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THE UNDERGROUND ECONOMY AND THE UNDERDEVELOPMENT TRAP*

by

Maria Rosaria Carillo♣ and *Maurizio Pugno*♠

Abstract. A general equilibrium model is proposed which assumes that firms hire both official and unregistered workers as imperfect substitutes, that entrepreneurs differ in their ability to increase the efficiency of official labour, and that this ability is due to heterogeneous original ability and to Marshallian (non-linear) externalities. In equilibrium, smaller firms hire fewer official workers and are less efficient. If externalities increase sufficiently when firms are numerous, two stable equilibria exist where the number and the size of firms, the proportion of official employment, overall output and efficiency are, respectively, small (the trap) and large. The increase of individual ability due to, e.g., educational policies, has positive effects on the equilibrium number of firms, overall output, and labour regularisation. High and evenly distributed entrepreneurship also make it more likely that increased externalities and penalties on the underground economy will have positive effects. These results may contribute to the current debate on the underground economy in the Southern areas of Italy

JEL Code: J21, O17

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0. Introduction

The "underground economy" is an awkward subject for both economists and policy makers. Economists find it difficult to define and to measure, while their main explanations of it are highly partial. Indeed, they produce extremely diverse estimates of the underground economy in the same country, depending on the definitions and the method used (Lippert and Walker 1997).[1] By contrast, explanations of the phenomenon at the theoretical and empirical levels are usually restricted to the heavy weight of the tax burden and to excessive regulations (Schneider 1997; Feige 1989; Tanzi 1980). Policy makers are discomfited by the fact that the underground economy is detrimental to tax revenues and, more generally, to social order, whereas it is able to generate employment and income.

A step towards better understanding and management of the problem of the underground economy is to consider it in connection with the structure of the economy, whether this is advanced or less developed. Estimates agree that the underground economy is most widespread in the less developed countries, and, within the Oecd, in Greece, Italy, Spain and Portugal (Schneider and Enste 2000, European Commission 1998; Schneider 1997). Nevertheless, the tax burden is not only particularly heavy in Greece and in Italy, it is also heavy in the Scandinavian countries, and even in Austria (Oecd 1997), which displays a very low incidence of underground economic activity.[2] But the most striking evidence concerns the South of Italy compared to the rest of the country. In

[1] Tanzi (1999), in surveying the literature, observes that these estimates, in percentages of GDP, "range from 1.4% to 47.1% for Canada, and from 6.2% to 19.4 for the US […] In Germany [they range] from 14.5 to 31.4".

[2] Johnson, Kaufman, and Zoido-Lobaton (1998) do find that more regulations are associated with a larger share of underground economy, but after controlling for Gdp per capita.

fact, the Southern Italian regions are characterised both by a less developed economic structure and by a more widespread underground economy, although they are subject to the same tax system and regulations - if not lighter ones - as the Northern regions. These facts can be explained if we look at the different forms assumed by underground activity. In the Mediterranean countries or regions, the non-registration of labour is standard practice for both firms, though to different extents, and private employees, who otherwise are faced by unemployment with no social benefits available. The economic structure thus mainly consists of small firms, which can compensate for technological inefficiencies by low unregistered labour costs (Donolo and Capparucci 1999; Commissione Lavoro della Camera dei Deputati 1998). By contrast, in the Northern countries or regions of Europe and in the US unregistered work is typically of secondary importance, and it is often pursued by those who are already employed.[3] Therefore, one may state the stylised fact that a widespread underground economy is associated with inefficient techniques, few and small units and low output; and conversely that a small proportion of underground activity in the economy is linked with more efficient techniques, more and larger units, and a greater output.

It might be thought that development, and hence the reduction of the underground economy, is an automatic process. However, this does not seem always to be the case. Analysis of convergence among per capita GDPs in the European regions clearly shows that many poor regions tend to stagnate, or even that they form a low income club of regions (Tondl 1999; Paci 1997). Even more clearly, recent trends in many regions of Southern Italy, together

[3] Another component of unregistered labour consists of immigrants, but its relative importance may be great in the richest countries and regions as well as in the other areas (European Commission 1998; Petersen 1998).

with the persistent, if not increasing, diffusion of underground practices, suggest the existence of an underdevelopment trap.

This paper is a first attempt to study the interaction between the underground economy and the economic structure as characterised by the size and the number of firms, as well as by overall productivity and output. It seeks to describe the case of an economy trapped in an equilibrium comprising a high proportion of underground activity, small sized and few firms, and overall low productivity and output. Conversely, it is possible to represent an economy in a better equilibrium where these characteristics are reversed.

The theoretical literature on the underground economy in a general equilibrium setting is not substantial, and it concentrates mainly on the effects of fiscal policy, paying little or no attention to the heterogeneous performance of firms, or to other characterisations of the economic structure (Bental et al. 1985; Ginsburgh 1985; Bennett 1990; Agenor and Aizenman 1999; De Geijsel 1985). When the connection between sluggish development and a large underground economy is studied, the erosion of the tax base in order to finance growth-enhancing public services has been considered (Loayza 1996; Johnson, Kaufmann, and Zoido-Lobaton 1998). However, South Italy has not been subject to revenue constraint because it is subsidised by North Italy. In this case, instead called into question has been the excessive labour cost fixed in the more productive part of the country (Brunetta and Ceci 1998). This paper, however, concentrates on the role of entrepreneurship, rather than on the provision of public services or on rigid wages.

The problem of determining an interior solution for the size of the underground economy is usually solved by distinguishing between two goods, officially and unofficially produced, and thus two kinds of demand for them.[4] Instead, in Rauch (1991) the economic structure is characterised by the allocation of heterogeneous entrepreneurship between the sectors, one informal and the other formal, and by the smaller-sized and less productive firms of the former. This approach is able to provide an interior solution, although both output and labour are homogeneous, but it fails to avoid the assumption of specialised firms in the two sectors, which is often unrealistic.[5]

The model presented here follows the latter approach, but it is also able to deal with mixed firms, i.e. those which employ both unregistered and official labour. It assumes that the potential entrepreneur - depending on his/her ability to train official labour better, and on the given possibility of evading the fiscal burden on labour - chooses the best mix, thus also choosing the technique for producing the same good. The second key feature of the model, intended to capture an important aspect of industrialisation, is the assumption of Marshallian externalities among firms. This assumption, combined with the given distribution of entrepreneurial ability, makes two general stable equilibria possible: one "good", and one "bad". This result suggests that development and underground activity may be induced into a trap.

The policy implications to be drawn from the model are interesting, not only as regards the possibility of passing from the "bad" to the "good" equilibrium, but also to check the popular wisdom that policies intended to reduce the underground economy also reduce the number of firms and overall

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[4] Alternatively, De Gijsel (1985) adopts a Nash solution, as due to different preferences of both the employers and workers between official and unregistered work. Bonatti (2000) fixes the numbers of firms in the legal sector and in the informal sector.

[5] The allocation of entrepreneurial talent approach was introduced by Lucas (1978) and then developed by Murphy, Shleifer, and Vishny (1991). For a first application of it to study of the underground economy see Pugno (2000).

output. This is of particular interest as regards the North/South dualism in Italy, and even more so as regards the different areas of South Italy.

The paper is organised as follows: section 1 sets out the assumptions of the model, sections 2 and 3 develop the solution of the model, section 4 carries out some exercises in comparative statics, and draws policy considerations, section 5 concludes, while three appendices give the mathematical proofs.

1. The Assumptions of the Model

Let us assume that numerous firms competitively produce one good by using homogeneous labour in two different ways, either by registering it and paying the relative taxes and contributions, or by not registering it and thus avoiding this fiscal burden.

The different treatment of labour by firms is taken a step further here, i.e. in the techniques of production. In the case of official labour, in fact, rules and norms, usually established by private contracts or collective bargaining, are applied, but they are not applied in the case of unregistered labour. When workers are officially employed, the relationship between them and firms is more stable and more closely integrated, and this makes it possible, or easier, to foster workforce learning activities – either unintentional, such as ‘learning by doing’, or intentional, such as ‘training on the job’. In fact, learning activity can be likened to specific investments that can take only place in the presence of stable relationships. By contrast, unregistered labour does not usually imply a stable and systematic relationship between workers and firms, so that a learning process rarely occurs, or does not happen at all. The learning activity carried on by legal workers implies that they can use more efficiently the technology adopted by firm, thus exhibiting a higher productivity. Illegal workers, instead, do not reach the same level of productivity since they do not acquire, or do not acquire in the same degree, the knowledge related to the level of technology adopted by firm. The hypotheses that the learning activity is directly related to the level of technology and that it is more probable when there are stable relationships between workers and firms have been advanced by several authors (Acemoglu 1997, Burdett and Smith 1996 and Stevens 1994)[6]. In this paper we extend these hypotheses to the case of legal and illegal workers, since one of major difference between these two kinds of workers is not only the different cost sustained by firms for them, but also the different types of working-relationship: stable and integrated in the case of legal workers, marginal and unstable in the case of illegal workers. These differences may have a direct effect on the learning by doing carried on by workers and, as a consequence, on their productivity. In order to capture these facts, two different techniques of production are assumed, depending on whether official or unregistered labour is employed.

Formally, the microeconomic production function specifies two different efficiencies for labour, as follows:

$$(1) \qquad y_i = \left[B_i l_{l,i}^{\alpha} + \beta l_{s,i}^{\alpha}\right] \qquad \text{with } 0 < \alpha < 1 \quad \text{and} \quad \beta \geq 0$$

where y indicates output of the only good in this economy whose price is the numeraire, l_l and l_S are respectively the official and the unregistered labour employed. The subscript i refers to the i-th firm. B_i is the productivity of legal workers, which is different from the productivity of illegal workers (β)[7], and it represents firm's best technology, insofar as $B_i > \beta$ (although this restriction is not necessary to the model).

[6] See for an application to a growth framework Aghion and Howitt (1998, ch. 6).
[7] Hence, l_l and l_S are not perfect substitutes, while neither of them is essential.

At this regard, a further crucial assumption of the model is that the firm's best technology depends on the entrepreneurial ability and on the positive externalities arising from existing firms. Individual entrepreneurial ability originates from the exogenous natural propensities of individuals which can be thought of with a fixed distribution over population (cf. Baumol 1990). While the externalities are assumed to be of Marshallian type, and are intended to capture the typical effects of the industrial district. In fact, a crucial feature in the development of an industrial district is that firms should be sufficiently numerous within a given area to be able to display productive inter-relatedness.[8] Hence, externalities may not be linear in the number of firms; rather, they may accelerate when the industrial district becomes established.

Formally, let us assume that B_i depends on entrepreneurial ability and on economy wide externalities according to the following equation:

(2) $$B_i = B(E_i, E) = A(E_i)T(E)$$

where $A(E_i)$ is the original individual ability, assumed to differ among individuals, so that they can be ranked in descending order of ability according to the following distribution function:

(3) $$A_i = \eta E_i^{\eta - 1} \qquad \text{with } 0 < \eta < 1 \qquad E_i \in \mathrm{R}$$

E_i indicates the *i*-th entrepreneur, who ranges from 0 to E, E is a measure of active firms. Since entrepreneurs are ranked, and run one firm each, E is also the group of the ablest entrepreneurs.[9] Hence, B_i is decreasing in E_i for any given E.

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[8] In Becattini's (1979:47) words: "The Marshallian industrial district consists of […] a localised thickening of interindustrial relationships" [our translation].

[9] This distribution is chosen because it belongs to the well-known Paretian type, but care must be taken over the limiting case of $E \longrightarrow 0$. The conclusions of the paper are qualitatively the same if the distribution is of Gaussian type.

The function T, which captures the externality effects, is increasing in E, so that the larger is E, the higher is the ability of all the active entrepreneurs, which represents the best technology. In particular, T is assumed to be of the logistic type, as follows:

$$T(E) = \frac{1}{1 + e^{v - zE}}$$

It is therefore possible to specify the productivity of the legal workers in the marginal firm, which is the least productive firm of the group E, and hence it is the E-th firm:

(2’) $$B = B(E) = A(E)T(E) = \frac{\eta E^{\eta - 1}}{1 + e^{v - zE}}.$$

This function has two decreasing traits at the extreme, where decreasing individual ability prevails, and it can have an increasing trait in the middle, where externality can prevail (see Fig.1). In fact, in the first trait the number of firms is too small for sufficient externalities to arise; in the second trait the number of firms may reach the critical mass required to form an industrial district, and hence to raise the efficiency of all firms, thereby overcoming the decreasing effect of individual ability; in the third trait externalities approach exhaustion, and the shape of ability distribution prevails. Note that for any given E, and hence for any point (E,B), there exists a function B_i, which is decreasing in $E_i(<E)$ until $E_i=E$, where $B_i=B$.

Finally we define the cost function which includes official labour, as weighted by the fiscal burden, and the unregistered labour, which is also burdened to some extent, because of the risk of being fined. A third cost component is assumed: namely a fixed cost, which captures the effort to enter the market. Thus:

(4) $$c_i = w_l\,(1+t)\,l_{l,i} + w_s\,(1+m)\,l_{s,i} + \bar{c}$$

with $0<t<1$ $\quad 0<m<1$ and $m<t$

where c_i is the total cost for the firm, w_l and w_s are the wage rates of official and unregistered labour respectively, t is the tax rate, inclusive of social contributions, and m is the fiscal burden on unregistered labour, which is due to a multiple of evaded taxes times the probability to be fined. Fixed cost is denoted by $\bar{c}$.

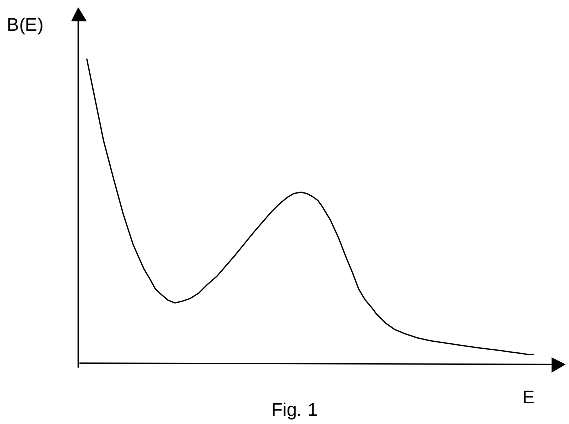

Fig. 1

As concerns the labour market, let us assume that it is populated by a fixed number of individuals: $L=\bar{L}$. They have an identical utility function linear in consumption and derive no disutility from supplying labour. Each individual is endowed with a one-unit flow of labour, which is offered inelastically. Therefore L is also equal to the aggregate flow of labour supply. Finally, the labour market is assumed to be perfectly competitive.

2. Microeconomic Equilibrium

Firms choose their amounts of official and of unregistered labour by maximising total profits given by:

(5) $\qquad \pi_i = y_i - c_i$

where π_i is the total profits, inclusive of the quasi-rent earned by the entrepreneurs as far as they can exhibit ability. The two labour demands for official and unregistered labour respectively, derived from first order conditions, are:

$$(6) \qquad l_{l,i}* = \left\{ \frac{\alpha \eta E_i^{\eta-1}}{w_l (1+t)(1+e^{v-zE})} \right\}^{\frac{1}{1-\alpha}}$$

$$(7) \qquad l_{S,i}* = \left\{ \frac{\alpha \beta}{w_S (1+m)} \right\}^{\frac{1}{1-\alpha}}$$

Hence, the ratio between l_l* and l_s* of the *i*-the firm is equal to:

$$(8) \qquad g_i = \left\{ \frac{w_S (1+m) \eta E_i^{\eta-1}}{\beta w_l (1+t)(1+e^{v-zE})} \right\}^{\frac{1}{1-\alpha}} .$$

Eqs. (6) and (8) indicate that the greater the ability of the *i*-th entrepreneur, the larger the size of his firm, and the greater the firm’s degree of regularisation. A first analytical result is thus obtained: the link among size, efficiency and the proportion of registered labour as characteristics of heterogeneous maximising firms.

By substituting equations (6), (7) into eqs. (1) and (4), and then into the profit function (5), we obtain the following equation:

$$(9) \qquad \pi_i^* = (1-\alpha)[A(E_i)T(E) l_l^{\alpha} * + \beta l_S^{\alpha} *] - \bar{c} = (1-\alpha) y * (E_i, E) - \bar{c} .$$

The *i*-th entrepreneur will enter the market if he will find positive (equilibrium) profits, i.e. if $\pi(E_i, E)^* \geq 0$. Since heterogeneous entrepreneurs imply heterogeneous profits, entrepreneurs will enter the market until the least able one finds zero profit, i.e. $\pi(E_i = E)^* = 0$. In this case, everyone will have made the best choice, and hence the equilibrium number of active firms has been determined.

As regards workers, these may choose to work as official or unregistered labour according to which arrangement ensures higher indirect utility. Further, we assume that workers are interested only in wages net of fiscal burden. Thus, given the assumptions on the utility function, the workers' decision rule about the type of job to take, legal or illegal, becomes:

(10) $\qquad w_l \geq w_S$.

3. General Equilibrium

This economy will be in equilibrium if three conditions hold: no further firm enters or leaves the market; no further worker changes type of employment; the labour market is in equilibrium. Given the assumption of free entry, the first equilibrium condition implies that for the marginal entrepreneur, who is least able, $\pi^* = 0$, while the second condition implies that the wages of official and unregistered workers in equilibrium will be equal. Finally the third condition is the usual market clearing condition whereby aggregate labour supply is equal to the aggregate labour demand.

By substituting the optimal values for l_l and l_S (equations (6) and (7) respectively) into equation (1), and then into (9), and by taking into account that in equilibrium $w_S = w_l = w$, the zero-profit condition *for the marginal firm* becomes:

(11) $$w_P = \left(\frac{1-\alpha}{\bar{c}}\right)^{\frac{1-\alpha}{\alpha}} \left[\left(B(E)\right)^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{1+t}\right)^{\frac{\alpha}{1-\alpha}} + \beta \left(\frac{\beta\alpha}{1+m}\right)^{\frac{\alpha}{1-\alpha}} \right]^{\frac{1-\alpha}{\alpha}}$$

Equation (11) is drawn in Fig. 2:

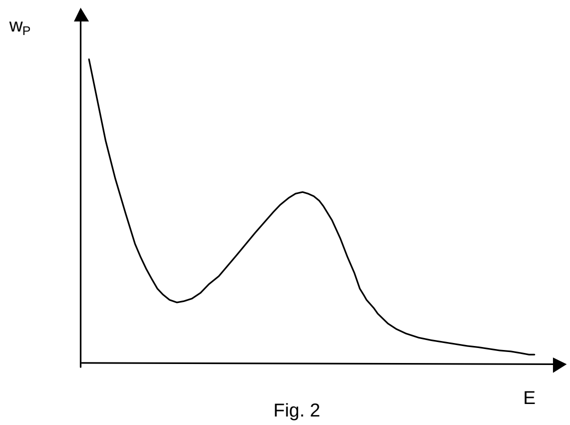

Fig. 2

This curve, which resembles the *B*(*E*) curve, shows different combinations of wage and number of active firms, the marginal of which exhibits zero profit. Hence, it does *not* reflect the technological conditions of the infra-marginal firms. These firms benefit both from the externalities given by the number of active firms like all the others, and from the individual higher ability of the entrepreneur, thus earning positive profits.[10] All firms take externalities as given, while the curve in Fig.2 depicts the conditions where externalities are endogenous. Note that if firms, for a given wage, conjecture the enjoyment of a

[10] For a given *E* the curve identifies the wage level that reduces the profit of the *E*-th firm to zero, while the other active firms (E_i), which are on the left of the *E*-th along the *x*-axis, would require a higher wage level to reduce profits to zero. Hence, a decreasing zero-profit curve for *all* active firms may be drawn for each *E*, which implies a certain degree of externality.

certain degree of externality which is generally different from the endogenous one, they adjust in the right direction.[11]

The labour market equilibrium condition is:

(12) $$\overline{L} = L_l + L_S$$

where $\overline{L}$ is the aggregate labour supply equal to the population, and it will normalised to 1, while $L_l = \int_0^E l_{l,i} di$ and $L_S = \int_0^E l_{S,i} di$ are the aggregate demands for official and unregistered labour respectively.

Substituting eqs. (6) and (7) into the integrals above, and then into eq. (12), the labour market equilibrium condition becomes:

(13) $$w_L = \left(\left(\frac{\alpha}{1+t} \right)^{\frac{1}{1-\alpha}} \left(\frac{\eta E^{\eta-\alpha}}{1+e^{v-zE}} \right)^{\frac{1}{1-\alpha}} \frac{1-\alpha}{\eta-\alpha} + E \left(\frac{\beta\alpha}{1+m} \right)^{\frac{1}{1-\alpha}} \right)^{1-\alpha}$$

Equation (13) shows different combinations of the wage and the number of firms ensuring equilibrium in the labour market. Obviously, the relationship between wage and number of firms is positive, since eq. (13) reflects the labour supply constraint. In equilibrium it must be that $w_P = w_L$.

Therefore the system formed by equations (11) and (13) gives rise to equation (14).

$$\left(\frac{1-\alpha}{\overline{c}} \right)^{\frac{1}{\alpha}} \left[\left(\frac{\eta E^{\eta-1}}{1+e^{v-zE}} \right)^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{1+t} \right)^{\frac{\alpha}{1-\alpha}} + \beta \left(\frac{\beta\alpha}{1+m} \right)^{\frac{\alpha}{1-\alpha}} \right]^{\frac{1}{\alpha}} = \left(\frac{\alpha}{1+t} \right)^{\frac{1}{1-\alpha}} \left(\frac{\eta E^{\eta-\alpha}}{1+e^{v-zE}} \right)^{\frac{1}{1-\alpha}} \frac{1-\alpha}{\eta-\alpha} + E \left(\frac{\beta\alpha}{1+m} \right)^{\frac{1}{1-\alpha}}$$

(14)

[11] If, for example, a certain degree of externality is conjectured, and hence a zero-profit curve for all firms can be drawn, a given wage would fix the conjectured number of active entrepreneurs on this curve. If the least able of them realises positive (negative) profits, more entrepreneurs enter (leave) the market, until the marginal firm is on the curve depicted in Fig.2.

From this equation the following can be stated.

Proposition 1: *There exists at least one equilibrium that yields the wage (w*) for which the labour market clears and no firm enters or leaves the market, thus determining E*. Moreover, there may also be multiple equilibria, one of which is unstable and two are stable. The first stable-equilibrium is characterised by a wage and a number of firms less than those of the second stable-equilibrium.*

Proof: see Appendix 1.

Fig. 3 depicts the above results by approximating equation (13) as a straight line.

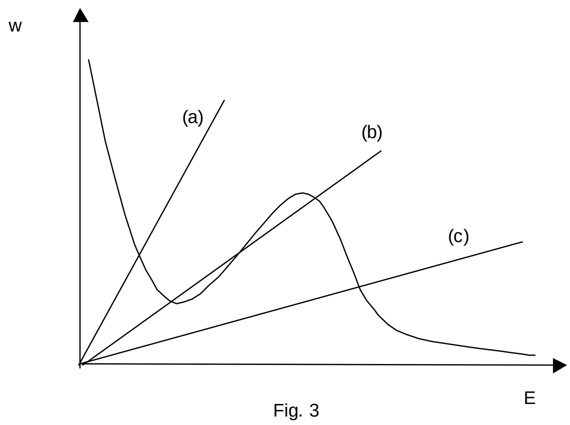

Fig. 3

The model thus yields at least one equilibrium, where a positive but not exhaustive proportion of underground economy is determined, and where all firms are involved in this mixed activity to different extents depending on their size.

In cases (a) and (c) there is a unique equilibrium. However the two cases are quite different. In case (a) the intersection between the two curves takes place in the first trait of the zero-profit curve, when the number of firms is so low that it does not give rise to substantial effects of Marshallian externalities. The size of firms is relatively small, and the underground proportion is relatively large. This equilibrium can represent an economy in the first stages of its development. Case (c) shows a completely different situation, although wages may be similar. In fact, the externalities have been largely exploited, and the zero-profit curve is decreasing because of the natural scarcity of individual ability. This may be the case of a more mature economy where firms are able to exploit their potential for growth. Case (b) is an intermediate situation. It shows the possibility that multiple equilibria may arise. In this case economies that start from different numbers of firms may reach a completely different equilibrium, even if they have equal parameters values. One equilibrium is characterised by a larger amount of firms and is similar to case (c), another has fewer firms and is similar to case (a).

The different cases can be also compared in terms of the aggregate output generated. In this regard we can state:

Proposition 2: *i) The condition* $\frac{1+m}{1+t} > \alpha$ *, is sufficient in order that a greater equilibrium number of firms generates a larger amount of aggregate output ;*
ii) in the case of multiple equilibria, for any values of parameters, equilibrium with a larger number of firms is Pareto-superior and is characterised by both average and marginal firm with a degree of regularisation (g) higher than that exhibited by both average and marginal firm in the low equilibrium.

Proof: see appendix 2.

Proposition 2 enables us to compare the different kinds of equilibrium discussed above according to the level of aggregate output generated. It states that if the ratio between the price of unregistered labour and the price of official labour, which because of the assumptions made is lower than 1, is larger than the parameter which captures the productivity of labour factor (irrespectively of whether it is legal or illegal), the equilibrium with a lower number of firms gives rise to a lower amount of aggregate output. As regards the case of multiple equilibria, for any values of parameters the lower equilibrium generates a level of aggregate output lower then that associated with a high equilibrium; moreover, in the low equilibrium firms use unregistered labour more intensively. The case of Pareto-ranked multiple equilibria is particularly interesting, since it implies the possibility that the economy, at an initial stage of its development, may be induced into an underdevelopment trap.

4. Comparative Statics and Policy Considerations

Simple exercises of comparative statics can help us to identify policies to reduce unregistered labour, increase the efficiency of the economy, and, possibly, to enable escape from the underdevelopment trap. Interesting parameters of the model for policies are: m, which is the fiscal burden on the unregistered labour; z, which is a measure of externalities; and η, which captures the entrepreneurial ability that does not depend on the economic environment.[12]

The fiscal burden may be increased by tighter fiscal controls and by raising penalties. Externalities may be increased by providing or incentivising public services for legal activities. Individual entrepreneurial ability may be increased by educational policies.

All these policy measures increase the degree of regularisation of the firms (*g*-ratio), and then reduce the overall size of the underground economy, as seen in the previous section. However, popular wisdom holds that reduction of the underground economy also reduces the overall number of firms and the level of overall economic activity. It is thus interesting to check whether the model confirms this result.

Let us first observe that the restriction $\alpha < \frac{1+m}{1+t}$ is not strict and can be taken for granted. In fact, even in an extreme case where $m = 0$ and $t = 0.5$, it becomes $\alpha<0.67$, and the data on the labour share in income not generally give a higher figure. Hence, a larger number of firms always produces a higher amount of output. This is a reasonable result when studying the underground economy, which is usually populated by small firms that cannot significantly exploit scale returns.

The effectiveness of policies can be studied by considering the following propositions.

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[12] The uncomfortable properties of the Paretian distribution around the asymptote suggest us to ignore that part in which E is very small. In fact, a rise in η increases individual ability if $\frac{\partial(\eta E^{\eta-1})}{\partial\eta} = \frac{1+\eta \ln E}{E^{1-\eta}} > 0$.

Proposition 3: *A higher level of parameter* η *implies a greater equilibrium number of firms (E*), and a higher level of overall output (Y*), in the case of one equilibrium. In the case of two stable equilibria these expansionary effects remain valid, in particular the lower equilibrium may disappear.*

Proof: see Appendix 3.

This proposition suggests that policies intended to increase individual entrepreneurial ability are always effective in both reducing the underground economy and expanding the number of firms and overall output. Moreover, this kind of policy may push the economy on to the right track, if it is caught in the underdevelopment trap.

Proposition 4: *A higher level of parameter z implies greater equilibrium numbers of firms, and higher levels of overall output (Y*) in both cases of one and two stable equilibria, if* $\frac{1+m}{1+t} < \frac{\eta-\alpha}{\alpha(1-\alpha)}$. *While a higher level of parameter z has ambiguous effects on the equilibrium numbers of firms, and on the levels of overall output (Y*) in both cases of one and two stable equilibria if* $\frac{1+m}{1+t} > \frac{\eta-\alpha}{\alpha(1-\alpha)}$. *However, if the equilibrium number of firms tends to* 0, *the expansionary effects are anyhow safe.*

Proof: see Appendix 3.

This proposition suggests that policies intended to increase positive externalities of production through the employment of official labour are generally effective in both reducing the underground economy and expanding overall output. Whereas an increase in η makes entrepreneurial ability more evenly distributed, and thus favours small firms, an increase in *z* favours the middle-able entrepreneurs. Hence, in this case the demand for labour is considerably increased, and this may raise wages and push small firms out of the market. This particular case occurs when small firms are very widespread because of very small η.

Proposition 5: *A higher level of parameter m implies greater equilibrium numbers of firms, and higher levels of overall output (Y*) in both cases of one and two stable equilibria, if* $\frac{1+m}{1+t} < \frac{\eta-\alpha}{1-\alpha}$. *A higher level of parameter m implies smaller equilibrium numbers of firms, and lower levels of overall output (Y*) in both cases of one and two stable equilibria if* $\frac{1+m}{1+t} > \frac{\eta-\alpha}{1-\alpha}$.

Proof: see Appendix 3.

This proposition suggests that policies intended to increase controls and penalties, though effective in reducing the underground economy, has ambiguous effects on the number of firms and on overall output. If controls and penalties are initially small in amount relatively to entrepreneurial ability, their increase is beneficial to overall output, but if they are initially of large amount, their increase is detrimental. In the case of two (stable) equilibria, increasing controls and penalties may be effective in escaping from the underdevelopment trap, but too much controls and penalties in an underdeveloped area may have perverse effects.

Corollary: *The relevant configurations of parameters can be of three types, and for each type a different mix of effects due to changes in z and m emerges as follows:*

$$if\ \frac{1+m}{1+t} < \frac{\eta-\alpha}{1-\alpha}\left(< \frac{\eta-\alpha}{\alpha(1-\alpha)}\right), \text{ then } \frac{\partial E^*}{\partial z} > 0 \text{ and } \frac{\partial E^*}{\partial m} > 0$$

$$if\ \frac{\eta-\alpha}{1-\alpha} < \frac{1+m}{1+t} < \frac{\eta-\alpha}{\alpha(1-\alpha)}, \text{ then } \frac{\partial E^*}{\partial z} > 0 \text{ and } \frac{\partial E^*}{\partial m} < 0$$

$$if\ \left(\frac{\eta-\alpha}{1-\alpha} <\right) \frac{\eta-\alpha}{\alpha(1-\alpha)} < \frac{1+m}{1+t}, \text{ then } \frac{\partial E^*}{\partial z} < 0 \text{ and } \frac{\partial E^*}{\partial m} < 0.$$

Whereas $\frac{\partial E^*}{\partial \eta}$ *is generally positive.*

Proof: It follows from Propositions 3, 4 and 5.

This schema suggests that individual entrepreneurial ability is a key factor, because if a policy is able to increase it, the effects are always positive, and if it is lacking, it may hinder the other policies.

5. Conclusions

The theoretical literature on the underground economy is meagre, and it concentrates mainly on the microeconomic aspects of tax evasion. The phenomenon of the underground economy is instead recognised as important by empirical studies, which also reveal that it is not evenly distributed, but is more widespread in less developed areas. This fact has prompted the present paper, which attempts to explain the different coexistence of the underground economy with the official economy in a more developed area with respect to a less developed one.

Unfortunately, underground economic behaviour is very heterogeneous, and difficult to observe, so that it cannot be easily stylised. Nevertheless, a few plausible hypotheses can be put forward regarding some important features of this phenomenon. Firstly, firms hire unregistered labour only partly, side by side with official employees. Secondly, firms use the two different kinds of labour more as complements to each other than as substitutes. This is because official labour implies a more stable relationship with the entrepreneur, so that greater efficiency may ensue. Thirdly, entrepreneurship is important in explanation of the abandonment by a firm of small-sized and low-productive processes largely based on unregistered labour. Fourthly, entrepreneurship depends, in a given area, on individual ability, which may be very heterogeneous, and across different areas, on the density of enterprises, which is likely to give rise to positive externalities. In particular, the literature on industrial districts emphasises the importance of a critical density which generates an acceleration in economic development.

On the basis of these hypotheses the model proposed is able to substantiate the following results:[13]

- an equilibrium both micro- and macro-economic exists when firms find it convenient to employ both unregistered and official labour;
- the degree of regularisation by each firm depends on entrepreneurship and on the relative fiscal burden; in particular, the better the entrepreneur's ability, the greater the demand for official labour, thus implying a more efficient and large firm;

[13] A refinement of the model could give better specification to the behaviour of the workers, who are here assumed to be homogeneous, and with a very simplistic (and implicit) utility function.

- in the macro-economic equilibrium the number of firms, their size, the overall productivity and output are determined as well;
- if a critical density of enterprises exists, two stable equilibria can be determined: a "good" equilibrium where the economy is populated by many firms, with high productivity and output and low degree of labour regularisation; and a "bad" equilibrium with the reverse features, which can thus be termed an underdevelopment trap;
- the possibility of escaping from the underdevelopment trap, or at any rate of increasing the level of regularisation and overall efficiency, derives from policy measures designed to improve entrepreneurship, especially when the improvement is evenly distributed;
- by contrast, tighter fiscal controls have overall perverse effects if entrepreneurship is particularly scarce.

These results are of particularly relevance to the debate on the underground economy in the Southern areas of Italy. In fact, these results suggest that an economy may fall into an undervelopment trap when underground activities are particularly convenient, although not exhaustive but rather complementary. The best policies suggested are those intended to improve entrepreneurship, especially through educational policies. The policies directly targeted on combatting the underground economy, like tighter controls and penalties, appear to be effective only when entrepreneurship is sufficiently developed and evenly distributed across firms.

Therefore, in order to reduce the underground economy, the most effective policy is to make registered labour more convenient, rather than to make unregistered labour less convenient. The best strategy appears to be that of combatting underdevelopment, rather than underground activities as such.[14]

Appendix 1

The expression on the LHS of the equation (14) is decreasing for $E \to +\infty$, and it tends to $+\infty$ for $E \to 0$; while the expression on the RHS is always increasing and is equal to 0 for E=0. This implies that the two curves intersect each other at least once.

Moreover, given that the zero-profit curve (eq.(10)) may change its course twice, as in Fig. 4, the curves may intersect with each other three times: twice in the descending traits of the zero-profit curve, and once in the increasing trait.

[14] A very recent paper on the effects of the underground economy on unemployment reaches an analogous conclusion. By adopting a very different model Boeri and Garibaldi (2000) conclude that the best policy for reducing unemployment is to raise overall productivity or to combat it directly, rather than to increase penalties on the underground activities, which may have perverse effects.

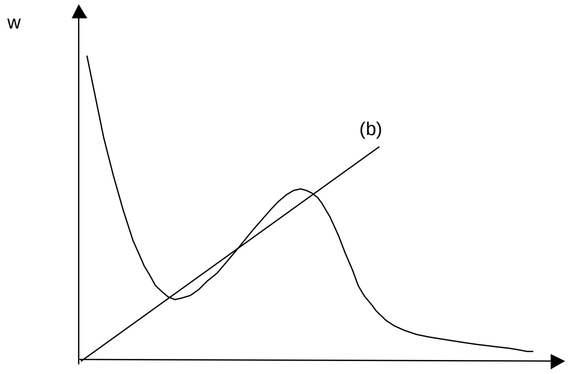

Fig. 4

Stability requires $\frac{\partial w_P}{\partial E} < \frac{\partial w_L}{\partial E}$ calculated over equilibrium values of E. This condition holds only when the two curves intersect in the decreasing traits of the zero-profits curve where $\frac{\partial w_P}{\partial E} < 0$ (see fig. 4).

Appendix 2

i) Aggregate output is:

$$Y = \int_0^{E^*} y_i di = \int_0^{E^*} \left[\left(\frac{1}{w^*} \right)^{\frac{\alpha}{1-\alpha}} \left[\left(\frac{\alpha}{1+t} \right)^{\frac{\alpha}{1-\alpha}} \left(\frac{\eta E_i^{\eta-1}}{1+e^{v-zE}} \right) + \beta \left(\frac{\alpha\beta}{1+m} \right)^{\frac{\alpha}{1-\alpha}} \right] \right] di$$

Solving the integral and substituting equation (13) we have:

$$Y = \frac{\left(\frac{\alpha}{1+t} \right)^{\frac{\alpha}{1-\alpha}} \left(\frac{\eta E^{*\eta-\alpha}}{1+e^{v-zE^*}} \right)^{\frac{1}{1-\alpha}} \frac{1-\alpha}{\eta-\alpha} + \beta^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{1+m} \right)^{\frac{\alpha}{1-\alpha}} E^*}{\left(\left(\frac{\alpha}{1+t} \right)^{\frac{1}{1-\alpha}} \left(\frac{\eta E^{*\eta-\alpha}}{1+e^{v-zE^*}} \right)^{\frac{1}{1-\alpha}} \frac{1-\alpha}{\eta-\alpha} + \left(\frac{\beta\alpha}{1+m} \right)^{\frac{1}{1-\alpha}} E^* \right)^{\alpha}}$$

The derivative of this expression with respect to *E** is always positive if $\frac{1+m}{1+t} > \alpha$. In this case a larger number of firms will give rise to a greater amount of aggregate output.

ii) The aggregate output can be rewritten as: $Y = \frac{\left(\frac{\alpha}{1+t}\right)^{\frac{\alpha}{1-\alpha}} B(E^*)^{\frac{1}{1-\alpha}} E^* \frac{1-\alpha}{\eta-\alpha} + \beta^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{1+m}\right)^{\frac{\alpha}{1-\alpha}} E^*}{\left(\left(\frac{\alpha}{1+t}\right)^{\frac{1}{1-\alpha}} B(E^*)^{\frac{1}{1-\alpha}} E^* \frac{1-\alpha}{\eta-\alpha} + \left(\frac{\beta\alpha}{1+m}\right)^{\frac{1}{1-\alpha}} E^*\right)^{\alpha}}$, whose derivative with respect to *B(E)* is positive (where $B(E) = \frac{\eta E^{\eta-1}}{1+e^{v-zE}}$). While the ratio between official and unregistered labour is given by $g_i = \left\{\frac{B(E_i)(1+m)}{\beta(1+t)}\right\}^{\frac{1}{1-\alpha}}$, which is positively related to $B(E)$. Hence, if high equilibrium has a higher *B(E),* it will have also a higher g_i .and a higher aggregate output.

If we rewrite equilibrium condition (eq. 14) as follows:

$$\frac{(1-\alpha)}{\bar{c}} B(E)^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{1+t}\right)^{\frac{\alpha}{1-\alpha}} = \left(\left(\frac{\alpha}{1+t}\right)^{\frac{1}{1-\alpha}} \left(\frac{\eta E^{\eta-\alpha}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}} \frac{1-\alpha}{\eta-\alpha} + E\left(\frac{\beta\alpha}{1+m}\right)^{\frac{1}{1-\alpha}}\right)^{\alpha} - \beta\left(\frac{\beta\alpha}{1+m}\right)^{\frac{\alpha}{1-\alpha}}$$

it is easily recoverable that the expression on the RHS is increasing in *E**. Then by increasing *E**, the expression on the LHS, which is positively related to *B(E*)*, must increase. But, if the parameter values do not change, this implies an increase in *B(E*)*. In the case of multiple equilibria, the parameters assume equal values, therefore the equilibrium characterised by a greater number of firms must have also a higher *B(E*)*, and thus a higher aggregate output, as well as a higher g_i.

Appendix 3

Rewriting equation (14) as:

$$F=\left(\frac{1-\alpha}{\bar{c}}\right)^{\frac{1}{\alpha}}\left[\left(\frac{\eta E^{\eta-1}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}}\left(\frac{\alpha}{1+t}\right)^{\frac{\alpha}{1-\alpha}}+\beta\left(\frac{\beta\alpha}{1+m}\right)^{\frac{\alpha}{1-\alpha}}\right]^{\frac{1}{\alpha}}$$

$$-\left(\frac{\alpha}{1+t}\right)^{\frac{1}{1-\alpha}}\left(\frac{\eta E^{\eta-\alpha}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}}\frac{1-\alpha}{\eta-\alpha}-E\left(\frac{\beta\alpha}{1+m}\right)^{\frac{1}{1-\alpha}}=0$$

Stable equilibria require that $F_E<0$. Hence, for the implicit function theorem, $sign\,\frac{\partial E^*}{\partial x}=signF_x$, for x=z, m, η. In particular, we have:

$$\text{(A4.1)}\quad \frac{\partial E^*}{\partial \eta}>0\Rightarrow\left(\frac{1-\alpha}{\bar{c}}\right)^{\frac{1}{\alpha}}\left[\left(\frac{\eta E^{\eta-1}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}}\left(\frac{\alpha}{1+t}\right)^{\frac{\alpha}{1-\alpha}}+\beta\left(\frac{\beta\alpha}{1+m}\right)^{\frac{\alpha}{1-\alpha}}\right]^{\frac{1-\alpha}{\alpha}}>\left[E\frac{\alpha^2}{1+t}\right]$$

$$\text{(A4.2)}\quad \frac{\partial E^*}{\partial z}>0\Rightarrow\left(\frac{1-\alpha}{c}\right)^{\frac{1}{\alpha}}\left[\left(\frac{\eta E^{\eta-1}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}}\left(\frac{\alpha}{1+t}\right)^{\frac{\alpha}{1-\alpha}}+\beta\left(\frac{\beta\alpha}{1+m}\right)^{\frac{\alpha}{1-\alpha}}\right]^{\frac{1-\alpha}{\alpha}}>\left[E\frac{\alpha^2}{1+t}\frac{1-\alpha}{\eta-\alpha}\right]$$

$$\text{(A4.3)}\quad \frac{\partial E^*}{\partial m}>0\Rightarrow\left(\frac{1-\alpha}{c}\right)^{\frac{1}{\alpha}}\left[\left(\frac{\eta E^{\eta-1}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}}\left(\frac{\alpha}{1+t}\right)^{\frac{\alpha}{1-\alpha}}+\beta\left(\frac{\beta\alpha}{1+m}\right)^{\frac{\alpha}{1-\alpha}}\right]^{\frac{1-\alpha}{\alpha}}<\left[E\frac{\alpha}{1+m}\right]^{\frac{1}{1-\alpha}}.$$

In order to show that inequality (A4.1) is always true, while inequality s (A4.2-3) are conditioned, let us again rewrite the equilibrium condition (eq. 14) as:

$$A \equiv \left(\frac{1-\alpha}{\bar{c}}\right)^{\frac{1}{\alpha}} \left[\left(\frac{\eta E^{\eta-1}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{1+t}\right)^{\frac{\alpha}{1-\alpha}} + \beta \left(\frac{\beta\alpha}{1+m}\right)^{\frac{\alpha}{1-\alpha}} \right]^{\frac{1}{\alpha}}$$

$$= \left(\frac{\alpha}{1+t}\right)^{\frac{1}{1-\alpha}} \left(\frac{\eta E^{\eta-\alpha}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}} \frac{1-\alpha}{\eta-\alpha} + E\left(\frac{\beta\alpha}{1+m}\right)^{\frac{1}{1-\alpha}} \equiv B$$

Then let us rewrite inequality (A4.1) thus:

$$A \equiv \left(\frac{1-\alpha}{c}\right)^{\frac{1}{\alpha}} \left[\left(\frac{\eta E^{\eta-1}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{1+t}\right)^{\frac{\alpha}{1-\alpha}} + \beta \left(\frac{\beta\alpha}{1+m}\right)^{\frac{\alpha}{1-\alpha}} \right]^{\frac{1}{\alpha}}$$

$$> \ \alpha \left(\frac{\eta E^{\eta-\alpha}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{1+t}\right)^{\frac{1}{1-\alpha}} + \beta \left(\frac{\beta\alpha}{1+m}\right)^{\frac{\alpha}{1-\alpha}} E \frac{\alpha^2}{1+t} \equiv u$$

Since, $B>u$ because:

$$\left(\frac{\alpha}{1+t}\right)^{\frac{1}{1-\alpha}} \left(\frac{\eta E^{\eta-\alpha}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}} \left(\frac{1-\alpha}{\eta-\alpha} - \alpha\right) + E\left(\frac{\beta\alpha}{1+m}\right)^{\frac{1}{1-\alpha}} \left(1 - \frac{1+m}{1+t}\right) > 0.$$

This implies that $\frac{\partial E^*}{\partial \eta}$ is always positive. From this proposition 3 follows.

Let us rewrite inequality (A4.2) thus:

$$A > (<) \left[\frac{\alpha(1-\alpha)}{\eta-\alpha}\right] \left(\frac{\eta E^{\eta-\alpha}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{1+t}\right)^{\frac{1}{1-\alpha}} + \beta \left(\frac{\beta\alpha}{1+m}\right)^{\frac{\alpha}{1-\alpha}} \left[E \frac{\alpha(1-\alpha)}{\eta-\alpha} \frac{\alpha}{1+t} \right] \equiv x$$

Since:

$$B - x = \left(\frac{\alpha}{1+t}\right)^{\frac{1}{1-\alpha}} \frac{(1-\alpha)^2}{\eta-\alpha} \left(\frac{\eta E^{\eta-1}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}} + (\beta\alpha)^{\frac{1}{1-\alpha}} \left(\frac{1}{1+m}\right)^{\frac{\alpha}{1-\alpha}} \left[\frac{\eta-\alpha}{\alpha(1-\alpha)} - \frac{1+m}{1+t}\right] > 0$$

if $\frac{1+m}{1+t} < \frac{\eta-\alpha}{\alpha(1-\alpha)}$

This implies that $\frac{\partial E^*}{\partial z}$ is positive; however, if $\frac{1+m}{1+t} > \frac{\eta-\alpha}{\alpha(1-\alpha)}$, the sign of $\frac{\partial E^*}{\partial z}$ is ambiguous, but when $E \to 0$ the positive term is greater. Instead, for $E \to +\infty$, the negative term prevails. From these proposition 4 follows.

Let us rewrite inequality (A4.3) thus:

$$A < (>) \left[\frac{\alpha}{1+m}\right]\left(\frac{\eta E^{\eta-\alpha}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}}\left(\frac{\alpha}{1+t}\right)^{\frac{\alpha}{1-\alpha}} + E\left(\frac{\beta\alpha}{1+m}\right)^{\frac{1}{1-\alpha}} \equiv y$$

Since:

$$B - y = \left(\frac{\eta E^{\eta-\alpha}}{1+e^{v-zE}}\right)^{\frac{1}{1-\alpha}}\left(\frac{\alpha}{1-\alpha}\right)^{\frac{1}{1-\alpha}}\left(\frac{1-\alpha}{\eta-\alpha} - \frac{1+t}{1+m}\right) < (>) 0 \quad \text{if} \quad \frac{1+m}{1+t} < (>) \frac{\eta-\alpha}{1-\alpha}, \quad \frac{\partial E^*}{\partial m}$$ is positive if this condition holds.

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