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*A Model of the Informal Economy  
in Transition Economies*

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**A Model of the Informal Economy  
in Transition Economies**

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**Abstract:** The informal economy has burgeoned in many transition economies but particularly in those of the Former Soviet Union. While this variation has commonly been related to the prevalent tax regimes and the degree of transparency in the legal and commercial system, the causality is far from obvious and other factors -- such as the importance of non-monetary compensation or social benefits -- seem to be important. This paper sets up a model of a formal and informal sector where multiple job-holding is feasible. The informal sector can choose to employ part time labour or full time workers; the latter will be subject to payroll taxation. The informal sector in this model makes its decisions contingent on the behaviour of the formal sector and parameters, such as tax rates and the probability of being caught evading taxes. The model allows us to retrieve the ratio of the types of employment in each sector and their associated levels. With the closed form, a set of simulations are run that indicate the effect of shocks to demand and/or financing of social benefits on labour allocation. The distribution of employment across full and part time employment is very sensitive to the scale of subsidy given to benefits, as well as the tax regime and incidence.

**JEL: J23,J32,P31,O11**

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## 1. Introduction

Informal sectors have long been a feature of developing economies. Economists have traditionally considered the size of the informal economy to be not only a function of the level of development but -- perhaps critically -- a function of government policy, particularly with respect to taxation and the size of the public sector. For example, high payroll taxes and a large, commonly unionised, public sector have tended to be associated with substantial informal sectors, with the latter acting in part as an employment ladder to the public sector<sup>2</sup>. In addition, explanations of the relative size of the informal economy have increasingly related these differences to the relative competences of governments and associated institutions. With this line of reasoning, where governments have provided an uncertain policy environment, where rules and restraints have been ineffectual and where public agency has possessed an overall low level of credibility, informal sectors will tend to be large<sup>3</sup>. Agents will attempt to evade capricious actions by public agencies, particularly in the realm of taxation, by directing their activities to the informal economy. In turn, large informal sectors have major implications not only for the type and scale of investment -- informal sector firms tend to remain relatively small scale -- but also for the ability of governments to continue to raise revenues and provide public goods<sup>4</sup>.

The rapid growth of an informal sector from a relatively low base has been a notable feature of the transition economies. But the incidence has also varied substantially, so much so, indeed, that it is possible to draw a stark contrast between Central Europe and countries further east. In the former Soviet Union (FSU), the growth of the informal sector has been particularly sharp. While it is always hard to measure the true size of the informal or untaxed economies, recent estimates suggest that in Russia, for example, by 1995/96 the informal sector may have accounted for over 40 percent of GDP. In most of Central Europe, the same approach yields estimates of under 15 percent of GDP<sup>5</sup>. Analogously, levels of unemployment have differed substantially across these

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<sup>2</sup> There is a large literature on these issues including, Harris and Todaro (1970); Stiglitz (1982).

<sup>3</sup> See, for example, Borner et al (1995); World Bank (1997).

<sup>4</sup> See Johnson, Kaufman and Shleifer (1997).

<sup>5</sup> Kaufman and Kaliberda (1996).

regions, with a clear inverse association between the size of the informal sector and unemployment.

This rapid but variable growth in the size of the informal economy has complex roots. One approach has been to emphasise the presence of high and variable taxes, as well as the absence of a transparent legal and commercial system, in propagating the informal economy<sup>6</sup>. Yet, the causality is by no means obvious. The expansion of the informal economy itself is likely to have been a major explanatory factor accounting for the absence of a stable environment for transactions, as much as a reflection of just such an environment.

Further, while models of the informal sector in transition have tended to characterise the economy in terms of two distinct sectors, the most striking feature of many FSU economies is the way in which the formal and informal sectors have tended to co-exist. Multiple job-holding rather than exclusive participation in either one or other sector appears to be the norm. From the perspective of the formal sector firm, this approach could be interpreted as an attempt to get greater flexibility given shocks. This seems an unlikely explanation in the transition context, unless there was the expectation that firms would see improvements in the product market that could motivate a response aimed at limiting layoff costs<sup>7</sup>. Given what we know about the evolution of demand and the size of shocks in the transition, not to speak of the initial conditions of chronic over-manning, such expectations would hardly be realistic.

The very existence of multiple job holding naturally warrants thinking about the way in which decisions are made not only by individual agents but, as importantly, the firm level contexts that sanction such decisions. Why, for example, should we expect formal sector firms to tolerate widespread participation by their workers in the informal economy, alongside continuing attachment? Similarly why do workers wish to retain this attachment? Existing work suggests that the answer likely lies with the combination of control regimes in formal sector firms and, in particular, the dominance of insiders and

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<sup>6</sup> As in, Brunetti, Kisunko and Weder (1997); Johnson, Kaufman and Shleifer (1997).

<sup>7</sup> As, for example, argued in the US context by Friesen (1997) who suggests that firms use part time labour for dynamic flexibility with hours of work being an important criterion in the internal labour market of the firm.

the level of outside opportunities -- particularly unemployment benefits -- made available to separated workers. In addition, empirical work shows that a major part of formal sector compensation has traditionally been non-monetary<sup>8</sup>. This appears to be a significant factor motivating workers to remain attached to formal sector firms.

In short, while it is true that multiple job holding or moonlighting is far from unique to these economies, the scale of such activity and the apparent sanction for such participation from formal sector firms raises some interesting questions about the origins of the informal economy, its characteristics and likely dynamics. These include questions concerning the role that the informal sector may play in the dynamic adjustment of firms in the formal sector.

This paper proceeds from a simple but suggestive characterisation of a transition economy as one where two types of firm and an associated labour allocation coexist. There is a formal sector, which is composed of state or privatised firms and faces a set of payroll taxes, and an informal and largely untaxed part of the economy which is in private hands. The informal or private sector can choose to employ part time labour -- subject to some probability of being caught evading taxes -- or full time workers who will be subject to the same rate of payroll taxation as in the formal sector. As such, the informal sector makes its decisions contingent on the behaviour of the formal sector and on a set of other parameters, including tax rates and the probability of being caught evading taxes. Section 2 provides some motivation for this set-up and specifies the objectives appropriate to each sector. Given the nature of the formal sector firm, we then work through the representative firm's problem to retrieve the allocation of employment across two types of labour, namely, full and part time labour. Solutions to the informal sector's problem are shown to be conditional on the actions of the formal sector firm. Section 3 takes the closed form of the model and provides a set of simulations looking at the impact of shocks to demand and/or financing of benefits on labour allocation over full and part time workers within and across sectors. We show that the distribution of employment across full and part time employment is very sensitive to the scale of subsidy provided to

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<sup>8</sup> See, for example, Commander, Lee and Tolstopiatenko (1996)

benefits provision in formal sector firms, as well as to the tax regime and incidence. Section 4 concludes.

## 2. A Model of Labour Allocation

The economy is composed of two sectors; the formal and informal. At first approximation, we can think of the former as being populated by state or privatised firms who entered the transition as formal or taxed firms. The informal sector is composed of private firms whose origin postdates the start of transition. Drawing on the extensive literature on transition firms, the formal sector firms can be seen as dominated by insiders who effectively appropriate all rents<sup>9</sup>. This corresponds to a wage setting rule in which wages are set equal to average product. A specific feature of such firms is that worker compensation has normally been composed of two parts; monetary and non-monetary, with the latter comprising benefits, such as housing, health and child care. These benefits have been largely firm-specific and have comprised an important share of total labour costs<sup>10</sup>. In addition, such benefits have commonly been part-financed by government through subsidies to firms. By contrast, informal firms are assumed to pursue conventional profit maximization. They receive no soft support. We start with the formal sector firm's problem.

### 2.1 The formal sector

The representative formal sector firm is assumed to maximize the utility of the insiders, considered to be risk-neutral,

$$U = N_{00}(sb + w_0(1 - \tau_0) - x_{00}) + N_{01}(sb + w_1(1 - \phi) - x_{01})$$

where  $sb$  are non-monetary benefits,  $w_0$  is the monetary wage in the formal sector,  $w_1$  is the informal sector wage,  $\tau_0$  denotes the payroll tax rate, and  $\phi$  is a parameter which describes the risk of being caught not paying taxes while working in the informal sector. Outside opportunities for formal and informal sector workers are  $x_{00}$  and  $x_{01}$  respectively.

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<sup>9</sup> See Blanchard (1997); Commander (1998). Empirical evidence on the dominance of insiders in Russian firms can be found in Blasi et al (1997); Commander, Fan and Schaffer (1996).

<sup>10</sup> Estimates for Russia and Ukraine suggest about 30 percent at the start of transition. See Rein, Friedman and Worgotter (1997), Commander and Schankerman (1997).

Note that in this set up, those who work full time in the state sector get benefits plus wages, net of payroll taxes. Those who work part time get benefits plus their wage from working in the informal economy, qualified by the risk of being caught evading taxation.

The firm maximizes utility with respect to three variables ( $N_{00}$ ,  $N_{01}$ ,  $w_0$ ) where the constraint is given by zero profits;

$$\pi = pY(N_{00}, \delta N_{01}) - N_{00}(sb(1-s) + w_0) - N_{01}sb(1-s) = 0$$

$\delta < 1$  gives the efficiency loss associated with use of part time labour and  $s < 1$  denotes the subsidy rate to firms providing benefits.

Assuming a non-binding constraint on total employment, the first order conditions and the profit constraint are;

$$N_{00}: \quad sb + w_0(1 - \tau_0) - x_{00} + \lambda \left( p \frac{\partial Y(N_{00}, \delta N_{01})}{\partial N_{00}} - sb(1-s) - w_0 \right) = 0$$

$$N_{01}: \quad sb + w_1(1 - \phi) - x_{01} + \lambda \left( p \frac{\partial Y(N_{00}, \delta N_{01})}{\partial N_{01}} - sb(1-s) \right) = 0$$

$$w_0: \quad (1 - \tau_0) - \lambda = 0$$

$$\pi=0: \quad pY(N_{00}, \delta N_{01}) - (N_{00} + N_{01})sb(1-s) - N_{00}w_0 = 0$$

We can determine  $\lambda$  from the first order condition for the wage,

$$\lambda = 1 - \tau_0$$

and exclude it from the first two equations, thereby getting,

$$(1 - \tau_0) p \frac{\partial Y(N_{00}, \delta N_{01})}{\partial N_{00}} = x_{00} - sb(1 - (1 - \tau_0)(1 - s))$$

$$(1 - \tau_0) p \frac{\partial Y(N_{00}, \delta N_{01})}{\partial N_{01}} = x_{01} - sb(1 - (1 - \tau_0)(1 - s)) - w_1(1 - \phi)$$

$$pY(N_{00}, \delta N_{01}) = (N_{00} + N_{01})sb(1-s) + N_{00}w_0$$

These duly give us the wage ( $w_0$ ),

$$w_0 = \frac{pY(N_{00}, \delta N_{01})}{N_{00}} - sb(1-s) \frac{N_{00} + N_{01}}{N_{00}}$$

To proceed, we need make some assumptions regarding the functional form of the production function. For the formal sector we assume a CES function with a constant elasticity of substitution between the two types of labour,

$$Y(N_{00}, \delta N_{01}) = C_0 (\alpha_0 N_{00}^{-\rho_0} + (1-\alpha_0)(\delta N_{01})^{-\rho_0})^{-\frac{\beta_0}{\rho_0}}$$

where  $\beta_0 < 1$  - returns to scale and  $\varepsilon_0 = \frac{1}{1+\rho_0}$ , the elasticity of substitution between the two types of labour input. The parameter  $\delta$  gives efficiency relative to full-time labour for use of part-time labour in the formal sector. Reverting to the first order conditions, we can divide the first equation by the second. From this we can immediately get the allocation of employment in the formal sector;

$$\mu_0 \equiv \frac{N_{01}}{N_{00}} = \left( \frac{x_{00} - sb(1-(1-\tau_0)(1-s))}{x_{11} - sb(1-(1-\tau_0)(1-s))} \cdot \frac{1-\alpha_0}{\alpha_0 \delta^{\rho_0}} \right)^{\varepsilon_0}$$

This result indicates that the allocation of labour is determined by the ratio of outside opportunities net of benefits, adjusted by taxes and subsidies and qualified by any loss of efficiency associated with the use of part time workers. The conditions for an interior solution are simple: outside opportunities for both types of workers must be larger than adjusted benefits.

Substituting the allocation ratio into the first order equations we can find the absolute employment of each type of worker and their wage in the formal sector.

$$N_{01} = \left( \frac{pC_0 \beta_0 \delta^{\beta_0} (1-\tau_0)(1-\alpha_0)((1-\alpha_0) + \alpha_0(\mu_0 \delta)^{\rho_0})^{-\frac{\beta_0+\rho_0}{\rho_0}}}{(x_{01} - sb(1-(1-\tau_0)(1-s)) - w_1(1-\phi))} \right)^{\frac{1}{1-\beta_0}}$$



$$N_{00} = \frac{1}{\mu_0} \left( \frac{pC_0 \beta_0 \delta^{\beta_0} (1-\tau_0)(1-\alpha_0)((1-\alpha_0) + \alpha_0(\mu_0 \delta)^{\beta_0})^{-\frac{\beta_0 + \alpha_0}{\beta_0}}}{(x_{01} - sb(1-(1-\tau_0)(1-s)) - w_1(1-\phi))} \right)^{\frac{1}{1-\beta_0}}$$

$$w_0 = \frac{((1-\alpha_0) + \alpha_0(\mu_0 \delta)^{\beta_0}) \mu_0 (x_{01} - sb(1-(1-\tau_0)(1-s)) - w_1(1-\phi))}{\beta_0(1-\tau_0)(1-\alpha_0)} - sb(1-s)(1+\mu_0)$$

## 2.2 The informal sector

The representative informal sector firm picks a combination of full ( $N_{11}$ ) and part time ( $N_{01}$ ) labour, the latter released by the formal sector, to maximize profits. In effect the informal firm's problem is conditional on this supply of part-time labour, where that supply in turn depends on the wage offer from the informal firm,  $w_1$ . We assume that, as with the formal sector, the informal firm's technology is also CES, so that;

$$Y(N_{11}, \delta N_{10}) = C_1 (\alpha_1 N_{11}^{-\rho_1} + (1-\alpha_1)(\delta_1 N_{10})^{-\rho_1})^{-\frac{\beta_1}{\rho_1}}$$

The firm's problem can be written;

$$\pi = pY(N_{11}, \delta N_{01}) - N_{11}w_1 - N_{01}w_1(1-\gamma\phi) \rightarrow \max(N_{11}, N_{01}, w_1)$$

where

$$\gamma = 1 - p_c \frac{P/UT}{\phi/\tau_1},$$

and  $p_c$  is the probability of being detected avoiding taxes,  $P$ = the penalty associated with detection and  $UT$ =unpaid taxes;

$$\text{subject to; } N_{01} = \left( \frac{pC_0\beta_0\delta^{\beta_0}(1-\tau_0)(1-\alpha_0)((1-\alpha_0)+\alpha_0(\mu_0\delta)^{\rho_0})^{-\frac{\beta_0+\rho_0}{\rho_0}}}{(x_{01}-sb(1-(1-\tau_0)(1-s))-w_1(1-\phi))} \right)^{\frac{1}{1-\beta_0}} \equiv f(w_1)$$

$$\text{and } N_{00} + N_{01} + N_{11} \leq LF,$$

Holding the total employment constraint to be non-binding, we get the following first order conditions:

$$p \frac{\partial Y(N_{11}, \delta N_{01})}{\partial N_{11}} = w_1$$

$$p \frac{\partial Y(N_{11}, \delta N_{01})}{\partial N_{01}} = w_1(1-\gamma\phi) + \lambda_1$$

$$-N_{11} - N_{01}(1-\gamma\phi) - \lambda_1 f'(w_1) = 0$$

Excluding  $\lambda_1$  we get,

$$p \frac{\partial Y(N_{11}, \delta N_{01})}{\partial N_{01}} = w_1(1-\gamma\phi) - \frac{N_{11} + N_{01}(1-\gamma\phi)}{f'(w_1)}$$

$$p \frac{\partial Y(N_{11}, \delta N_{01})}{\partial N_{11}} = w_1$$

$$N_{01} = f(w_1)$$

For a CES production function these can be transformed into a closed form:

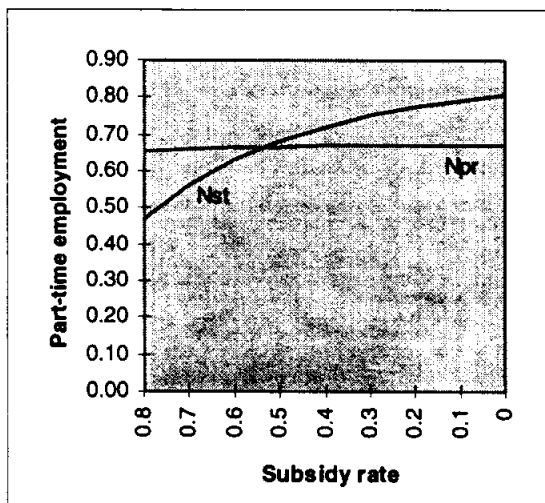
$$pC_1\beta_1\delta_1^{\beta_1}(1-\alpha_1)((1-\alpha_1)+\alpha_1(\mu_1\delta_1)^{\rho_1})^{-\frac{\beta_1+\rho_1}{\rho_1}} f^{\beta_1-1}(w_1) = w_1(1-\gamma\phi) - \frac{f(w_1)(1+\mu(1-\gamma\phi))}{\mu f'(w_1)}$$

$$pC_1\beta_1\delta_1^{\beta_1+\rho_1}\alpha_1\mu_1^{1+\rho_1}((1-\alpha_1)+\alpha_1(\mu_1\delta_1)^{\rho_1})^{-\frac{\beta_1}{\rho_1}} = w_1 f^{1-\beta_1}(w_1)$$

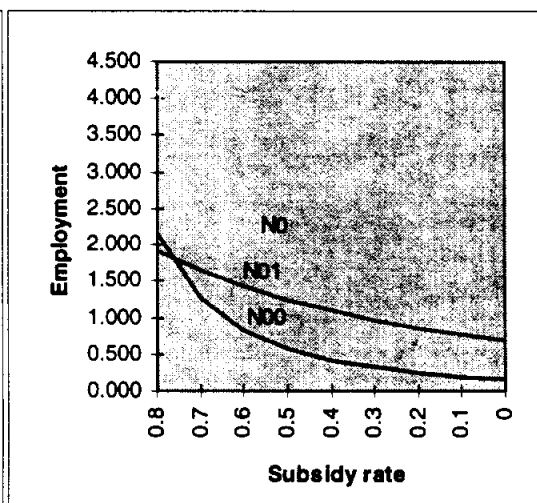
These equations give us the allocation of employment ( $\mu_1 = N_{01}/N_{11}$ ), and the wage ( $w_1$ ) in the private sector.

### 3. Simulations

The model set out above yields a closed form solution that permits simulation. We now present a set of simulations that allow us to look at the impact of a change in a number of key policy and other variables. In particular, we concentrate on the effect of a change in the subsidy rate to benefits and variation in the tax rate or probability of being caught evading taxes on the respective allocations of employment across full and part time work in both formal and informal sectors. We also look at the consequences of a negative price shock to the formal sector. The simulations cover not only the ratio of full and part time to total employment in each sector but also the evolution of employment levels and compensation. Throughout, the level of benefits is fixed exogenously. The base values of the key parameters are reported in the appendix.



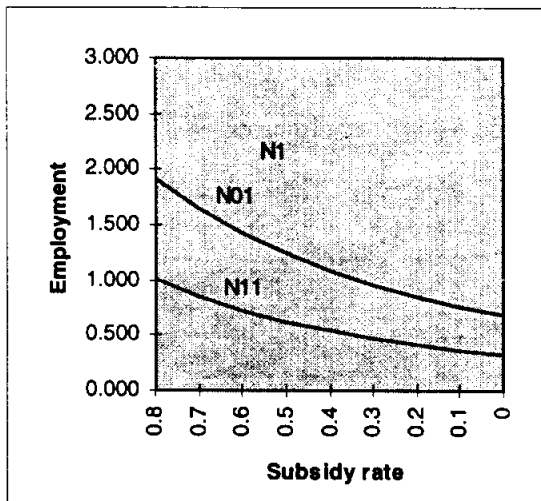
**Fig.1.** Subsidies and the share of part-time employment.  
*Legend:* Nst - share of part time workers in the formal sector, Npr - share of part time workers in the informal sector.



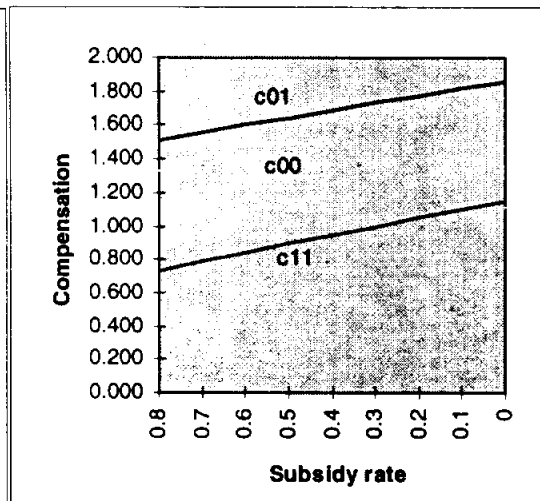
**Fig 2.** Subsidies and employment levels in the formal sector.  
*Legend:* N0 - formal sector total employment, N00 - number of full time workers in the formal sector, N01 - number of part time workers in the formal sector.

*Figure 1* indicates the effect of different levels of subsidy on the ratio of part-time to total employment in both formal and informal sectors. It is clear that the main effect of

a decrease in the subsidy rate is on the ratio in the formal sector. As the subsidy rate declines the share of part time workers in the formal sector rises substantially; the difference between a zero subsidy and the benchmark or high -- 0.8 -- subsidy rate is almost a doubling in the share of part time employment. With elimination of the subsidy to benefits, the share of formal sector workers picking part time employment exceeds 80 percent. By contrast, the part time share in the informal sector remains high and stable -- at around 0.65 -- irrespective of the subsidy rate. With regard to the levels, we can see from *Figures 2 & 3* that a subsidy shock unambiguously reduces total employment in both sectors, with most of the decline in the formal sector being concentrated on full time work. In the informal sector, the decline is roughly proportionately distributed over both types of labour.

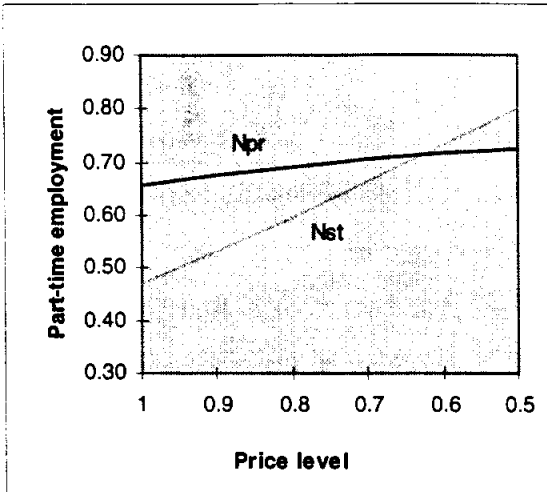


**Fig.3.** Subsidies and employment levels in the informal sector.  
*Legend:* N1 - informal sector total employment, N11 - number of full time workers in the informal sector, N01 - number of part time workers in the informal sector.

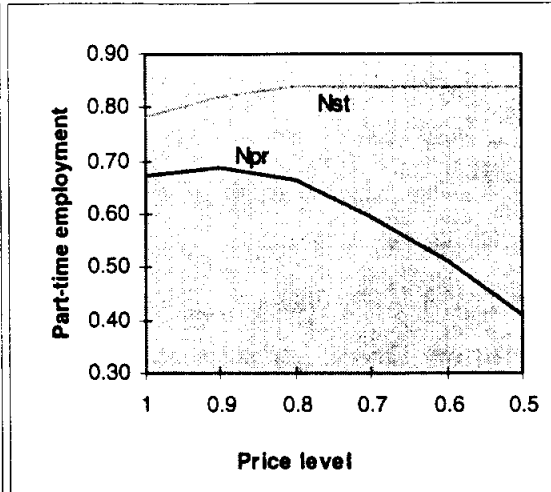


**Fig 4.** Subsidies and compensation.  
*Legend:* c00 - compensation of full time workers in the formal sector, c01 - compensation of part time workers, c11 - compensation of full time workers in the informal sector.

Turning to compensation -- defined as net of taxes in formal employment and/or the probability of being caught when working part time -- we see that with a fall in subsidies (*Figure 4*), compensation for full time workers in the formal sector follows an inverted U shape settling at zero subsidies at a value not very much larger than the exogenously given level of benefits. By contrast, both part and full time compensation in the informal sector increases as subsidies fall.

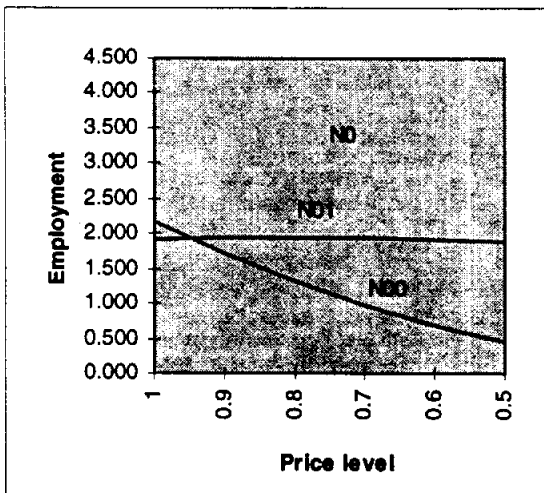


**Fig.5.** Price shock and the share of part-time employment for high (0.8) subsidy rate.  
*Legend:* Nst - share of part time workers in formal sector, Npr - share of part time workers in the informal sector.

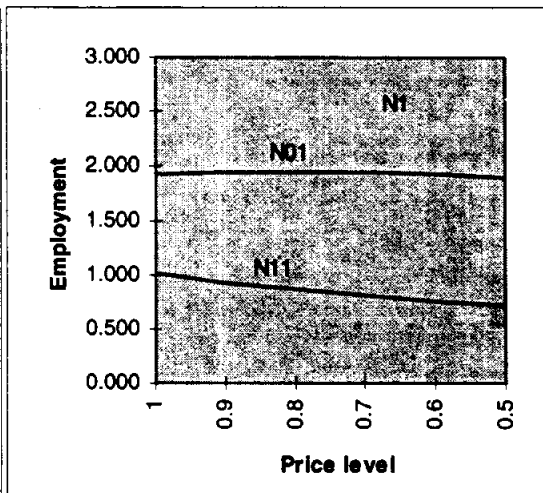


**Fig 6.** Price shock and the share of part-time employment for low (0.1) subsidy rate.  
*Legend:* Nst - share of part time workers in formal sector, Npr - share of part time workers in the informal sector.

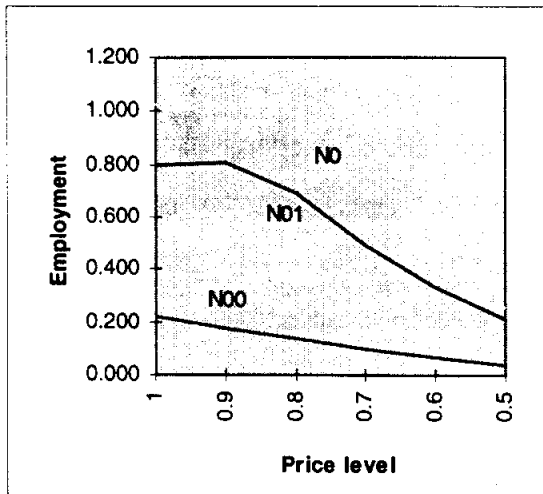
Figures 5 & 6 now present the results of a price shock under two subsidy regimes; a high (0.8) and a zero subsidy rate. It is clear that at a high subsidy, the main effect of a negative price shock is to cause an increase in part time work in the formal sector and, to a lesser extent, in the informal sector.



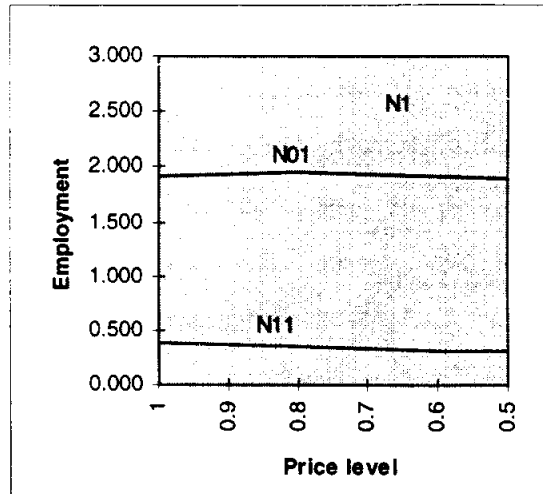
**Fig.7.** Price shock and employment levels in formal sector for high (0.8) subsidy rate.  
*Legend:* N0 - formal sector total employment, N00 - number of full time workers in the formal sector, N01 - number of part time workers in the formal sector.



**Fig 8.** Price shock and employment levels in informal sector for high (0.8) subsidy rate.  
*Legend:* N1 - informal sector total employment, N11 - number of full time workers in the informal sector, N10 - number of part time workers in the informal sector.

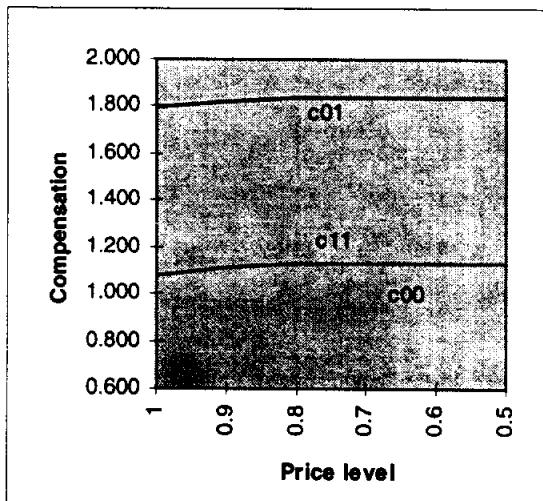


**Fig.9.** Price shock and employment levels in formal sector for low (0.1) subsidy rate.  
*Legend:* N0 - formal sector total employment, N00 - number of full time workers in the formal sector, N01 - number of part time workers in the formal sector.

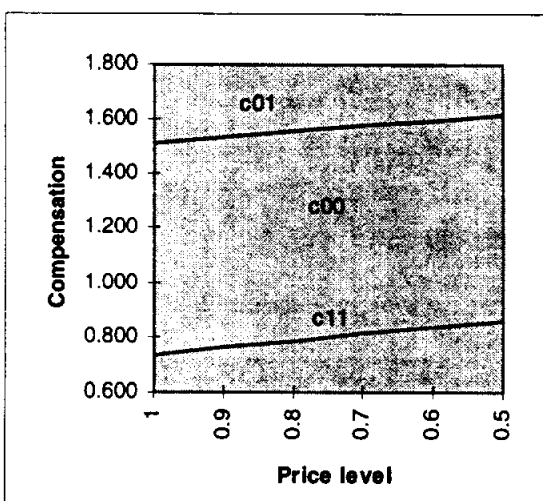


**Fig 10.** Price shock and employment levels in informal sector for low (0.1) subsidy rate.  
*Legend:* N1 - informal sector total employment, N11 - number of full time workers in the informal sector, N10 - number of part time workers in the informal sector.

For the levels (Figures 7-10), there is a large fall in full time employment but almost no effect on part time employment. In the informal sector, a negative price shock similarly leads to a smaller fall in full time employment. With a zero subsidy rate, the direction of change is similar but the strongest effect is in the informal sector where we can observe a sharp increase in the share of full time workers.



**Fig.11.** Price shock and compensation for low (0.1) subsidy rate.  
*Legend:* c00 - compensation of full time workers in the formal sector, c01 - compensation of part time workers, c11 - compensation of full time workers in the informal sector.



**Fig 12.** Price shock and compensation for high (0.8) subsidy rate.  
*Legend:* c00 - compensation of full time workers in the formal sector, c01 - compensation of part time workers, c11 - compensation of full time workers in the informal sector.

With respect to compensation (*Figures 11 & 12*) a large price shock ( $>0.2$ ) drives full time formal compensation down to the exogenously given benefits level with compensation for the other types of employment roughly stable. In short, we can see that a combined subsidy and price shock has the effect of raising yet further the share of part time employment in the formal sector but exerts a contrary effect in the informal sector. Here, with  $p=0.5$  full time employment in the informal sector is close to 0.6 as against 0.3 in the case of only a subsidy shock.

The model developed above clearly indicates the way in which taxation will affect the level and distribution of employment and employment types across sectors. In addition, we have shown that the ratio of part to full time employment in the informal sector will also depend on the probability of being caught evading taxes while employed in a part time capacity. *Table 1* reports the effects of varying payroll tax rates and of a change in the detection probability. In the case of both high and zero subsidy rates to benefits, a decrease in the tax rate from the benchmark (0.4) is predictably associated with an increase in the share of full time workers in the formal sector. By contrast, an increase in the tax rate from the benchmark leads to an unambiguous growth in part time

	----High subsidy (0.8)----		----Low subsidy (0.1)----	
<b>Tax rate (<math>\tau</math>)</b>	<b>Formal</b>	<b>Informal</b>	<b>Formal</b>	<b>Informal</b>
0.6	.61	.29	.85	.71
0.5	.53	.31	.82	.69
0.4	.47	.36	.78	.67
0.3	.41	.39	.75	.64
0.2	.35	.42	.70	.59
<b>Evasion (<math>\gamma</math>)</b>				
1	.47	.65	.80	.67
0.9	.40	.56	.76	.60
0.8	.36	.51	.71	.51
0.7	.32	.44	.66	.43

work in both sectors. Introducing a positive probability of being detected evading taxes, ( $\gamma < 1$ ), the result, again predictable, is to raise full time employment in both sectors, particularly in the informal sector. The strength of the effect is quite large. A move away from zero probability ( $\gamma=1$ ) to ( $\gamma=0.7$ ) leads to the ratio of full time employment going

from around 0.2 to 0.4 with low subsidies and from 0.35 to over 0.5 in the high subsidy case.

#### **4. Conclusion**

In this paper, we have considered some of the factors behind the rapid growth of the informal economy in some transition economies. In particular, we have tried to explain why it is that in much of the FSU the informal sector has developed alongside the formal economy, with workers commonly participating in both sectors. To arrive at a satisfactory explanation requires modeling both the decision making process in the formal economy, as well as the incentives facing the informal firm. These latter have obviously included relative labour taxation as also the structure of labour costs originating from the presence of non-trivial non-monetary compensation in the formal sector. Indeed, the presence of social benefits – commonly subsidised by government -- is shown, in combination with the structure of control in formal sector firms, to be an important factor in configuring the types of employment in the two sectors and their relative sizes.

We develop a model of the formal or state sector and an informal or private sector. We then use the closed form solutions for a set of simulations. These indicate that as subsidies to benefits decline, this will be accompanied by a dramatic decline in the ratio of full time work in the formal sector. Further, there is a very substantial decline in the level of employment, particularly for full time employment. With benefits fixed, a subsidy shock is largely absorbed in employment and less in compensation. However, for full time workers a subsidy shock does indeed lead to a significant fall in the monetary component of compensation. These effects are magnified in the case of a negative price shock. However, in the case of a combined price and subsidy shock to the formal sector firm, there is the additional effect that the share of full time workers in the informal sector grows significantly; in part the consequence of the collapse in monetary compensation in the formal sector. The simulations also underline the strong sensitivity of the types of employment to payroll tax rates and the probability of being caught evading taxes in the informal sector.



Finally, our set-up has obvious limitations. For instance, to this point we have considered workers in formal sector firms to be homogeneous. Extensions to our model could include a richer characterisation of the internal labour market of the formal sector firm and the decision rules governing allocation of work to insiders as well as types of workers – such as primary and secondary workers.

## Appendix

### Variables list

- $N0$  (formal sector total employment)
- $N00$  (number of full time workers in the formal sector)
- $N01$  (number of part time workers in the formal sector)
- $N1$  (informal sector total employment)
- $N01$  (number of part time workers in the informal sector)
- $N11$  (number of full time workers in the informal sector)
- $w0$  (wage in the formal sector)
- $w1$  (wage in the informal sector)

### Parameters, definitions and values in the benchmark case

- $sb$  (social benefits provided by the formal sector): 0.9
- $\tau0$  (payroll tax rate in the formal sector): 0.4
- $\tau1$  (payroll tax rate in the informal sector): 0.4
- $\phi$  (parameter describing the risk of being caught not paying taxes while working in the informal sector): 0.5
- $x00$  (outside opportunities in the informal sector for full time workers): 1
- $x01$  (outside opportunities in the informal sector for part time workers): 1
- $\delta0$  (parameter giving efficiency relative to full-time labour for use of part-time labour in the formal sector): 0.8
- $\delta1$  (parameter giving efficiency relative to full-time labour for use of part-time labour in the informal sector): 0.8
- $s$  (subsidy rate to firms providing benefits): 0.8
- $\varepsilon0$  (elasticity of substitution between two types of labor in the formal sector): 2
- $\varepsilon1$  (elasticity of substitution between two types of labor in the informal sector): 2

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