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# Moral, the informal sector, and unemployment<sup>\*</sup>

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## Abstract

While examining the macroeconomic effects of increased government control of the informal sector, this paper develops a two-sector general equilibrium model featuring matching frictions, and heterogeneous workers in terms of moral. This facilitates an analysis of how wage setting and unemployment is affected by punishment policies, which is ignored in the previous literature.

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## 1 Introduction

Some goods are produced in both the formal and the informal sector. A given worker faces a decision of whether to perform his activities in the formal or the informal sector. When making that decision, the worker compares net payoffs and employment perspectives in the two sectors. Considering this sectorial choice, one question emerges: why do not all workers apply for jobs in either the formal- *or* the informal sector? Why do both sectors exist?

One prominent explanation is that workers differ in moral. Entering the informal sector is associated with moral costs. Some workers have higher

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<sup>\*</sup>A longer version of the paper is found in Kolm and Larsen 2001.

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moral preventing them from performing illegal work. Other workers have lower moral and enter the informal sector gladly. The informal sector then consists of low-moral workers and the formal sector consists of high-moral workers.

The purpose of this paper is to examine how a larger control of the informal sector affects the size of the informal sector, wages, unemployment and welfare. To that end, we develop a two-sector general equilibrium model featuring matching frictions, heterogenous workers in terms of moral, worker-firm wage bargains, and endogenous sector division.

Although there has been a recent explosion of the literature on tax evasion and tax avoidance, the research is mainly carried out within the public finance tradition.<sup>1</sup> In this literature wages are either assumed to be fixed or determined by market clearing.<sup>2</sup>

The main novelty of this paper is to incorporate an imperfectly competitive labour market. This facilitates an analysis of how punishment policies affect wage setting and unemployment. Previous literature on tax evasion has either assumed that wages are fixed or determined by market clearing, which obvious is an inadequate framework to use when analyzing how tax evasion opportunities affect wage setting and unemployment.

## 2 The Model<sup>3</sup>

The economy consists of two sectors producing a homogenous good; a formal sector and an informal sector.

We assume that workers have moral considerations. There is a distribution of moral values,  $m$ , in the economy,  $m \in [0, 1]$ . For simplicity we assume the distribution to be uniform. Moral costs of applying for a job in the informal sector, is denoted  $c(m)$ , where  $c'(m) > 0$ .

### 2.1 Matching

We assume that only unemployed workers search for jobs.

The matching functions for the formal and informal sectors are

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<sup>1</sup>See Slemrod and Yitzhaki (2000) and Schneider and Eneste (2000) for two recent surveys.

<sup>2</sup>An exception is Chang and Lai (1996) who examines the relationship between underreporting of income and total tax revenues taking into account the efficiency wage hypothesis.

<sup>3</sup>The model is along the line of Pissarides 1990.

$$X^j = (v^j)^{1-\eta} (u^j)^\eta, j = F, I,$$

where  $u^j$  and  $v^j, j = F, I$  are the unemployment- and vacancy rates for the two sectors. The rates are defined as the numbers relative to the sector labour forces. The total labour force is normalized to unity, which is divided into the two sectors. The worker's and firm's transition rates are  $\lambda^j = X^j/u^j = (\theta^j)^{1-\eta}, j = F, I$  and  $q^j = X^j/v^j = (\theta^j)^{-\eta}, j = F, I$ . Here  $\theta^j = \frac{v^j}{u^j}, j = F, I$  is labour market tightness.

## 2.2 The formal and the informal sector

The present discounted values of unemployment,  $U^F$  and  $U^I$ , and employment,  $E^F$  and  $E^I$ , are:

$$rU^F = \lambda^F(E^F - U^F), \quad (1)$$

$$rU^I = \lambda^I(E^I - U^I) - c(m), \quad (2)$$

$$rE^F = w^F(1-t) + s(U^F - E^F), \quad (3)$$

$$rE^I = w^I(1-p\delta) - c(m) + (s+p)(U^I - E^I), \quad (4)$$

where  $r$  is the exogenous discount rate;  $w^j, j = F, I$  denotes wages in the two sectors;  $s$  is the exogenous separation rate;  $t$  is the proportional income tax rate;  $p$  is the rate at which an informal worker is detected by the government, and  $\delta$  is the proportion of the evaded income the worker has to pay as a punishment fee if detected. For simplicity, we assume that unemployment benefits are equal to zero.

The informal worker faces the separation rate  $s+p$  as he may be separated from his job due to an exogenous market separation or due to detection. The moral cost is paid by all informal workers as applying for a job in this sector involves moral considerations.

Firms in the two sectors are characterized by the arbitrage equations:

$$rJ^j = y - \omega^j + s^j(V^j - J^j), j = F, I, \quad (5)$$

$$rV^j = q^j(J^j - V^j) - k, j = F, I, \quad (6)$$

where  $J^j$  and  $V^j$  give the value of a filled- and unfilled job;  $\omega^j, j = F, I$ , where  $\omega^F = w^F(1+z)$  and  $\omega^I = w^I(1+p\alpha)$  denote producer wages in the two sectors;  $z$  is the payroll tax rate and  $\alpha$  is the proportion of the evaded wage the informal firm has to pay as a punishment fee if detected. The marginal productivity of manual workers is  $y$ . Hiring costs are denoted  $k$ .

### 2.2.1 Wage determination

Wages solve first order conditions from the Nash Bargaining Solutions with the worker's bargaining power being equal to  $\gamma$ .

$$\frac{\gamma}{1-\gamma} \frac{1}{\phi^j} (J^j - V^j) = E^j - U^j, j = F, I, \quad (7)$$

where  $\phi^F = \frac{1+z}{1-t}$  and  $\phi^I = \frac{1+p\alpha}{1-p\delta}$  are the tax- and punishment wedges.

By use of equation (1)-(6) in equation (7), and assuming free entry,  $V^j = 0$ ,  $j = F, I$ , and symmetric conditions facing agents within each sector, producer wages are:

$$\omega^j = \gamma (y + \theta^j k), j = F, I. \quad (8)$$

### 2.2.2 Labour Market Tightness

Labour market tightness for the two sectors are determined by equations (5) and (6) using the free entry condition and the wage equations (8):

$$\frac{k(r+s)}{q^F} = (1-\gamma)y - \gamma\theta^F k, \quad (9)$$

$$\frac{k(r+s+p)}{q^I} = (1-\gamma)y - \gamma\theta^I k. \quad (10)$$

Note that  $\theta^F > \theta^I$  since  $s+p > s$ .

### 2.2.3 Unemployment

Steady state employment- and unemployment rates are derived by considering the flows into and out of employment. The unemployment rates,  $u^F$  and  $u^I$ , can then be solved as:

$$u^F = \frac{s}{s + \lambda^F}, \quad (11)$$

$$u^I = \frac{s+p}{s+p+\lambda^I}. \quad (12)$$

The total number of unemployed workers are given by:

$$U_{TOT} = u^F (1 - \hat{m}) + u^I \hat{m}. \quad (13)$$

where  $1 - \hat{m}$  and  $\hat{m}$  defines the sector labour forces.

## 2.3 Sector Division

Workers enter the unemployment pool and choose whether to apply for formal- or informal jobs. In making the choice they compare the values of being in the two sectors. The marginal worker,  $\hat{m}$ , is indifferent between entering the formal- or the informal sector, i.e.,  $rU^F = rU^I$ . Rewrite the condition by using (1)-(4) and (8), free entry ( $V^j = 0$ ) and that  $J^j = \frac{k}{q^j}$  as

$$k \frac{\gamma}{1-\gamma} \frac{1}{\phi^p} (\theta^F - \psi \theta^F) = c(\hat{m}), \quad (14)$$

Workers with low moral,  $m \leq \hat{m}$ , become informal workers whereas workers with high moral,  $m > \hat{m}$ , become formal workers. Hence  $\hat{m}$  and  $1 - \hat{m}$  resolve the labour forces in the two sectors. For the informal sector to exist,  $\hat{m} > 0$ , we need that  $\frac{\theta^I}{\theta^F} > \psi$ . Put differently, the wage premium for workers employed in the informal sector has to be large enough to counteract that the expected time spent in unemployment is lower in the formal sector.<sup>4</sup>

## 3 Comparative Statics

We consider the impact of the punishment system (higher audit rate,  $p$ , or higher punishment fees,  $\alpha$  or  $\delta$ ) on tightness, equilibrium producer wages, unemployment rates, the number of unemployed workers, and sector division. We regard fully financed changes, that is, the tax rates  $t$  and  $z$  adjust in order to balance the government budget:

$$R = \omega^F \left(1 - \frac{1}{\phi^F}\right) (1 - \hat{m}) (1 - u^F) + \hat{m} \omega^I \left(1 - \frac{1}{\phi^I}\right) (1 - u^I). \quad (15)$$

It is straightforward to verify propositions 1-5 by differentiating the equations determining the equilibrium variables (presented in section 2) as well as equation (15) with respect to the policy variables,  $p, \alpha, \delta, t$  and  $z$ .

The effects on the equilibrium variables are summarized in the following propositions.

**Proposition 1** *A fully financed increase in the audit rate,  $p$ , will have no impact on formal tightness,  $\theta^F$ , and reduce informal tightness,  $\theta^I$ . Both  $\theta^F$  and  $\theta^I$  are unaffected by fully financed changes in the punishment rates,  $\delta$ , or  $\alpha$ .*

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<sup>4</sup>For the informal sector to have a wage premium,  $\psi < 1$  needs to hold. This is also in line with what we observe empirically (see Pedersen and Smith (1998)). More details on existence are given in appendix B.

When the audit rate increases, the expected duration of an informal match decreases. It is therefore less profitable for a firm to open informal vacancies, whereby vacancies relative unemployed workers in the informal sector decreases.

**Proposition 2** *A fully financed increase in the audit rate,  $p$ , will have no impact on formal producer wages,  $\omega^F$ , and reduce informal producer wages,  $\omega^I$ . Both  $\omega^F$  and  $\omega^I$  are unaffected by a fully financed increase in the punishment rates,  $\delta$  and  $\alpha$ .*

When the audit rate increases, informal tightness decreases, whereby lower hiring costs are induced. Hence informal producer wages decrease.

**Proposition 3** *A fully financed increase in the audit rate,  $p$ , will have no impact on the formal unemployment rate,  $u^F$ , and increase the informal sector unemployment rate,  $u^I$ . Neither  $u^F$  and  $u^I$  are affected by a fully financed increase in the punishment rates,  $\delta$  and  $\alpha$ .*

The informal unemployment rate increases for two reasons. A higher audit rate increases the separation rate in the informal sector. A higher  $p$  also reduces sector tightness and thereby reduces the unemployed worker's transition rate into informal sector employment. Both effects increase the informal unemployment rate.

Next, we consider the impact on the sector division. Since  $\hat{m}$  is affected by changes in  $t$  and  $z$ , we have to account for repercussions of tax adjustments on  $\hat{m}$ . Changes in the tax- and punishment system affects the government revenue in a number of ways.<sup>5</sup> We focus on the case when we are located on the positively sloped side of the Laffer curve, in the sense that dynamic adjustments in equilibrium wages, employment rates and labour force are not dominating the direct effects; an increase in the audit rate,  $p$ , or the punishment fees,  $\alpha$  and  $\delta$ , then calls for reductions in the tax rates in order to maintain a balanced budget.

**Proposition 4** *A fully financed increase in the audit rate or the punishment rates,  $p$ ,  $\alpha$ , and  $\delta$ , will reallocate workers towards the formal sector considered that we are located on the positively sloped side of the Laffer curve.*

An increase in the audit rate reduces the size of the underground economy since both consumer wages and employment perspectives in the informal sector are reduced. Increased punishment fees reduce the informal sector by

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<sup>5</sup>See appendix A for details.

reducing the sector consumer wages. The reduced taxation of the formal sector reinforces the reallocation of workers towards the formal sector by increasing formal consumer wages.

**Proposition 5** *A fully financed increase in the audit rate,  $p$ , has an ambiguous impact on total unemployment,  $U^{TOT}$ , whereas a fully financed increase in the punishment rates,  $\alpha$  or  $\delta$ , reduces  $U^{TOT}$  considered that we are located on the positively sloped side of the Laffer curve.*

A higher  $p$  induces a reallocation of workers towards formal employment reducing total unemployment as the unemployment rate is relatively smaller in the formal sector. However, the unemployment rate in the informal sector increases which tends to raise total unemployment. The overall effect on unemployment of an increase in the audit rate is hence ambiguous. An increase in the punishment rates,  $\alpha$  and  $\delta$ , will unambiguously reduce total unemployment since only the reallocation effect is at work.

## 4 Welfare

This section is concerned with welfare effects of punishment systems. We consider a utilitarian welfare function, which for  $r \rightarrow 0$  is given as:<sup>6</sup>

$$W = (y(1 - u^F) - u^F \theta^F k)(1 - \hat{m}) + \int_0^{\hat{m}} (y(1 - u^I) - u^I \theta^I k - c(m)) dm. \quad (16)$$

Welfare depends on both the welfare generated in each sector and the allocation of workers across the two sectors. There are no welfare effects from changes in sectorial division,  $\frac{\partial W}{\partial \hat{m}} = W^I(\hat{m}) - W^F = 0$ , as both workers and firms are unaffected. Workers are indifferent between the two states since the moral costs equal the expected gain of informal sector work for these workers. Firms make zero profits in the long run.

**Proposition 6** *A fully financed increase in the audit rate,  $p$ , will reduce welfare whereas higher punishment rates,  $\alpha$  and  $\delta$ , will have no impact on welfare.*

The proposition can be verified by differentiating (15) and (16) with respect to the policy variables,  $p, \alpha, \delta, t$  and  $z$  and using the previous propositions.

A higher audit rate implies lower welfare as welfare for the informal sector is reduced, because the increase in the unemployment rate is dominating the increased welfare due to lower hiring costs.

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<sup>6</sup>The government budget is balanced at all times.



## 5 Conclusion

We have shown that increased government control of the underground economy in terms of more frequent auditing will reduce the size of the underground economy. The reason is that employment perspectives and relative consumer wages in the informal sector are reduced. Furthermore, increased auditing reduces welfare since employment perspectives in the informal sector are reduced and the reallocation of workers leaves welfare unaffected. There is an ambiguous impact on overall unemployment as the reduced employment perspectives in the informal sector are counteracted by the fact that workers reallocate towards the formal sector where the unemployment rate is lower. Higher punishment fees reduce the size of the underground economy, do not affect welfare and reduce overall unemployment.

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## 5.1 Appendix A: Impact on revenue

Differentiating the government budget constraint in (15) with respect to  $p$  and  $x = t, z, \delta, \alpha$  gives the following expressions:

$$\begin{aligned} \frac{\partial R}{\partial p} = & \frac{\partial \hat{m}}{\partial p} \left( \omega^I \left( 1 - \frac{1}{\phi^p} \right) n^I - \omega^F \left( 1 - \frac{1}{\phi^t} \right) n^F \right) \\ & + \hat{m} \frac{\partial \omega^I}{\partial p} \left( 1 - \frac{1}{\phi^p} \right) n^I \\ & + \hat{m} \omega^I \left( 1 - \frac{1}{\phi^p} \right) \frac{\partial n^I}{\partial p} \\ & + \hat{m} \omega^I \frac{1}{(\phi^p)^2} n^I \frac{\partial \phi^p}{\partial p}, \end{aligned} \quad (17)$$

$$\begin{aligned} \frac{\partial R}{\partial x_1} = & \frac{\partial \hat{m}}{\partial x_1} \left( \omega^I \left( 1 - \frac{1}{\phi^p} \right) n^I - \omega^F \left( 1 - \frac{1}{\phi^t} \right) n^F \right) \\ & + \hat{m} \omega^F \frac{1}{(\phi^p)^2} (1 - u^I) \frac{\partial \phi^p}{\partial x_1}, \quad x_1 = \delta, \alpha. \end{aligned} \quad (18)$$

$$\begin{aligned} \frac{\partial R}{\partial x_2} = & \frac{\partial \hat{m}}{\partial x_2} \left( \omega^I \left( 1 - \frac{1}{\phi^p} \right) n^I - \omega^F \left( 1 - \frac{1}{\phi^t} \right) n^F \right) \\ & + \omega^F \frac{1}{(\phi^t)^2} (1 - \hat{m}) (1 - u^F) \frac{\partial \phi^t}{\partial x_2}, \quad x_2 = t, z, \end{aligned} \quad (19)$$

where we can divide the influences on the government revenue into four categories characterized by each row in the two equations. The *first* row in each equation captures how revenues are altered by the change in the number of workers choosing the informal sector. The *second* row in equation (17) captures how revenues are influenced by changes in the equilibrium producer wage for informal sector workers. The *third* row in equation (17) gives the impact on revenues due to employment changes for informal sector workers. Finally, the *fourth* row in equation (17) and the second row in equations (18) and (19) gives the direct effect.

Consider first how revenues change with an increase in audit rate,  $p$  (cf. equation (17)). From the discussion in section 3 we concluded that the number of informal sector workers decreases with a higher audit rate. Revenues then increase to the extent that formal sector workers pay more taxes than informal sector workers pay in punishment fees. The second row encapsulates that a higher audit rate implies lower informal sector producer wages, the

government revenues fall. Since the employment rate for informal sector workers decreases, the government revenues fall. Finally, the direct effect will always increase revenues.

Since the dynamic effects move in different directions it is difficult to determine whether they reinforce or weaken the direct effect. However, we assume that we are located on the upward sloping part of the Laffer curve and hence the dynamics effects will never dominate the direct effect.

Analogous reasoning can be conducted for equation (18). We derived that the number of informal sector workers decreases with higher punishment fees. Revenues then increase to the extent that formal sector workers pay more taxes than informal sector workers pay in punishment fees. The direct effect will always increase revenues.

Finally, from equation (19) we observe that the reallocation effect between the two sectors tends to decrease revenues if formal sector workers pay more taxes than informal sector workers pay in punishment fees, whereas the direct effect increases revenues.

## 5.2 Appendix B: Existence of $\hat{m}$

We observe that for the informal sector to exist, that is for  $\hat{m}$  to be positive, we need that labour market tightness in the informal sector relatively to labour market tightness in the formal sector is larger than the wedge,  $\frac{\theta^I}{\theta^F} > \psi$ . Put differently, the wage premium for workers employed in the informal sector has to be large enough to counteract that the expected time spent in unemployment is lower in the formal sector.

Consider the specific matching function where  $\eta = \frac{1}{2}$ . In this case the condition reduces to:

$$\left( \frac{-(r+s+p) + \sqrt{(r+s+p)^2 + 4\gamma \frac{(1-\gamma)y}{k}}}{-(r+s) + \sqrt{(r+s)^2 + 4\gamma \frac{(1-\gamma)y}{k}}} \right)^2 > \psi.$$

The smaller  $p$  is, the smaller is the difference between the two labour market tightness, and hence the more likely it is that the condition is satisfied. The more  $p$  increases, the less attractive the informal sector becomes as employment opportunities are diminished and wages are reduced in the informal sector. The left hand side therefore decreases in  $p$ . The right hand side, on the other hand, increases in  $p$ . Hence, there exists a value for the audit rate,  $p^*$ , for which for  $p \in (0, p^*)$  the informal sector exists and for which  $p \in (p^*, 1)$  the informal sector does not exist. Empirically the informal sector exists, wherefore we concentrate on the former range.

Furthermore, for a given distribution of morals, the form of the cost function,  $c(m)$ , will be determinate for the size of the informal sector relative to the formal sector. We assume that the cost function is such that  $c(1) = \infty$  to guarantee the existence of a formal sector. Ceteris paribus, both a high audit rate and high moral costs cause a small informal sector.