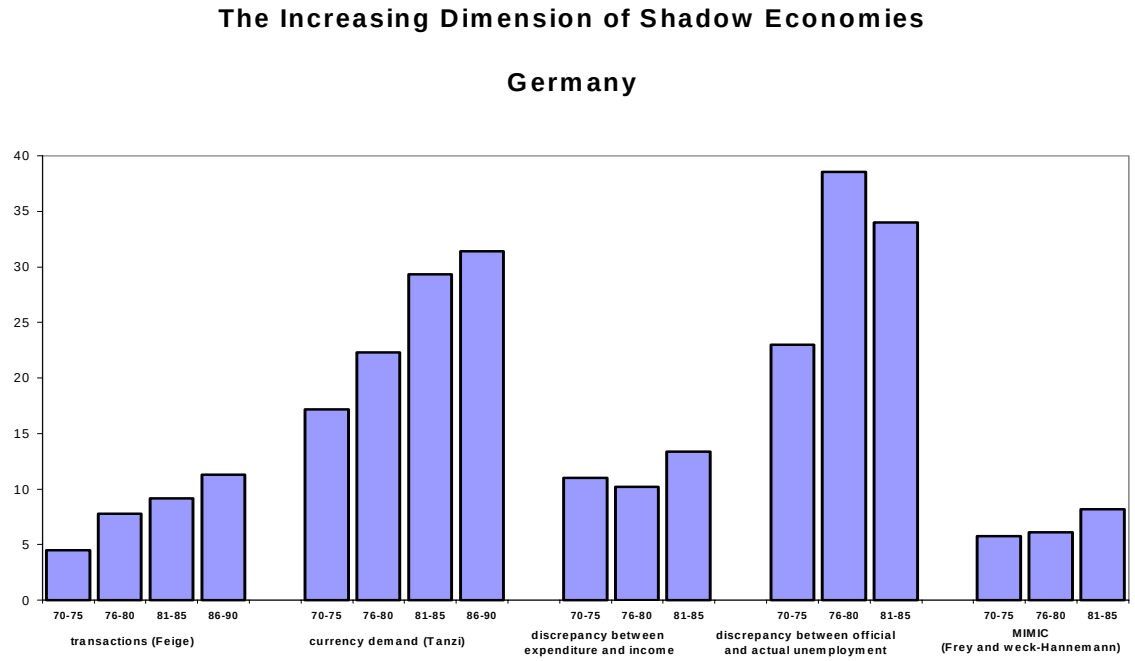

Figure 1: The size of the shadow economy in Germany

unregistered" [Feige, 1989; Feige 1994; Lubell 1991 and Schneider 1994] and a variety of methods are being used to measure it. Estimates of the shadow economy either draw from direct inferences, that is surveys trying to elicit involvement of respondents in unregistered activities, or from indirect methods, which basically draw on the inconsistencies between different statistical sources in order to gauge the size of the underground economy. Among the latter methods, discrepancies between national income and expenditure statistics or between physical (mainly electricity consumption) indicators of economic activity and official GDP statistics are most frequently used. Analogously, employment in the shadow economy is measured by comparing employment data reported by enterprises with employment self-reported by households, which is supposed to capture also activities that are not registered by employers.

All the above methods have pros and cons, and the wide variance of estimates being provided is an indication of the limitations of these techniques. Yet, there are two findings which are confirmed by all studies we are aware of.

The first of these *facts* is a marked upward trend in the size of the shadow economy in European countries. Estimating shadow activity is obviously a difficult task, and different methodologies have been proposed in the literature (Dixon, 1999). Figures 1-3 reproduce rates of change in the size of shadow activity in all countries for which different estimates, *based on the same methodology,* are available. According to all measures available, the shadow economy is on the rise. The same trend is observed in Austria, Denmark, France

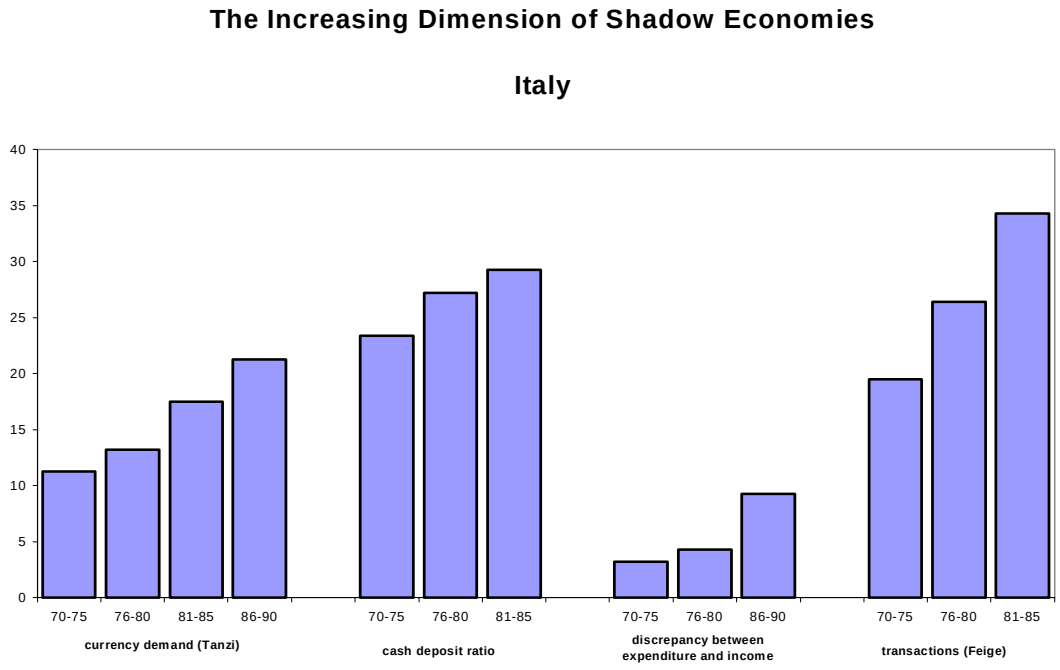

Figure 2: The size of the shadow economy in Italy

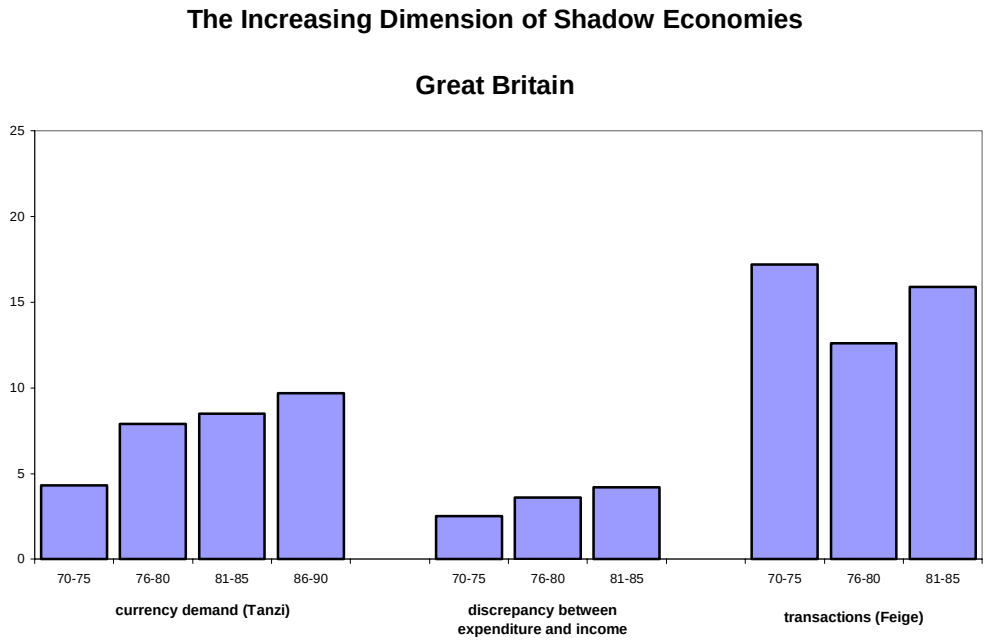

Figure 3: The size of the shadow economy in Great Britain

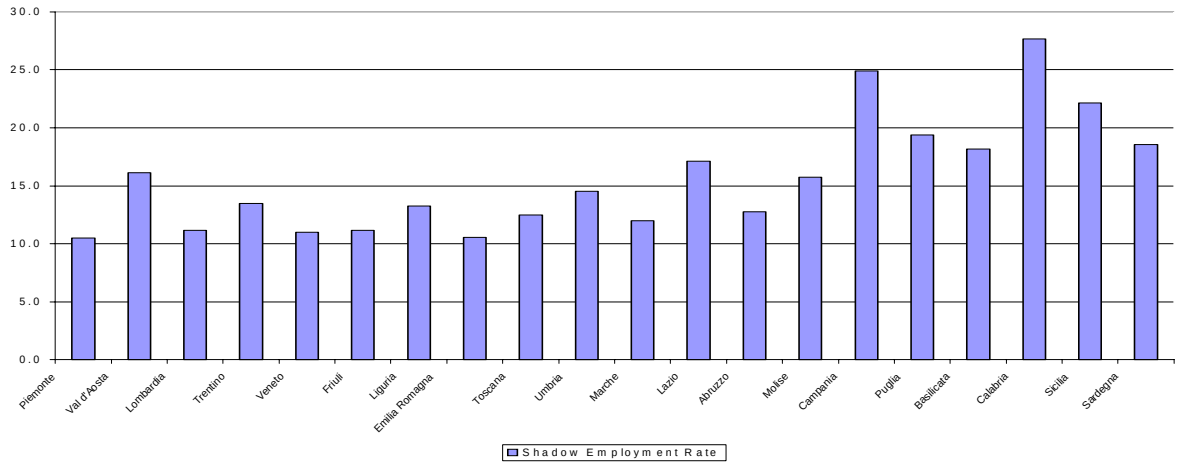

Figure 4: Average Shadowm Employment Rate (1995-99) over 20 Italian regions.

and Sweden, where estimates are only available based on the currency demand approach or in terms of headcounts. Schneider (2000) estimates that in the European area the number of persons working in the unofficial economy doubled within the two decades from 1978 to 1998.

The second *fact* is the significant within-country variation in the incidence of the shadow economy. Depressed regions, that is, areas with low productivity and high unemployment, display significantly larger shares of unregistered activities and employment than the country averages. The case of the Italian Mezzogiorno is particularly striking in this respect. Available estimates suggest that the shadow rate, the proportion of employment that is irregular, may be as high as 30-35 per cent in the South, around 20 per cent in the Centre and at one-digit level in the North-West and the North-East, the latter macro-region being the one with the lowest level of shadow activity. Differences are marked not only in agriculture, but also within industry, with the South displaying an incidence of shadow employment that is twice as high than in the rest of the country. Significantly, there is no tendency over time to the narrowing of the regional differentials in the incidence of the shadow economy: in 1995 the South to Centre-North gap was roughly the same as 10 years earlier[1]. Chart 4 plots the average shadow employment rate over 20 Italian regions, and shows that shadow employment changes from 10 percent in Piedmont (North-West) to more than 30 percent in Sicily (South).

The explanation being provided for the upward trend in the shadow economy is generally in the heavy (and increasing over time) tax, social security and administrative burdens imposed on activities which are officially registered (Schneider, 1998). Overstrict regulations in the labour market area, e.g., high costs involved by dismissals also bear the brunt of blame for the rise in shadow employment. Chart 5 reports data on the size of the shadow economy

[1]See Calzaroni and Pascarella (1998) for details on the estimates of shadow employment in Italian macro-regions.

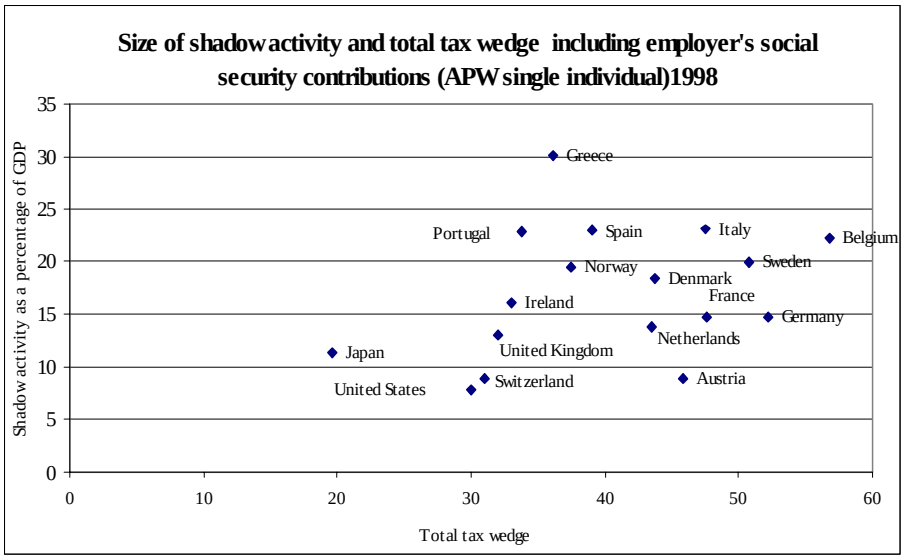

Figure 5: Shadow sector and the taxation

(reproduced from Schneider and Enste, 2000) and on the total tax wedge on labour over a panel of OECD countries (OECD, 2000). The chart hints at a positive correlation between the two measures[2]. However, we do not have a satisfactory theory behind this correlation, and one possibly allowing us to make inferences about the order of causality. Many dreams are often made among policy-makers about the presence of Laffer curves behind this chart. If lower tax rates could actually reduce the shadow economy without reducing fiscal revenues, then why Governments are not doing it?

Moreover, the persistence of wide regional differentials in the fraction of employment which is shadow suggests that traditional explanations of the rise in shadow activity, which are based on country-wide regulations and tax burdens, are likely to miss an important dimension. As in the case of the Italian Mezzogiorno, the regions displaying the largest shadow rates often benefit from tax deductions, which should, ceteris paribus, reduce pressures to go shadow. Thus, the fact that shadow rates vary so much across regions sharing a similar regulatory environment points to variable enforcement of the rule of law as an important determinant of the documented rise in the volumes of shadow activity. Put another way, not only better regulations, but also tighter enforcement of the rule of law could bring down significantly the shadow sector.

Finally, improvements in information technologies have significantly reduced over time the costs of detecting unregistered activities. For instance, it is possible to match records provided by the same individual to different administrations and use discrepancies between declared value added, income taxes and social security contributions to infer the likely presence of irregular activities. In a nutshell, enforcement is easier but would seem to be weaker

[2]However, there is no correlation between tax receipts or public expenditure over GDP and the size of the shadow economy.

and weaker.

The obvious questions are then:

- Why are Governments finding it so hard to repress illegal employment?
- Do they really want to do it?
- Why are regulations so poorly enforced in some regions?
- Is there anything good in the shadow economy?

In an attempt to answer such questions, the next Section develops a theoretical model framing the trade-offs involved by the repression of the shadow economy, which has empirical implications qualitatively different from those of the literature on the relation between tax incidence and the shadow sector. Unlike previous literature, it also focuses on *flows* across the shadow margin rather than yielding predictions only on labour market *stocks*.

Table 1: Estimates of the size of the shadow economy in some european countries

Countries	Years	Participants as share of employment	Size as a share of GDP
Austria	1990-91	9,6	5,47
	1997-98	16	8,93
Denmark	1980	8,3	8,6
	1986	13	na
	1991	14,3	11,2
	1994	15,4	17,6
	1998	22,5	18,4
France	1975-82	3.0-6.0	6,9
	1997-98	6.0-12.0	14,7
Germany	1974-82	8.8-12.0	10,6
	1997-98	22	14,7
Italy	1979	20.0-35.0	16,7
	1997-98	11.5-32.3	23,1
Sweden	1978	13.0-14.0	13
	1997	19,8	19,8

Source: Schneider and Enste (2000)

3 A Model of Shadow Employment

The model developed in this section aims at capturing the stock-flow relationship between shadow economic activity and unemployment. Two things should be stressed at the outset regarding the type of shadow employment that the model is meant to capture.

First, our notion of shadow or illegal employment is one of tax evasion, rather than crime. Jobs are not declared in order to avoid paying taxes and job destruction costs. Rather than dealing with crime and unemployment [see Burdett, Lagos and Wright, 2000], we try to complement the literature on tax evasion, which has so far overlooked the effects of tax evasion and shadow employment on unemployment.

Second, in the terminology of policy makers, we are framing "marginal shadow employment', that is, employment in low productivity jobs, rather than "development shadow employment', i.e., new jobs which have the potential to become highly productive after some gestation period. In other words, "infant industry" arguments cannot be applied to justify tolerance vis-á-vis the informal sector. We are looking for deeper and empirically more relevant ("development shadow employment" is, in any event, deemed to involve a small fraction of unregistered employment) explanations for the weak and regionally diversified repression of shadow employment.

Overall, the closest statistical approximation to our notion of shadow activity is the definition of "underground or shadow economy" as provided in the 1993 System of National Accounts [SNA, 1993]. The latter defines the "shadow sector" as the set of legal activities unknown to the public administration because of tax evasion, unwilligness to pay social security contributions, non-application of contractual wage minima or hours of work and health at work standards. In particular, we focus on the "economic shadow sector", that is, the range of activities for which there is a deliberate choice of unreporting in order to reduce production costs rather than simply negligence on the part of employers in filling statistical questionnaires. The SNA "shadow economy" is distinguished from the informal sector (activities having a low level of organization, and based on informal work relationships, e.g., within the family) and the "illegal sector", involving either the production of goods which are banned or carried out by individuals who are not legally authorized to do so.

In the model, all job start-ups are on the technological frontier. Every now and then, such jobs become obsolete, and turn into low-productivity jobs. Firms have to pay taxes (production taxes) in either good and bad times and destruction costs upon firing. In addition, firms have an option of entering into shadow activity, which implies not paying production taxes and destruction costs. Nevertheless, there are some risks involved with shadow activity, since jobs can be monitored. If found cheating, the job is immediately destroyed and a large penalty is imposed. There is on the job search, and workers in shadow jobs always look for formal jobs, as the latter pay higher wages. Wages are set according to a Nash bilateral bargaining rule in high productive as well as in low productive jobs. Kolm and Larsen (2001) propose a matching model in which goods in the legal and informal sectors are perceived to be different by consumers and different prices, but they do not explicitly consider productivity differentials between the two sectors. In addition, Kolm and Larsen do not model on-the-job search, which is a key feature of our analysis.

3.1 Building Blocks

We propose a matching model with on-the-job search. Firms are one-job and the technology is irreversible; time is continuous. All jobs start at the highest level of productivity[3] and then may become low-productivity (bad) jobs or die. Bad jobs never return to the technology frontier. In particular, good jobs turn bad at rate λ and all jobs (good or bad) die at rate δ. Good jobs produce y_g, while bad jobs produce y_b, where $y_g > y_b$. In legal activity there is a production tax τ. Firms are monitored at an exogenously determined Poisson process with arrival rate equal to ρ. If found complying with the (tax) regulation, nothing happens to the match. If found cheating and engaged in shadow activity (not paying taxes τ), the job is immediately destroyed and a large penalty $\phi\tau$ is imposed, where ϕ is a multiple of the production tax τ. Wages are the outcome of a bilateral bargaining, and the worker gets a fraction β of total surplus. For simplicity, we assume that the bargaining share β is the same in legal and illegal jobs. Finally, labour supply is fixed and inelastic, and normalized to 1 for simplicity. The matching function displays constant returns to scale, and there is search on the job. The number of contacts between searching firms and job seekers is given by the matching technology

$$x = x(v, u + n_e),$$

where x is the total number of matches in a given instant, v is the number of vacancies, u is the unemployment rate, and n_e is a measure of employed job seekers (in our model $n_e = n_s$, where n_s is a measure of shadow employment, characterized below). With constant returns to matching, the instant probability that a vacant job meets a job seekers is given by[4]

$$\frac{x(v, u + n_e)}{v} = x(1, \frac{u + n_e}{v}) = q(\theta); \qquad \theta \equiv \frac{v}{u + n_e}$$

with $q'(\theta) < 0$. In the matching literature (Pissarides, 2000) θ, the ratio of vacant firms to job seekers, is typically referred to as market tightness from the firms standpoint. The total number of contacts between unemployed job seekers and vacant jobs is

$$\frac{u}{u + n_e} x(v, u + n_e) = \frac{v}{u + n_e} \frac{x(v, u + n_e)}{v} = u\alpha(\theta); \qquad \alpha(\theta) = \theta q(\theta)$$

with $\alpha'(\theta) > 0$. Finally, the total number of contacts between employed job seekers and vacant firms is

$$\frac{n_e}{u + n_e} x(v, u + n_e) = n_e \alpha(\theta)$$

3.2 Bellman Equations

We initially take the policy parameters ρ and τ as given, and derive the decentralized equilibrium for given policy package (τ, ρ, ϕ). The next section introduces efficiency argument,

[3] This assumption can be easily relaxed, but it makes the derivation of the model more tedious.

[4] This matching technology is similar to the one used by Garibaldi (1999) and Pissarides (2000).

and discusses how the parameters can be set optimally from the standpoint of a regulators that wants to maximize net output. Let's assume that good jobs choose legal activity (this is a key assumption and will be confirmed in equilibrium). The value function of a good job, J_g, reads

$$(r+\delta)J_g = y_g - \tau - w_g + \lambda[Max(\widetilde{J}_b, J_b) - J_g], \tag{1}$$

where the productivity shock λ is associated with a permanent fall in productivity to a level y_b. Let the superscript $\widetilde{}$ indicate shadow activity. Conditional upon λ striking, there are two different outcomes, depending on whether it is optimal to continue into legal activity (J_b is the highest) or continuing into shadow activity ($\widetilde{J}_b$ is the highest). The value of a legal bad job, reads

$$[r+\delta+\alpha(\theta)]J_b = y_b - \tau - w_b, \tag{2}$$

where, by virtue of the matching technology, $\alpha(\theta)$ is the instant probability that a worker in a bad firm finds a good vacant job. >From the firm stand-point, on-the-job search operates as an increase in the discount rate, since it reduces the average duration of employment. The value of bad shadow job reads

$$[r+\delta+\alpha(\theta)]\widetilde{J}_b = y_b - \tilde{w}_b - \rho[\widetilde{J}_b + \phi\tau] \tag{3}$$

The present discounted value of a shadow job features the nature of shadow employment: firms do not pay production taxes, but are immediately destroyed if ρ strikes. Further, conditional on being caught illegal, employers have to pay a large penalty, $\phi\tau$.

A worker engaged in good job, enjoys a wage w_g and his value function reads

$$rW_g = w_g + \lambda[Max(\widetilde{W}_b, W_b) - W_g] + \delta[U - W_g],$$

where the max operator reflects the option of entering shadow activity. Workers in bad jobs can be employed in legal or illegal jobs, the difference being the wage rate they receive, and the probability of having their job destroyed by an inspection. Formally, W_b and $\tilde{W}_b$ read

$$\begin{aligned} rW_b &= w_b + \delta[U - W_b] + \alpha(\theta)[W_g - W_b] \\ r\tilde{W}_b &= \tilde{w}_b + \delta[U - \tilde{W}_b] + \alpha(\theta)[W_g - \tilde{W}_b] + \rho[U - \tilde{W}_b] \end{aligned}$$

Finally, the value of unemployment reads

$$rU = b + \alpha(\theta)[W_g - U]$$

as all jobs start on the technology frontier.

3.3 Wage Determination and Shadow Equilibrium

Wages are the outcome of a bilateral bargaining, attributing to the worker a given fraction of total surplus, so that

$$[W_g - U] = \beta S_g$$

where $S_g = J_g + W_g - U$. A similar sharing rule holds also for shadow jobs and legal bad jobs, so that $[\tilde{W}_b - U] = \beta \tilde{S}_b$ and $\beta[W_b - U] = \beta S_b$ Since firms prefer legal activity if $\tilde{J}_b > J_b$ while workers choose shadow activity if $(\tilde{W}_b - U) > (W_b - U)$, the following remark applies

Remark 1 *Nash bargaining implies that there is full agreement between the worker and the firm on the decision to go idle.*

Substituting the expression of the previous section in the wage determination rule, after few simplification, one gets the following wage expressions:

$$\begin{aligned} w_g &= b(1-\beta) + \beta[y_g - \tau + c\theta] \\ w_b &= b(1-\beta) + \beta[y_b - \tau] \\ \tilde{w}_b &= b(1-\beta) + \beta[y_b - \rho\phi\tau] \end{aligned} \tag{4}$$

Few remarks are in order. First, wages in good jobs are larger than wages in bad jobs. Second, wage in bad jobs (both legal and illegal) do not depend on outside market conditions. This property is a feature of on the job search models, and was noted also by Pissarides (2000). Finally, wages in bad shadow jobs are larger than wages in bad legal jobs ($\tilde{w}_b > w_b$) when $\rho\phi < 1$, that is, when either the detection probability or the sanctions are not too large. Finally, as it is true in most models with Nash Baragaining, the tax is copaid by the worker.

The equilibrium we want to characterize is one in which good jobs are legal while bad jobs are shadow. Since we have shown that there is full agreement on the decision to go idle, we can simply focus on the firm's decision, knowing that the worker always agrees with the firm decision. Substituting wages into the relevant value function, it follows that a bad firm will go shadow if $J_b > \tilde{J}_b$ or

$$\frac{y_b - \tilde{w}_b - \rho\phi\tau}{r + \delta + \rho + \alpha(\theta)} > \frac{y_b - w_b - \tau}{r + \delta + \alpha(\theta)}$$

which, by virtue of the wage rule is simply

$$\frac{(y_b - b - \rho\phi\tau)}{r + \delta + \rho + \alpha(\theta)} > \frac{(y_b - b - \tau)}{r + \delta + \alpha(\theta)} \tag{5}$$

which, in light of (4) implies that $\tilde{w}_b > w_b$, that is, the decision to go idle is jointly efficient for the firm and the worker. Simplifying, equation (5) reads

$$\tau(1 - \rho\phi) > \rho S_b \tag{6}$$

where $S_b = \frac{y_b - \tau - b}{r + \delta + \alpha(\theta)}$. The condition above implies that a job enters shadow activity if the expected benefit is larger than the expected cost. The expected benefit is the net tax being avoided, while the expected cost is the loss of a legal bad job, conditional on being caught in illegal activity. This result can be easily summarized in the following remark.

Remark 2 ***Enforcement of Legal Activity.*** *It is always technically possible to have parameters of enforcement (ρ or ϕ sufficiently large) so as to prevent the emergence of a shadow sector.*

Firms come into the market by posting vacancies. Since we assume that firms have the option to freely choose the technology, profit maximization trivially implies that all vacancies will be good. If V is the present discounted value of a vacancy, its expression reads simply

$$rV = -c + q(\theta)[J_g - V],$$

where c is the flow cost of vacancy posting and $q(\theta)$ is the instantaneous probability of filling a vacancy. Free entry on the job implies $V = 0$, so that market tightness θ is determined by

$$J_g = \frac{c}{q(\theta)}. \tag{7}$$

The discussion so far has worked on the assumption that firms in good jobs choose to operate in legal activity. This is not necessary the case, and we have to consider a further possible deviation, namely that

$$J_g > \tilde{J}_g$$

where $\tilde{J}_g$ is the value of good job in bad legal activity. Obviously, if the conditions above is not satisfied, there are no legal jobs in the labor market, and the equilibrium is degenerate. It is easy to show that the condition above implies

$$\tau(1 - \rho\phi) < \rho S_g \tag{8}$$

where $S_g = \frac{y_g - \tau - b + \lambda \tilde{S}_b}{r + \delta + \lambda + \beta\alpha(\theta)}$. Obviously, the surplus in good jobs is larger than the surplus in bad job, so that $S_g > \tilde{S}_b > S_b$, where the last inequality follows from the condition (6). In what follows we assume that the policy and structural parameters are such that both conditions (6) and (8) are satisfied, which is equivalent to assuming that the productivity differential $y_g - y_b$ is large enough. Further, the following remark follows.

Remark 3 *As long as taxes are positive, the monitoring intensity must also be positive for legal activity to be chosen in equilibrium.*

The previous remark is immediate from condition (8), since it is clear that with $\rho = \phi = 0$, legal activity will never be chosen in equilibrium. It is important to keep in mind this result for the discussion of the efficiency properties of the model.

3.4 Steady State Stocks and Equilibrium

There is a fixed labor supply of mass 1. Under the equilibrium configurations discussed below, shadow employment n_s is a measure of on-the-job search, and there are no legal bad jobs. If we indicate with n_o official employment in good jobs, the mass of workers is divided as

$$1 = u + n_s + n_o. \tag{9}$$

Since jobs enter into unofficial activity at rate λ, and leave it at rate $\alpha(\theta)+\delta+\rho$, the balance condition for shadow jobs is

$$\lambda n_o = (\delta + \alpha(\theta) + \rho) n_s. \tag{10}$$

The balance condition for official jobs is

$$\alpha(\theta)(u + n_s) = (\delta + \lambda) n_o \tag{11}$$

Finally, unemployment is constant if

$$\alpha(\theta) u = \delta(n_s + n_o) + \rho n_s, \tag{12}$$

where ρn_s is the flow of shadow jobs monitored and destroyed. Equations (10), (11) and (12) form a rank-deficient system in u, n_s and n_o, which, together with the summing up condition (9) yield the following equilibrium stocks[5]

$$u = \frac{\rho(\delta + \lambda) + \delta[\delta + \lambda + \alpha(\theta)]}{[\delta + \lambda + \alpha(\theta)][\rho + \alpha(\theta) + \delta]} \tag{13}$$

$$n_s = \frac{\lambda \alpha(\theta)}{[\delta + \lambda + \alpha(\theta)][\rho + \alpha(\theta) + \delta]} \tag{14}$$

$$n_o = \frac{\alpha(\theta)}{[\delta + \lambda + \alpha(\theta)]}. \tag{15}$$

Equations (13) (14) and (15) show that the size of official jobs n_o is not directly affected by ρ, even though it is indirectly affected through θ. The proportion of shadow jobs in total employment or *shadow rate* (an important variable in the policy context) is simply defined as

$$s(\theta) \equiv \frac{n_s}{n_o + n_s} = \frac{\lambda}{\delta + \lambda + \alpha(\theta) + \rho}. \tag{16}$$

Note that as $\rho \longrightarrow \infty$ unemployment is $u(\rho = \infty) = \frac{(\delta+\lambda)}{\delta+\lambda+\alpha(\theta)}$; and $n_s(\rho = \infty) = 0$, while when $\rho = 0$ we have $u(\rho = 0) = \frac{\delta}{\delta+\alpha(\theta)}$

We are now in a position to define the equilibrium.

[5]Making use of equation (9) to eliminate n_o from equations (11) and (12), one obtains a system of two equations

$$\alpha(\theta) u = \delta(1 - u) + \rho n_s$$
$$\alpha(\theta)(u + n_s) = (\delta + \lambda)(1 - u - n_s)$$

which simplifies to

$$u(\alpha(\theta) + \delta + \lambda) + n_s(\alpha(\theta) + \delta + \lambda) = \delta + \lambda$$
$$u(\alpha(\theta) + \delta) - n_s \rho = \delta$$

Definition 4 ***Equilibrium with shadow activity.*** *An equilibrium with shadow activity is a n-ple* (θ, u, n_s, n_o) *satisfying*

- *the conditions for shadow activity* (equation 5 and 4);
- *the free entry condition on the part of firms* (equation 7);
- *a set of balance flow conditions (equations* 13, 14 and 15).

Thus, the equilibrium value of θ, making use of equations (12), and (16), together with condition (5) reads

$$\frac{(r+\delta+\lambda)c}{q(\theta)(1-\beta)} + \frac{\beta c\theta}{1-\beta} = [y_g - \tau - b] + \lambda[\frac{y_b - b - \rho\phi\tau}{r+\delta+\rho+\alpha(\theta)}]. \tag{17}$$

As established by the following propositions, when the fine increases and monitoring becomes more intense, θ falls and unemployment raises.

Proposition 5 *The Shadow Rate and the Unemployment Rate are two faces of the same coin. Indeed, any parameter that decreases (increases)* θ *increases (decreases) both the unemployment rate and the shadow rate*

To proof this, it is sufficient to differentiate equation (17) with respect to τ to obtain

$$-\frac{(r+\delta+\lambda)cq'(\theta)}{q(\theta)(1-\beta)}\frac{\partial\theta}{\partial\tau} + \frac{\beta c}{1-\beta}\frac{\partial\theta}{\partial\tau} + \lambda\frac{\alpha'(\theta)(y_b - b - \rho\phi\tau)}{[r+\delta+\rho+\alpha(\theta)]^2}\frac{\partial\theta}{\partial\tau} = -1 - \frac{\lambda\phi\rho}{[r+\delta+\rho+\alpha(\theta)]},$$

which implies that $\frac{\partial\theta}{\partial\tau} < 0$. By the definition of shadow rate and the value of equilibrium unemployment (13), it follows immediately that both variables monotonically fall with θ, so that unemployment and shadow activity are two sides of the same coin. An important implication of this result is as follows.

Remark 6 *A SHADOW Paradox. A tougher penalty on shadow activity (i.e. an increase in* ϕ*) has an adverse impact on the shadow rate.*

To see the remark above, it is sufficient to differentiate equation (17) with respect to ϕ to obtain

$$-\frac{(r+\delta+\lambda)cq'(\theta)}{q(\theta)(1-\beta)}\frac{\partial\theta}{\partial\phi} + \frac{\beta c}{1-\beta}\frac{\partial\theta}{\partial\phi} + \lambda\frac{\alpha'(\theta)(y_b - b - \rho\phi\tau)}{[r+\delta+\rho+\alpha(\theta)]^2}\frac{\partial\theta}{\partial\phi} = -\frac{\lambda\rho\tau}{[r+\delta+\rho+\alpha(\theta)]}$$

The intuition of the previous result is as follows. An increase in the penalty rate clearly reduces the expected value of shadow activity. However, as long as firms enter into illegal activity at a rate λ, the reduction in the value of legal activity has an adverse impact on the job creation condition, since also the expected value of a good job increases. Indeed, with

lower θ workers in shadow activity have a lower probability of finding a good job, so that the duration of shadow jobs increase, causing an increase in the shadow rate.

Conversely, an increase in the monitoring intensity ρ has ambiguous effects on the shadow rate. To see this, note that by definition of the shadow rate in equation (16), ρ has a direct negative impact on the shadow rate. Yet, a tougher repression policy has also an indirect effect through $\alpha(\theta)$, since it induces a reduction in θ Indeed, with lower θ workers in shadow activity have a lower probability of finding a good job, so that the duration of shadow jobs increase, causing an increase in the shadow rate. The overall effect is ambiguous. Further, an increase in ρ unambiguously increases unemployment. The relationship between θ and ρ can be easily obtained by differentiating equation 17 with respect to ρ

$$-\frac{(r+\delta)cq'(\theta)}{q(\theta)}\frac{\partial\theta}{\partial\rho}+\beta c\frac{\partial\theta}{\partial\rho}+\lambda\frac{\alpha'(\theta)}{[r+\delta+\rho+\alpha(\theta)]^2}\frac{\partial\theta}{\partial\rho}=-\frac{\lambda(y_b-b)}{[r+\delta+\rho+\alpha(\theta)]^2},$$

which shows that $\frac{\partial\theta}{\partial\rho}<0$.

From the discussion of this section, it is clear that in order to reduce the proportion of shadow employment it is necessary to increase θ. In the model this is obtained via a reduction of taxes and an increase in productivity. But, as we show below, taxes cannot be easily reduced as long as they are used to finance some level of public spending that must necessarily be produced. The problem then reduces to choosing the optimal level of enforcement.

4 Efficiency

The discussion so far has been silent on the efficient level of the policy package τ, ρ (and of the penalty[6], ϕ) with the consequent efficient level of shadow employment. For notational ease, we just work with the monitoring rate and the tax rate, and set the penalty rate to zero $\phi = 0$.[7] Further, in this section we rely on some results recently obtained by Garibaldi and Wasmer (2002) in a matching model with home production and endogenous labor market participation, and we characterize the optimal level of taxation τ and the optimal level of enforcement ρ in a context in which a policy-maker maximizes the net value of output, where the latter includes public spending yielding some (concave) utility $P(G)$ with $P'>0$, $P''<0$.

The problem we consider is particularly simple and useful for our analysis, since the optimal level of taxation is independent of the enforcement and on market tightness. In other words, there is full separability between the choice of taxation and public spending

[6]The penalty rate ϕ will be set to zero by the benevolent social planner as good jobs can be induced to remain legal by an appropriate choice of ρ.

[7]In a previous version of the paper, we considered the case in which taxes are used to finance some social program for the non-employed (including those working in the shadow sector). Assuming exogenous wages, we obtained two equilibria. In the "good equilibrium", tighter enforcement is desirable, since it induces a reduction in the tax rate and an increase in the number of high productivity jobs. In the "bad equilibrium" with high taxes/high unemployment/high shadow activity, a tightening of controls on shadow activity results in an increase in taxes.

and the choice of enforceability and market tightness. This separability result, derived by Garibaldi and Wasmer (2002), is very useful in the analysis that follows

Let G be public spending, financed by a tax t on a base B so that $tB = G$. If H is the size of the shadow economy, or the contribution to social welfare that is not taxed, and x are some other control variables of the policy-maker, the program is

$$\begin{aligned} \underset{t,x}{Max}\Omega(x,\tau) &= B(1-\tau) + H + P(B\tau) \text{ under some constraint } F(x) = 0 \\ \text{or } \underset{t,x,\upsilon}{Max}\Lambda(x,\tau) &= B(1-\tau) + H + P(B\tau) - \upsilon\mathcal{F}(x) \end{aligned}$$

where clearly υ is the Lagrangian multiplier associated with the feasibility constraint. The first order condition on t implies then

$$-B + BP'(B\tau^*) = 0$$

or

$$P'(B\tau^*) = 1$$

Without surprise, the marginal utility of public spending must be equal to its marginal cost, i.e., 1.

In turn, the first order conditions on variables x imply

$$\begin{aligned} \frac{\partial B}{\partial x}(1-t) + \frac{\partial H}{\partial x} + t\frac{\partial B}{\partial x}P'(Bt) - \upsilon\frac{\partial F}{\partial x}(x) &= 0 \\ F(x) &= 0 \end{aligned}$$

and, using the unity of the marginal impact of public spending, we obtain that

$$\begin{aligned} \frac{\partial(B+H)}{\partial x} &= \upsilon\frac{\partial F}{\partial x}(x) \\ F(x) &= 0 \end{aligned}$$

In words, the optimal taxation problem does not affect the choice of the policy-maker with respect to the variables x and, as such, we can hereafter simplify the derivation of the social optimum by ignoring taxation. The reciprocal, however, turns out to be wrong, that is, optimal taxation is affected by the optimal choice of variables $x = x^*$, given by

$$P'(B(x^*)\tau^*) = 1 \tag{18}$$

In our problem, the net output is simply given by

$$\Omega = y_g n_g + y_b n_b + bu - c\theta u$$

where u n_g and n_b are given by equations (15) (13) and (14). Clearly, if the central planner had no problem of enforcement, the optimal policy maximizing net output would be to leave open any bad job producing $y_b > b$, and set the enforcement rate at $\rho = 0$. Yet, a more

interesting case is one in which a policy maker must set ρ so as to guarantee that good firms choose to be legal, and that a positive amount of revenues is raised in equilibrium. This implies that the market tightness θ is chosen by firms through the free entry condition $V = 0$, and its expression is given by equation (17)[8] In this case, she must set ρ in an interval such that conditions (6) and (8) be satisfied, so that

$$\frac{\tau^*}{S_g(\rho)} \leq \rho \leq \frac{\tau^*}{S_b(\rho)}$$

From the above, it follows that the optimal level of ρ in an equilibrium with shadow employment is to choose the enforcement level which is located at the lowest level of the previous interval, i.e., ρ^*satisfies

$$\frac{\tau^*}{S_g(\rho^*)} = \rho^*$$

The trade-offs related to the choice of the optimal enforcement intensity ρ are described in Figure 6. For a given optimal tax rate τ^*, the conditions (6) and (8) constrain the enforcement intensity ρ in the interval defined by the loci A and point B in the figure. The two points, which correspond respectively to (6) and (8), are obtained by the intersection between the upward sloping functions $\frac{\tau}{S_g}$ and $\frac{\tau}{S_b}$ and the 45 degree line. The two functions are obviously upward sloping since an increase in enforcement intensity reduces the surplus from the job. In light of the constraint, it is obvious that the optimal enforcement rule ρ^* will be at A, which corresponds to the minimum degree of enforcement ensuring that legal jobs exist.

Our final result concerns the relationship between optimal monitoring intensity and market tightness.

Remark 7 *The lower the job finding rate, the lower the monitoring intensity.*

The optimal monitoring intensity is increasing with the job finding rate $\alpha(.)$ (other things equal). To see this, one has to differentiate the condition $\rho^* S_g(\rho^*) = \tau$ with respect to α to get

$$\frac{\partial \rho^*}{\partial \alpha} S_g[1 + \varepsilon_{s_g,\rho}] = -\frac{\partial S_g}{\partial \alpha}$$

[8]Note that if we let the central planner choose also market tightness, the first order condition for θ would be

$$\frac{c}{q(\theta)(1-\eta(\theta))} = \phi_g \frac{(1-n_g)}{u} + \phi_u$$

where $\eta(\theta)$ is the elasticity of the matching function with respect to θ and ϕ_g and ϕ_u are the Lagrange multipliers associated with good legal jobs and unemployment respectively. Note that the efficient centralized market tightness does not correspond to the decentralized equilibrium even the when the Hosios conditions (i.e. $\beta = \eta(\theta)$) are satisfied. This result, albeit surprising, is common to most models with on the job search, and is not linked to the existence of a shadow sector. Indeed, the departure from the Hosios condition depends on the wage determination rule, and on the outside option available to the employed workers at the time of the initial job match. In the current paper, we follow Pissarides (1994), and we set the outside option equal to the value of unemployment. See Pissarides (1994) for a detailed discussion on this topic.

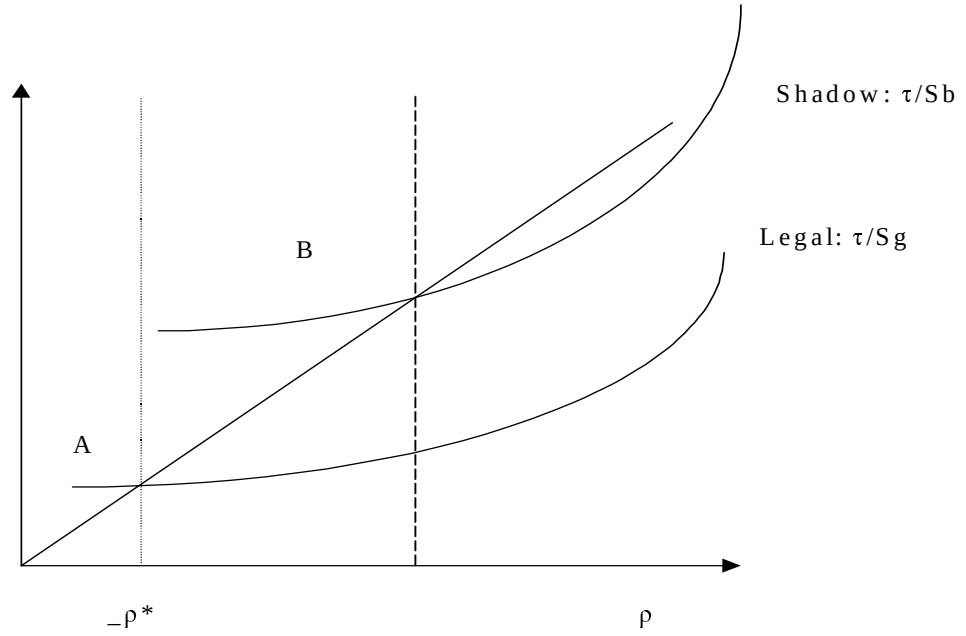

Figure 6: Optimal Enforcement Level

where $\varepsilon_{s_g,\rho}$ is the absolute value of the elasticity of the surplus with respect to the monitoring intensity, which is strictly less than one in absolute value. Since $\frac{\partial S_g}{\partial \alpha} < 0$, it immediately follows that $\frac{\partial \rho^*}{\partial \alpha} > 0$, so that the monitoring intensity is lower in labor markets with lower job finding rates. In other words, labor markets with lower job finding probabilities should be characterized by lower monitoring intensities.

5 Empirical Implications and Relevance of the Model

Our theoretical perspective has proposed a simple model of the labor market in which the unemployment rate and the size of the shadow economy are endogenously determined, closely interrelated, and depend on the general state of the market. Shadow activity emerges in equilibrium as the endogenous response of low productivity matches feeling overburdened by taxes (and possibly other regulations imposing a deadweight loss on legal jobs[9]) and rationally choosing the risks linked to shadow employment.

Changes in the penalties imposed on illegal jobs induce an increase in unemployment and, somewhat paradoxically, also on the shadow rate,since they increase the duration of shadow jobs. To investigate further the effects of changes in the enforcement intensity, we have also

[9]Annex 2 consider the case where firing costs are imposed on legal jobs being termined, under exogenous wages. We show that under these conditions a particular equilibrium configuration may emerge, namely a *shadow trap*, in which jobs generating negative value added are not destroyed in order to allow workers to find another job.

studied the case when the tax rate levied on official employment is endogenously determined, since a binding (and static) public budget constraint requires some optimal level of public spending be financed entirely from taxes levied on official jobs. We have shown, that under these circumstances, the optimal enforcement level will be the lowest one ensuring that good jobs are legal. In this respect, the theoretical analysis suggests that monitoring intensity moves with the job finding rates, with lower intensity in more depressed labour markets.

Our set-up is extremely simple, and our firms are either entirely legal or shadow. In reality, firms are likely to employ a combinations of legal and shadow employment, especially in sectors such as construction and or retail trade. However, as long as the marginal jobs in such firms are shadow jobs, the interactions between legal and shadow employment highlighted by our theory can shed important insights into real life labour markets. Kolm and Larsen (2001) find that tougher punsihment rate reduces the informal sector since they assume that firms in the legal and illegal sectors are distinct entities, so that a reduction in the latter induces an increase in the former.

Unsurprisingly, given the foundations of our model in the matching literature, our theoretical perspective suggests that the shadow economy can be better understood by looking through flows across the shadow margin. The model predicts that the size of the shadow sector is ultimately determined by the duration of shadow jobs, which is in turn negatively related to the degree of market tightness, and the turnover of the unemployment pool.

The first empirical implication of our model is that *economies with low unemployment turnover* (that is low flows in and out of unemployment) *should be characterized also by low turnover over the shadow margin* (that is low flows in and out of shadow employment). Note that this prediction is not shared by labor market theories in which the secondary informal sector is modeled as a frictionless market, and shadow employment plays the role of an adjustment buffer. In "dual" labour market models, and, more broadly, in models of labour market segmentation, flows along the shadow margin tend to be very similar to those of competitive and very flexible markets, even though the unemployment pool is stagnant. In some cases the turnover of the "flexible" margins" is increasing in the stagnancy of unemployment pools. Hence, dual models yields empirical predictions which are the polar case of those of our model.

The above prediction cannot be readily tested, since the empirical literature on the shadow economy has so far focused only on stocks. Yet, there is also a theoretical prediction in terms of stocks, since *we expect shadow employment and unemployment to be positively correlated both over time and over a cross-section.*

Finally, we try to check one substantive assumption of our model, namely the characterisation of shadow employment as a set of low-productivity jobs. Note that our characterisation is at odds with "infant industry" views of the shadow sector (the so-called "development shadow sector), whereby shadow jobs involve highly skilled individuals in matches whose productivity potential has still to be unfolded. As probably both types of shadow employment exists, the relevance of our model can also be tested by evaluating *which fraction of irregular employment is* indeed *represented by low productivity jobs.* In the rest of this section, we look for empirical evidence in support of these predictions, starting from the latter one.

5.1 Are Shadow Jobs Low-Productivity Jobs?

The shadow economy is a multi-dimensional phenomenon. Our model captures just one particular type of shadow economy, namely low productivity jobs. How relevant is this component of the shadow economy? Had we access to data on pay in the shadow segment, we could estimate earning functions and test whether, ceteris paribus, the fact of working in the shadow segment involves a lower gross remuneration. Unfortunately such data are not available.

Yet, we have access to data from a special survey on the shadow sector carried out by the Fondazione Curella – in co-operation with the Italian Statistical Office – in Sicily (Busetta and Giovannini, 1998), the Italian region with one of the largest shadow rate, estimated to be in the 1980-95 well above one third. The survey was carried out over a stratified sample of individuals aged 15 to 65. Two questions allowed to elicit the presence of irregular jobs: the first asked the individual about the contractual nature of her job, the second, in case the individuals reported that the job was "irregular", asked about the nature of the non-conformity with law (e.g., because of the absence of a formal contract, the fact of being paid below statutory minima, etc.).

Table 2, drawn from this survey, suggests that the proportion of workers with a primary or lower level of education is larger in the shadow segment than elsewhere. In the irregular economy there are also twice as many workers as in the regular segment who report that their salary is inadequate. A surveys carried out by ISAE in February 2002 also suggests that the shadow rate is highest in small units (with less than 10 employees) and in low-productivity traditional sectors, such as footwear (ISAE, 2002). We interpret all these results as an indication that a large proportion (i.e., no less than two-thirds) of shadow employment is indeed represented by low-productivity jobs.

Table 2: Characteristics of Shadow Employment in Sicily

	Shadow	Non Shadow
Share of workers with primary education or less	51.29	40.59
Share of workers considering their salary inadequate	72.08	35.22
Source: Busetta and Giovannini (1998)		

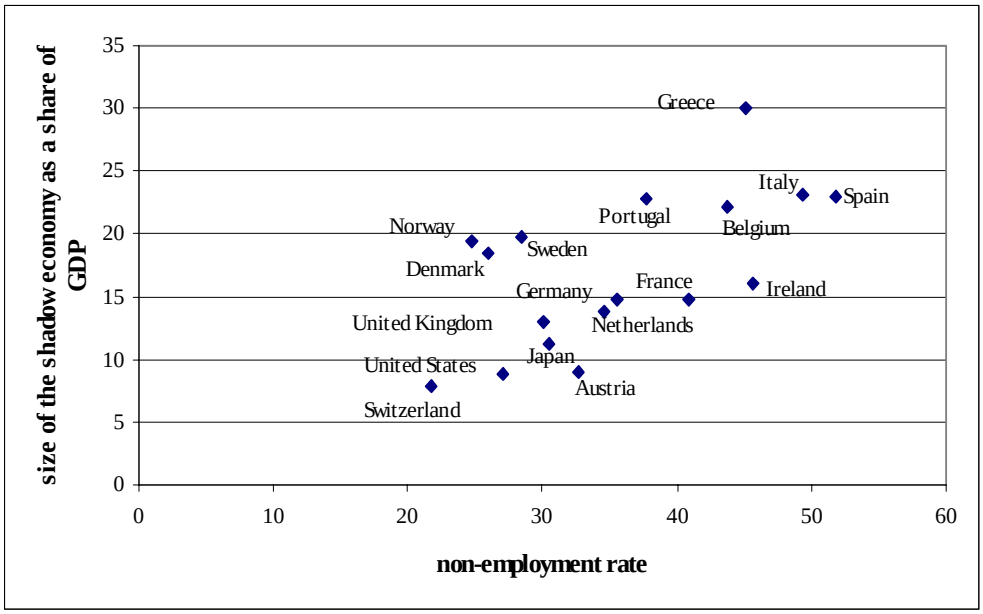

Figure 7: Shadow rate and non-employment

5.2 Are Unemployment and Shadow Employment correlated over time and across space?

A key implication of the model is that unemployment and shadow employment are two sides of the same coin. This may rationalize why Governments allow for variable enforcement of the rule of law depending on the amount of labour slack: the larger the slack the loser law enforcement. The empirical counterpart of this property of the model is that we should generally[10] observe a positive relation both over time and across space between the unemployment and the shadow rate.

Various pieces of macroeconomic evidence are in line with this implication of the model. First,the upward trend in the size of the shadow economy documented in Section 2 has been paralleled by the rise of unemployment. Second, work done in estimating the size of the informal sector in transitional economies (Lacko, 1999) points to a positive time-series correlation between the share of the unofficial economy in GDP and unemployment. Third, looking across countries, there are indications of a strong positive correlation (.60 which is significant at 99 per cent confidence levels) between shadow activity and non-employment rate, as reported in Figure 7. Fourth, indications as to the presence of a positive cross-sectional and time-series correlation between the informal sector and unemployment come by data referred to Italian regions.

[10] Only when Governments try to repress shadow employment without tackling the structural factor behind unemployment, shadow employment and unemployment will move in opposite directions. The issue is that shadow employment can be brought down to zero by improving the enforcement of the rule of law while unemployment cannot.

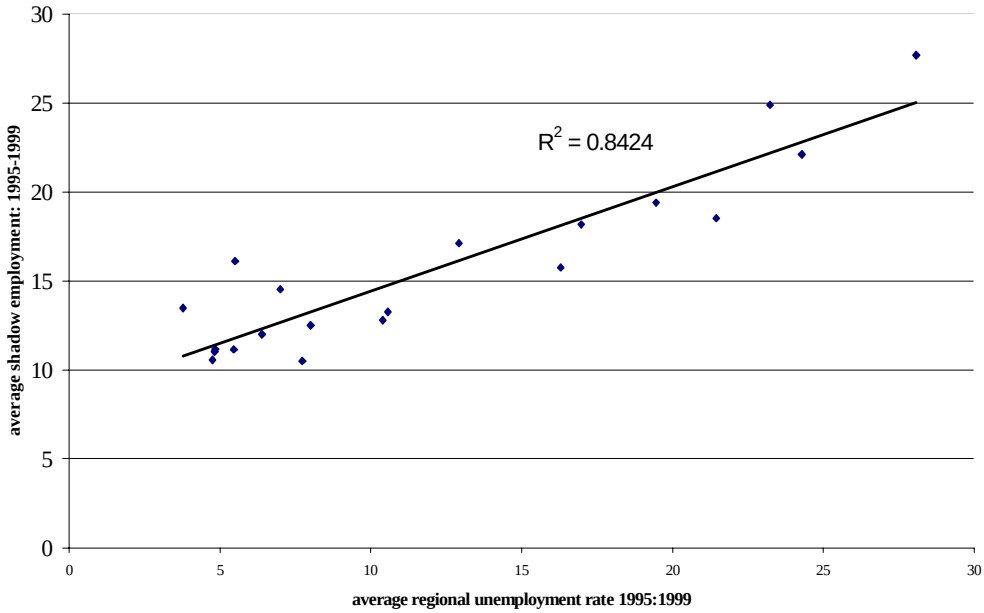

Figure 8: Unemployment and Shadow Employment Across 20 Italian Regions

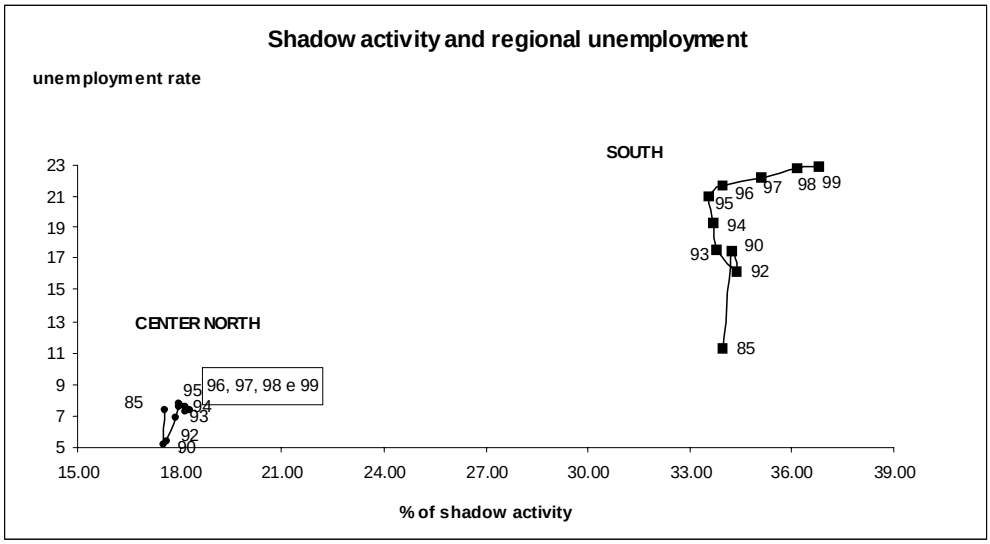

Figure 9: Unemployment and the shadow rate across Italian regions

Figure 8 displays average unemployment rate and the average shadow employment for 19 Italian regions between 1995 and 1999. The positive correlation between two figures is remarkably high. Further, Figure 9 displays the shadow rate (the share of "irregular" jobs in the total number of positions estimated by Istat) and the unemployment rate in the Centre-North and in the South of Italy for all years in which both series are available. The figure is consistent with a positive relationship between unemployment and the shadow rate both cross-sectionally (shadow employment is higher in the high-unemployment Southern regions) and over time: in the years where unemployment is on the rise, the shadow rate is also increasing.

Finally, note that several estimates of shadow employment provided at Istat (e.g., summarized in Calzaroni, 2000) point to a negative relationship between the dynamics of official and unreported employment, which is also in line with our theoretical perspective.

5.3 How about the Duration of Shadow Employment?

The positive correlation between unemployment and the shadow rate in our model comes from the fact that both variables depend negatively on market tightness and on the duration of unemployment. Unfortunately there are no data, nor even educated guesses, concerning the duration of shadow employment. The literature on shadow employment is silent about flows over the shadow margin. Hence, we have to generate our own estimates, which is a dauntingly difficult task. The results from three methods to estimate such flows are reported below: they rely on i) stock variation at highly disaggregated level, and ii) matched records across Labour Force Surveys.

5.3.1 Estimates based on stock variation

Our first attempt to estimate the duration of shadow employment is to generate flows over the shadow margin from stock variation for highly disaggregated data. Istat provides estimates of shadow employment by 20 Italian regions and 60 sectors for three years (1996,1997 and 1998). Shadow employment is defined as the number of irregular jobs ("posizioni lavorative irregolari", including multiple job holding) and is measured by taking the difference between employment figures computed from surveys or censuses having as statistical unit the household and figures reported by enterprises (mainly within the enterprise Census). The rationale behind this procedure is that enterprises report only "regular" jobs, while individuals provide information on all kind of jobs, regardless of their position in terms of fiscal compliance.[11]

By crossing sectors and regions it is possible to obtain a 60×20 matrix S, whose entries s_{ij} are shadow employment stocks in region i and sector j. The first difference $S_t - S_{t-1}$ provides 1200 cells of yearly net variations in the stocks of shadow employment. By adding up the

[11] Estimates are then complemented with information on specific sectors (e.g., agriculture of services to households) and segments of the population (e.g., foreigners) in which the shadow sector is more developed and which are not covered by standard household-based surveys (for instance, non-resident foreign workers are not captured by the Labour Force Survey which covers only the resident population).

cells with negative variations (in modules) we can proxy gross (shadow) job destruction (NEG) that is

$$NEG_t = \frac{\sum_{i,j \in S^-} |s_{ij}(t) - s_{ij}(t-1)|}{\sum_{i,j} s_{ij}(t-1)}$$

where S^- is the set of Italian sectors and regions displaying negative yearly variations in shadow employment stocks (i.e. the cells for which for which $s_{ij}(t) < s_{ij}(t-1)$). We computed this proxy job destruction measure for Italy as a whole as well as for its Centre-North and Southern regions.

Table 3 displays our results. With the exception of agriculture, Southern regions systematically display *lower* rates of job destruction than their Central and Northern counterparts. This is, prima facie, an indication of a longer duration of shadow employment in the Mezzogiorno than in the other Italian regions. At the steady state, the average duration of shadow employment in macro-region r is indeed given by

$$DUR_r = \frac{1}{NEG_r}$$

Although our series are too short to allow us to estimate the steady state shadow employment stocks and flows, our proxy job destruction measures do not contradict the empirical implications of the model: *shadow employment has longer duration just in those regions where a low turnover of the unemployment pool is observed.* Put another way, in regions like the Italian Mezzogiorno a large fraction of employment is shadow and stagnant at the same time.

Table 3: Job Destruction Rates for Shadow Employment

	Centre-North			South		
Sector	1996-7	1997-8	average	1996-7	1997-8	average
Agriculture	0.6	5.3	3.0	2.2	3.6	2.9
Industry	8.0	5.7	6.9	1.5	2.8	2.2
Services	1.7	2.2	2.0	1.0	0.3	0.7
Total	2.5	2.9	2.7	1.4	1.5	1.5
Source: Author's calculation based on Istat's estimates						

5.3.2 Estimates based on flows across labour market states

Another way to estimate flows over the shadow margins is from matched records across Labour Force Survey (LFS) waves. Before doing this we need to disentangle shadow employment from the key labour market aggregates measured by these surveys, as we do not know whether Istat shadow employment is a component of LFS employment, inactivity or unemployment. There are good reasons to believe that LFS employment offers a limited coverage of shadow employment, which appears to be present also among individuals who are classified, according to the survey definitions, either as unemployed or inactive (Meldolesi and Aniello, 1998). For instance, insofar as individuals involved in shadow activities cooperate with their employers in the decision to go idle (in our model the decision to be shadow is, after all, a jointly efficient one) they may well decide not to declare to be working.

Indications as to the presence of shadow employment among LFS unemployment come from the analysis of the wage aspirations of job-seekers. The LFS questionnaire contains a question on the lowest pay the interviewee is willing to accept when offered a job. The average reservation wage in the various quarters turns out to be between one-half and one-third of the actual average wage. Moreover, the question is formulated in such a way as to find out whether or not the job seeker had in mind posts outside the place of residence (likely to involve therefore some compensation or premium for the costs of mobility) or involving reduced working time, e.g., part-time jobs. Hence, by checking all these factors, it is possible to get some comparable information about the reservation wage of individuals. Observations on the same individual over time and comparisons of reservation wages stated when searching a job with the actual wages accepted by individuals are encouraging as to the reliability of such data. According to job search theory, the stated reservation wage of workers should coincide with their opportunity cost of employment which, ceteris paribus, is larger for individuals holding a job in the informal sector. The Annex reproduces some estimates (with LFS data and with a 4-country representative survey) of reservation wage functions. Consistently with previous studies (e.g., Faini, Galli and Rossi, 1998; Boeri and Pagani, 1999), we observe that reservation wages of unemployed individuals resident in the Southern regions are significantly higher than those observed in the Centre-North. This may be explained by *the presence of shadow activities carried out by individuals classified as unemployed, which would bias their reservation wages upwards* [12].

There are also indications of a presence of irregular forms of employment among individuals classified by the Italian LFS as inactive.

Over the 1990s, the North-South differential in employment rates increased by almost 4 percentage points because of an increasing gap in labour force participation rates – mainly among male, prime-aged, individuals – rather than larger differences in the incidence of unemployment across the two macro-regions. In the North-East of Italy the employment-to-population ratio for males aged 30 to 44 is almost 100 per cent while in the South more than 10 per cent of the men in this age group are inactive. What do prime-aged individuals do in the South? Actual labour market transitions of prime-aged individuals (males aged 30- to

[12] Alternative explanations for this fact are in sample selection and the presence of relatively many public sector jobs in the South. We control for both factors in our estimates.

45) in the period 1993-6, available upon request from the authors, point to significant OLF-E and E-OLF flows in the South, where OLF is out of the labor force and E is employment[13]. In light of the definitions of inactive status adopted in the LFS (individuals are not supposed to be seeking jobs or not available to take up job offers), such flows are puzzling. In this section we interpret the size and magnitude of such flows as evidence of shadow activity wrongly classified within the inactive status. This is consistent with evidence collected in the context of a joint Istat-Fondazione Curella survey suggesting that about 25 % of the shadow sector is wrongly assigned to the inactive status by the LFS.

The above evidence suggests that shadow employment encompasses at least a portion of LFS inactivity and unemployment. Although it is difficult to assess how large are "shadow unemployment" and "shadow inactivity", we need some estimates of these stocks in order to measure flows across the shadow margin. The transition matrices displayed below are based on the following assumptions. First, we consider prime-aged males "available" for work, but not actively seeking jobs as part of the "shadow inactivity" segment. This group accounts for about 10 per cent of the inactive in the Italian Mezzogiorno and is overrepresented in OLF-E flows[14]. Second, we decide to include in "shadow unemployment" those individuals who, after controlling for personal characteristics, display the highest reservation wages. In particular, individuals are assigned to the shadow segment when they display regression residuals in the reservation wage equation exceeding a given threshold, which is defined on the basis of the magnitude of the regional dummies and of the standard deviation of residuals[15]. According to our estimates, about 45 per cent of Southern unemployment is shadow, compared with about 30 per cent in the Centre and 25 per cent in the North-West.

Table 4, shows the transition matrix obtained by tracing flows of individuals across the

[13]The average 1993-6 E-OLF probability is 1.6 in the South compared with .0.5-0.7 in the other macro-regions. The average OLF-E probability is about 22 per cent in Southern regions compared with 17 to 21 per cent in the other regions.

[14]OLF-E probabilities are 2 to 4 times larger among individuals declaring to be available for work than for the remaining inactive individuals. Furthermore, almost one fifth of the flows from employment to inactivity are to the subset of individuals who are available for work.

[15]The threshold is obtained as follows. Suppose that the residuals from regressions omitting regional dummies is the weighted sum of two (normally distributed and independent) random variables, X_1 and X_2, whose means we will denote as μ_1 and μ_2 (where $\mu_1 < \mu_2$) respectively. In other words:

$$u = \alpha X_1 + (1-\alpha) X_2$$

where (1-α) denotes the fraction of employment being shadow in each region. It follows that $u \sim N(\alpha\mu_1 + (1-\alpha)\mu_2, \alpha^2\sigma_1^2 + (1-\alpha)^2\sigma_2^2)$. Take unemployment in the North-East (the region with the lowest mean of the residuals) as the numeraire, that is, assume that in this region $\alpha = 1$. For the regional dummies to be significant at 95 per confidence levels, it must be that $\mu_2 > \mu_1 + \frac{1}{2}(\sigma_1 + \sigma_2)$.Take for simplicity the case where $\sigma_1 = \sigma_2$.Upon some manipulations, it is then possible to show that for any macro-region displaying a statistically significant dummy variable,

$$\hat{\alpha} = \frac{\hat{D}_r}{2\,\hat{\sigma}_1}$$

Thus we defined in each region the threshold level of the residuals as the $\hat{\alpha}$-th percentile of each distribution.

shadow margin (encompassing shadow employment, "shadow unemployment" and "shadow inactivity") and the remaining labour market states. Southern regions display the lowest levels of mobility across labour market states even when the shadow sector is taken into account. This can be seen by looking at the scalar indexes of mobility for transition matrixes displayed at the bottom of each matrix[16]. Moreover, the stayer coefficient (the proportion of those not changing labour market status within a year) for the shadow segment is higher in the South than in the other regions. Overall, the second method used to estimate the flows between the shadow segment and the other labour market aggregates *suggests that shadow employment has longer duration just in those regions where a low turnover of the unemployment pool is observed.* Once more, a condition which shares similar properties than unemployment – notably, which is as sclerotic as unemployment – rather than a competitive fringe, supposedly subject to the highest turnover rates especially in labour markets where a low mobility in the "official" segment of the economy is observed. In the Italian Mezzogiorno a large fraction of employment is shadow and stagnant at the same time, in line with the prediction of our model.

Table 4: Transition Matrix, Average 93-94, 94-95 and 95-96

SOUTH	employed	shadow emp.	shadow unem.	shadow in.	unemployed	inactive
employed	91.9	2.1	0,6	0,5	0,7	4,1
shadow employed	40,3	44,8	4,8	1,7	6,0	2,7
shadow unemployed	15,3	7,4	41,1	5,4	19,7	11,1
shadow inactive	4,5	1,1	2,8	53,2	2,9	35,5
unemployed	13,7	7,5	14,1	6,5	49,4	8,7
inactive	2,1	0,2	0,6	3,8	0,7	92,4
Mobility Index	0,42					
Stayer coeff. Shadow	51,35					
NORTH-WEST	employed	shadow emp.	shadow unem.	shadow in.	unemployed	inactive
employed	92,9	1,5	0,2	0,5	0,5	4,3
shadow employed	52,7	38,3	2,0	0,8	3,9	2,4
shadow unemployed	27,6	6,0	27,2	5,7	20,2	13,4
shadow inactive	5,0	0,7	0,8	43,8	2,1	46,8
unemployed	28,3	8,4	5,4	7,1	38,7	12,1
inactive	2,5	0,3	0,2	2,6	0,6	93,8
Mobility Index	0,53					
Stayer coeff. Shadow	41,22					
South and North West; males and females in working age.						
Source: Authors' calculation						

[16]The index is defined as follows

$$I = \frac{(s - tr(M))}{s - 1}$$

where s indicates the number of states of the matrix M. As shown by Shorrock (1978), when matrices have a maximal diagonal – that is, stayer coefficients are larger than any individual mover coefficient — this index satisfies a number of desirable properties. In particular, the index is bounded between 0 and 1, is monotonically increasing in mobility, attaches value zero only to identity matrices, and is equal to one for matrices with identical rows (hence probabilities of moving independent of the state originally occupied). All the computed matrices had maximal diagonal, hence in our case the index satisfies the four properties listed above.

5.4 How much Shadow Employment is already recorded as non-employment?

Part of the shadow sector is wrongly classified as unemployment or inactivity by available statistics. Due to these measurement errors, flows from shadow employment to unemployment and non-employment occurring as a result of tighter controls may simply not be measured by official statistics. This may reduce the political costs of the repression of shadow employment. Thus, it is important to make some inferences about these statistical errors before we discuss the policy implications of our model.

Based on the methodology described in the previous section, we estimate that in Italy about 45 per cent of LFS unemployment and 10 per cent of the LFS inactive are actually employed in the shadow segment. This is surprisingly quite similar to the dissonance we can estimate between self-reported labour market status and the fact of holding an irregular job, according to the survey of the Fondazione Curella. In that survey almost 35 per cent of those declaring to be unemployed, stated that they were holding an irregular job. One inactive out of five was also declaring to have a shadow employment. Thus, a significant portion of flows from shadow employment to non-employment may not be reported by official statistics and surveys relying on self-reported labour market state.

6 Summary and Policy Implications: Much Ado About Nothing?

The link between shadow activity and unemployment is at the heart of the policy dilemma faced by policy makers who would like to fight shadow employment, but realize that a more aggressive approach against shadow activity may ultimately fail, and results only in a more depressed labor market. The main message delivered by the theoretical model developed in this paper and our empirical findings is that shadow employment shares the same properties as unemployment and that policies most likely to succeed in reducing shadow employment are just those that may contribute to unemployment reductions. Conversely, repressing shadow employment is likely to increase unemployment, by either reducing gross job creation and closing down low-productivity jobs in the shadow segment. This may explain why the growth of the informal sector has been tolerated in OECD countries, in spite of its adverse effects on fiscal revenues.

The main policy implication of the theory is quite simple: *in order to reduce shadow employment, it is necessary to reduce unemployment. A reduction of unemployment is also a sufficient condition for a decline in shadow employment.* In this context, the model confirms the traditional wisdom on labour market reforms, and suggests that any policy that fosters job creation and enhances aggregate productivity will induce a reduction in shadow employment. Furthermore, policies that increase labor mobility, making the matching process more efficient, ease workers' transition from shadow employment onto legal employment, inducing a fall in unemployment.

What about specific policies (e.g. an increase in the penalty rate associated to shadow

activity), supposedly aimed at discouraging the emergence of shadow activity? Our simple theory suggests that a very cautious approach in this area is warranted, since an increase in the enforcement or in the penalty rate may be perceived by newly created firms as a reduction in benefits stemming from the "shadow option", and may therefore completely backfire: in equilibrium higher penalty fees reduce job creation, and increase the average duration of shadow activity. In a nutshell, our results provides support to the view that "it is not certain that all shadow economic activity should be discouraged" (Fleming, Roman and Farrell, 2000).

How to judge, on the basis of these findings, the current policy debate on policies coping with shadow employment? Can we say that it is much ado about nothing? Certainly the debate would turn out to be more productive if it were to address unemployment and the size of the shadow sector as two closely interrelated phenomena. The policy debate would also benefit if it were to take into account the risks involved by a muscular approach to the problem, that is one focused on the use of the repression apparatus. Such an approach may simply not work and there are good reasons why it is not applied in OECD countries which have an efficient policy enforcement mechanism. There are many instances, perhaps too many, in which a tough policy on shadow employment would seem to be unwarranted according to our model. Ongoing discussions on policies to reduce shadow employment also envisage improvements of the external environment in which firms operate. According to this paper, such policies would be certainly welcome, since they belong to the set of unemployment reducing policies. This means, after all, that should be adopted anyway, independently of the presence of shadow employment.

Would these policy implications change were we to consider also the so-called "development shadow employment", that is, shadow employment associated to native firms, who are able to emerge in equilibrium only if they can operate in the "underground sector"? We documented above that most shadow employment corresponds to our characterisation, that is, it is composed of low-productivity jobs. While it is certainly possible to extend the model and our empirical approach in order to encompass this type of shadow employment, we believe that our insights would go through also in such a context. Not only the policy dilemma faced by policy makers would continue to apply, but it would probably be even stronger, since the costs associated with destroying this type of underground sector are larger, as they are likely to undermine the emergence of future high productivity jobs.

Finally, there is a set of policies which has the potential of contributing to reducing shadow employment by corrupting the jointly efficient character of the decision to go shadow on the part of the firm *and* the worker. Such policies are those that condition access to social insurance, e.g. insurance against job loss, only to persons with a previous formal working record and which actually enforce work-test in order to prevent holders of jobs in the shadow segment to draw non-employment benefits. If unemployment benefits were to be collected only by workers with official employment history, the workers' incentive to enter the shadow sector would be obviously reduced, and would have to be compensated in terms of higher current wages. The firm, in turn, would perceive such a policy as an increase in the costs associated to underground activity, and would tend to stay in the official sector.

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7 ANNEX 1: Estimating Reservation Wage Functions

We run the following ("augmented" Mincer-type) earning equation:

$$\log(w_i^*) = a + D_r + X_i\beta + u_i$$

where w_i^* denotes the reservation wage of individual i, D_r are intercepts allowed to vary across macro-regions and the vector X_i summarizes the personal characteristics of individuals, while u_i is the error term. In particular, in our basic specification X included a gender dummy, linear and quadratic terms for age, education dummies, as well as variables capturing the relationship between the individual and the head of the household. Dummies capturing receipt of unemployment benefits and the type of job being pursued (part-time or full-time, within the residence area or reachable within daily commuting and, as suggested by Boeri and Pagani, 1999, public or private[17]) are also included. The other specifications summarized in Table ?? [18] include unemployment rates at the district level (capturing local labour market conditions) and a Heckman-correction term. The latter aims at capturing effects of self-selection which may be overlooked by an imperfect measurement of personal characteristics of individuals.

Regression results consistently indicate larger reservation wages in the South than elsewhere, even when controlling for local labour market conditions and including a selection term[19]. The Southern dummy is always positive and significant at conventional levels. The sign of the estimated coefficients is broadly in line with that of actual wage equations – suggesting that individuals have wage aspirations in line with labour demand – and consistent with a-priori expectations. In particular, the coefficients for gender, age, education, and family terms as well as the private/public jobs are "reasonably" signed.

Ceteris paribus, the fact of being living in the South, yields about a 10 percent increase in reservation wage aspirations. We interpret these results as indications of the fact that some fraction of LFS unemployment in the South may be involved in shadow activities, which increase the opportunity cost of accepting formal job offers. Significantly, the Southern dummies – as the available estimates of shadow employment – are increasing over time, but this latter remark should be taken with the grain of salt as we have only three observations.

Similar results were obtained by running a reservation wage function using a 4-country representative survey carried out by Fondazione Rodolfo Debenedetti (Boeri, Boersch-Supan and Tabellini, 2001). The sample is much smaller than in the Italian LFS. We consistently obtain a positive coefficient for the Italian Mezzogiorno. The dummy for the Spanish regions with high unemployment (Southern regions) is also positive, but not statistically significant.

[17] As in Boeri (1999) we disentangle search for public and private jobs by looking at the job search activities carried out by individuals. Those seeking only for public jobs are those who declare to have been seeking only via public competitions ("concorsi pubblici").

[18] We also carried out separate regressions for males and females as well as for prima-aged individuals. Results are available upon request. They are in line with those displayed in the main text.

[19] Our results are also robust to outlier detection, which may be another way to explain the high reservation wages observed in the South. Hypothetical bias, which may be more serious in regions where jobseekers are rarely confronted with job offers, may induce individuals to state "unreasonable" reservation wage values.

Table 5: Reservation Wages of the Unemployed; 1995

	coeff	sig	st. err.		coeff	sig	st. er.		coeff	sig	st. er.
gender (M=1)	0,0593	**	0,0127		0,0585	**	0,0234				
age	0,0200	***	0,0030		0,0196	***	0,0030		0,0274	***	0,0056
age^2	-0,0003	***	0,0000		-0,0002	***	0,0000		-0,0003	***	0,0001
level of education:											
primary or lower	-0,1370	**	0,0272		-0,1385	***	0,0271		-0,1265	***	0,0445
tertiary	-0,2023	**	0,0274		-0,2053	***	0,0274		-0,2108	***	0,0446
type of job being seeked:											
in the private sector	-0,0432	**	0,0183		-0,0435	**	0,0182		-0,0269		0,0308
part-time	-0,2300	**	0,0153		-0,2298	***	0,0153		-0,2237	***	0,0247
within comm. distance	-0,0123	**	0,0106		-0,0135		0,0106		-0,0134		0,0108
labour market status											
first-time jobseeker	0,0039	**	0,0127		-0,0010		0,0127		0,0005		0,0129
un. benefit recipient	0,0489	**	0,0223		0,0517	**	0,0222		0,0483	**	0,0216
relation vis-a-vis household											
husband/wife	-0,0894	**	0,0196		-0,0887	***	0,0195		-0,0589	*	0,0335
son/daughter	-0,0694	**	0,0195		-0,0691	***	0,0195		-0,0574	*	0,0318
relative	-0,0854	**	0,0295		-0,0836	***	0,0295		-0,1093	**	0,0495
nr of family members	0,0021	***	0,0044		0,0013		0,0044		0,0060		0,0074
local conditions											
un. rate (district-level)					0,4793	***	0,1075				
dummy North-West	0,0358	***	0,0199		0,0319		0,0199		0,1136	***	0,0416
dummy Center	0,0435	**	0,0199		0,0269		0,0202		0,0340		0,0325
dummy South	0,1115	**	0,0182		0,0460	**	0,0234		0,0744	**	0,0321
constant	13,9764	*	0,0731		13,9493	***	0,0732		13,8686	***	0,1247
Mills lambda									-1,7710	***	0,6008
R2	0,1242				0,1276						
n	5112				5112				5112		

Estimates of Mincer-type reservation wage equations

Source: Authors' calculation

Table 6: Reservation Wages of the Unemployed in Four European Countries

	coeff	sig	st. err.		coeff	sig	st. er.
Male (M=1)	1.58	*	1.15		1.3	*	0.54
Com. Educ	-3.01	**	2.63		-2.50	**	1.82
Age	0.07		0.09		0.05		0.87
year seek $<$ 2 years	-6.87	**	3.01		-5.11	**	4.97
seek $>$ 2 years	-7.91	**	3.43		-8.21	**	5.63
Married	-7.33	*	4.03		-7.33	*	6.78
Poor	-6.32	*	3.79		-6.31	*	5.62
last time jobseeker	0.43		7.75		0.31		2.98
num. family members	-0.41		0.94		-0.37		0.91
suport from relatives	9.61	*	5.31		9.70	*	8.32
public pension	-5.10	**	2.36				
Reform	3.49	*	2.11				
white collar					7.50	**	6.91
blue collar					-5.91		4.94
Dummy North-West Italy	-1.26		6.67		-1.28		0.96
Dummy Centre Italy	3.95		3.04		3.92		2.81
Dummy South Italy	7.97	**	3.61		7.92	**	0.62
Dummy North East Spain	-3.54	*	2.15		-3.58		1.89
Dummy South Spain	0.57		0.26		-0.52		0.39
Dummy East Germany	-0.72	**	0.36		-0.69	*	0.13
N	132				125		
LR chi2(14)	29.87				21.3		
Prob¿chi2	0.008				0.006		
Pseudo R2	0.4985				0.3859		

Estimates of Mincer-type reservation wage eqations

Source: Boeri Axel Bosch and Tabellini (2001)