



# Department of Economic Studies University of Naples "Parthenope"

**DES - DIS**

## Discussion Paper

No.3/2007

**Title:** Structural and Cyclical Patterns of  
Underground Labour Input in Italy from 1980 to  
2004

**Author:** **Bruno Chiarini\***  
**Elisabetta Marzano\***

**Affiliation:** \* University of Naples Parthenope

2007

# **Structural and Cyclical Patterns of Underground Labour Input in Italy from 1980 to 2004<sup>1</sup>**

**Bruno Chiarini and Elisabetta Marzano<sup>♦</sup>**  
**(University of Naples, Parthenope)**

## **Abstract**

In this paper we investigated empirically the nature of underground employment in Italy, considering its long-run trend and short-run fluctuations. The examined time series of underground employment is provided by the Italian National Institute of Statistics (ISTAT), though for the business cycle analysis we also employ a time series of evaded tax base provided by the Ministry of Finance. The analysis focuses on the period 1980-2003, a time span during which major labour market reforms occurred in Italy, with an evident impact on underground employment.

Our investigation pointed out several interesting regularities. Cyclical behaviour of the regular labour input is deeply affected by the aggregate measure of economic activity used as reference variables, i.e. total or market GDP. Second, the cyclical regularities indicate that the resources allocated to the underground economy are mostly motivated by flexibility requirements. Third, the dynamic adjustments of employment between the regular and underground market, are inextricably tied to one another over the cycle. Surprisingly, the relationship between the labour inputs changes with the GDP measure adopted. It may highlight a reallocation mechanism among labour inputs or a labour drag effect.

**JEL: E26; E32; J21.**

**Keywords: Underground employment; business cycle, labour allocation mechanism**

---

<sup>1</sup> We are indebted to Stefano Pisani and Mauro Marè for their helpful comments.

<sup>♦</sup> Address correspondence to: BrunoChiarini, Dipartimento di Studi Economici, Università "Parthenope", Via Medina, 40, 80133 Napoli, Italy, [bruno.chiarini@uniparthenope.it](mailto:bruno.chiarini@uniparthenope.it).

## 1. Introduction

An extensive literature in economics has examined the determinants of underground economy and tax evasion.<sup>2</sup> However, studies investigating the role of hidden activities and underground employment over the business cycle are rare.<sup>3</sup> In order to understand an economy with a sizeable hidden production, we need to know the recorded as well as the hidden component of the economy. More importantly, the effort should be addressed to estimating the dynamic adjustments of employment and activity between the regular and underground market, since they are inextricably intertwined over the cycle.

In this paper, exploiting the only official Italian time series on underground employment and a proxy of the underground production size, we investigate their dynamic characteristics, stressing the empirical relevance for assessing business cycles.<sup>4</sup> Cyclical analysis allows us to gain new information, so far neglected by the existing literature, on key features of aggregate underground employment. In particular, we identify some interesting phenomena from the dynamic link between market and underground labour input, such as a reallocation mechanism among labour inputs and a leading underground labour drag effect.

Before engaging in this brief analysis, we recall two important issues related to the economic data: i) the accuracy of the economic observations (we are dealing with estimates of unobservable data); ii) their nature (we are dealing with aggregate realizations rather than observable or theoretical behaviours). Both these features should be kept in mind while discussing the relationships between labour inputs using aggregate time series for underground variables.<sup>5</sup>

The paper is organized as follows. The following section shows magnitudes and long-run features of the underground economy in Italy, while Section 3 provides some evidence about the business cycle movement of the regular and irregular labour input in Italy. Section 4 concludes the article.

## 2. The Italian underground economy

The underground economy is widespread in Italy, and has attracted a great deal of attention by policy-makers as well as researchers.<sup>6</sup> The National Institute of Statistics (ISTAT, 2005) provides a time series of the size of the underground economy from 1992 until 2003, showing an increasing trend during the period considered, rising from 15.8% of the total GDP in 1992 to 16.7% in 2003. Digits available for 2003 point out that the share of the underground production in Italy is particularly high in the primary sector (36.4% of total value added), while it decreases to 19.4% in services and amounts to 10% of total valued added generated in the secondary sector.

### 2.1 Time series data

---

<sup>2</sup> For instance, Cowell, (1990); Allingham and Sandmo, (1972). See the Economic Journal Symposium on The Hidden Economy (1999) and Schneider and Enste (2002) for a survey. There are several different definitions of the underground economy, also referred to as shadow economy, or black economy, or irregular economy. The OECD handbook (OECD, 2002) on the issue of the measurement of the non-observed economy (NOE), distinguishes among: underground production, illegal production and informal production.

<sup>3</sup> See Giles (1997); Busato and Chiarini, (2004).

<sup>4</sup> Employment series is provided by the Italian National Institute of Statistics (ISTAT); the proxy of underground activity is from the Ministry of Finance.

<sup>5</sup> Spanos (1999), amongst others, stresses these aspects when dealing with time series.

<sup>6</sup> See, amongst others, Busetta and Giovannini (1998); Camera dei Deputati (1998); Bovi (1999); Zizza (2002); Bianco (2002); Lucifora (2003); Chiarini and Marzano (2004).

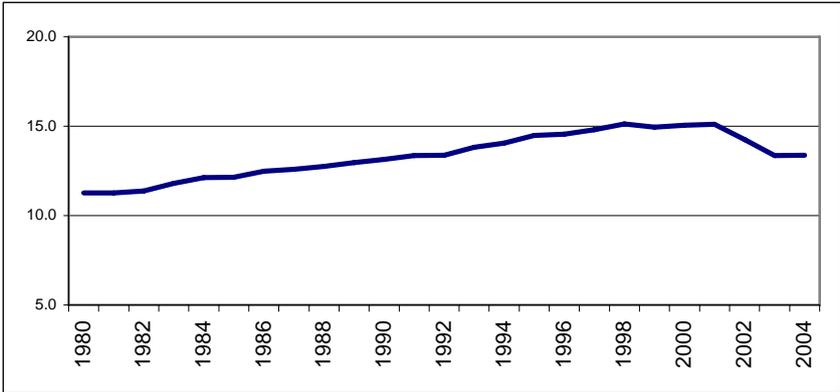
A different source of data on underground economy in Italy is the Ministry of Finance, which has recently estimated a yearly time series of the non-reported Value Added Tax base (Marigliani and Pisani, 2006). This issue is crucial, since evading VAT means under-reporting production, labour activities and revenues. Hence, this time series estimate for the period 1980-2003 can be used as a proxy for the size of underground production.

With regard to underground employment, ISTAT provides a yearly time series covering the period 1980-2004 for the country as whole. The ISTAT method of estimating the size of underground employment (labour input method) is well described in OECD (2002). It is worth stressing a statistical feature of the data analysed. The available time series estimate of the irregular labour input deals with *full time equivalent workers*: the data include both the number of underground working positions and irregular worked hours.

2.1 Trends

The magnitude of underground employment is shown in Figure 1. Two important facts should be noted: the magnitude of the phenomenon as a percentage of full-time equivalent workers, and the marked reduction in the underground employment share registered in recent years (2002-04), mainly due to a sharp reduction in irregular foreign workers, resulting from an amnesty given in 2002 (Law 189).<sup>7</sup>

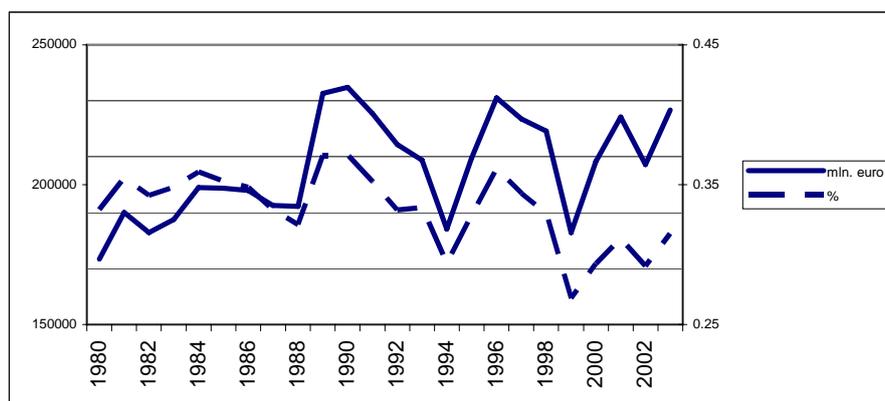
Figure 1: underground employment ratio (underground as a % of total full time equivalent workers).



The size of the unreported VAT tax base is shown in Figure 2, both in absolute terms (solid line) and as a share of the total tax base (dashed line).

<sup>7</sup> See, for instance, OECD (2005).

**Figure 2: VAT undeclared tax base, mln. euro (left axis) and percentage of total tax base (right axis)**



The input of non-regular employment (Figure 1) displays an increasing trend over the first two decades examined which, however, slows down in the early 1990s; by contrast, at the beginning of the new millennium we observe a downward pattern in the size of the underground employment. The reforms involving the regulation of the labour market in the 1990s and the amnesties for foreign workers declared in the early years of the new millennium have certainly contributed to determine these changes.<sup>8</sup>

Interestingly, with regard to the estimated tax evasion (Figure 2), we observe an increasing trend for the unreported VAT tax base (solid line), but equally clearly it appears that the share of VAT non-compliance (dashed line) decreases, with a drop in the two decades of approximately 5 percentage points.

Statistical tests support the idea that the two estimates of the underground economy, the underground employment share and the VAT non-compliance share, have a different trend: deterministic for the first series, stochastic for the second.<sup>9</sup> This has important economic implications: a trend-stationary time series (such as irregular workers) evolves around a deterministic trend, i.e. around some specified and predictable function of time. Conversely, a series with a stochastic trend (such as non-reported VAT) has no clear long-run pattern, since its longer term movement is affected by stochastic disturbances, which have an enduring effect on the future path of the series. In our context, this means that a shock occurring to the estimated series of VAT tax evasion (as a share of the total tax base) due for instance to institutional change and/or new laws to combat tax evasion, has a permanent impact on the long-run movement of the series. This may explain the long-run reduction in VAT tax evasion.

<sup>8</sup> Italy has increased the flexibility of its labour market with steady deregulation throughout the last fifteen years. At the beginning of the 1990s the change in the labour market was spontaneous, but by the mid 1990s the process had become policy-driven. The government, formalizing and improving flexibility arrangements and fostering entrepreneurial dynamism, has generated a rise in participation and employment rates. See, amongst others, OECD (2002a).

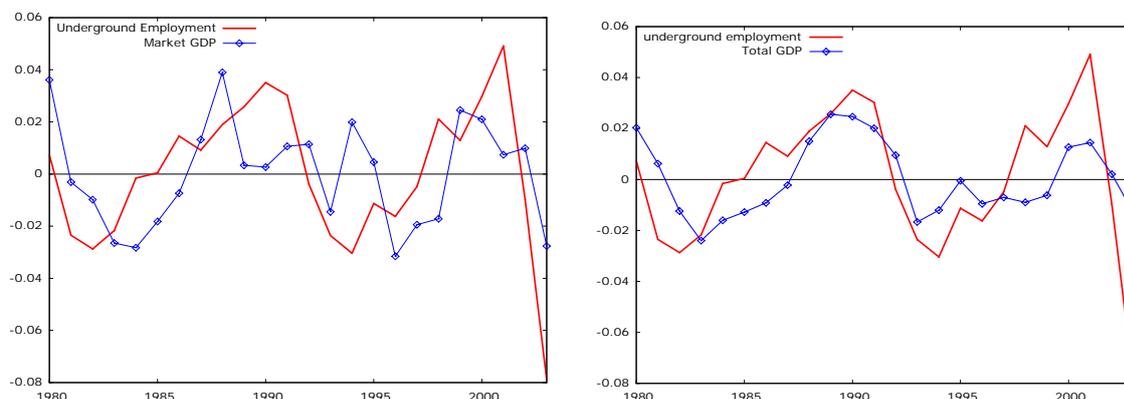
<sup>9</sup> We used the techniques developed by Dickey and Fueller to test whether the time series are difference-stationary rather than trend-stationary. We also considered, for the series of underground employment, a model in which the linear trend is subject to occasional shifts (structural break). The tests are available from the authors upon request.

### 3. Underground employment over the business cycle

In this section we give a brief overview of some major facts about the short-run fluctuations for underground employment in Italy. As a measure of the aggregated economic activity, we use both the total GDP (source: national accounts, ISTAT), and a proxy for the market GDP. This last aggregate is produced by subtracting from the time series of the GDP the size of the evaded VAT tax base discussed in the previous section. Although we cannot deliver a statistical analysis based on a unique source for the output components (a GDP component for underground production is not provided by ISTAT for the sample examined), it may be very helpful in indicating some central problems in discussing the dynamics of labour inputs. Moreover, it is useful to recall that the Ministry of Finance estimates originate from national accounts.<sup>10</sup>

The cyclical analysis presupposes that the examined variables are detrended. The technique used for extracting the cyclical component is the Hodrick-Prescott (HP) filter.<sup>11</sup>

**Figure 3: the cycle of underground employment (full-time equivalent subordinate workers)**



In Figure 3 the cyclical pattern of irregular employment (full-time equivalent units, solid line) is plotted against both the market GDP (left panel) and the total GDP (right panel). The cyclical pattern shows that underground employment has a pro-cyclical dynamic: the correlation coefficient is, in both cases, positive and significantly different from zero (respectively 0.45 and 0.64).

To analyse the dynamic features of the relationship between the economy and the use of irregular labour input, a measure of the correlation with cyclical GDP at leads and lags of up to two years are reported. Moreover, the volatility and persistence of the time series are investigated. Tables 2 and 3 report the business cycle statistics for the following variables: regular full-time equivalent subordinate workers; underground full-time equivalent subordinate workers; the ratio of underground to total full-time equivalent subordinate workers (underground employment ratio). For each variable, Tables 1 and 2 describe, respectively in relation to the total GDP and the market GDP: the contemporary correlation

<sup>10</sup> There is now extensive literature on the relationships between data construction, theoretical abstract variables and measurement. See, amongst others, Spanos (1999) and Lutkepohl and Kratzig (2004).

<sup>11</sup> The smoothness parameter chosen for the yearly data is 100. Things do not change with other commonly used low values. See, for instance, Ravn and Uhlig (2001).

( $\rho$ ), the lead-lag maximum correlation ( $\rho_{\max}$ ), the number of years of advance (+) or delay (-) relative to the business cycle, the absolute ( $\sigma_i$ ) and the relative volatility ( $\sigma_i/\sigma_y$ ), and the degree of persistence of the examined series as to the first 2 lags (AR). The main stylized facts are commented upon in the subsequent sections.

**Table 1: cyclical behaviour of Italian employment relative to total GDP**

	$P$	$\rho_{\max}$	Lead (+) / lag (-)	$\sigma_i$	$\sigma_i/\sigma_y$	AR
Underground workers	<b>0.64</b>	<b>0.71</b>	+1	0.027	1.85	0.54; -0.07
Regular workers	0.31	<b>0.53</b>	-1	0.016	1.09	0.81; 0.40
Underground employment ratio	0.28	<b>-0.59</b> <b>0.55</b>	-2 +1	0.027	1.85	0.57; -0.12

*The null hypothesis of no correlation is rejected for the correlation coefficients marked in bold*

### 3.1 Employment relative to the total GDP business cycle

According to the evidence displayed in Table 1, we can draw the following insights about the co-movement of the labour market input with total (real) GDP for the Italian economy:

1. the irregular full-time equivalent workers have a pro-cyclical dynamic, and they lead the cycle by one period;
2. the regular full-time equivalent workers have a pro-cyclical dynamic, but they lag the cycle by one period;
3. the previous two points engender a clearly counter-cyclical ratio of underground to total employment, lagging the cycle by two periods.

The stylized facts listed above suggest some remarks on the dynamic adjustment between regular and underground employment during the business cycle. The story goes as follows: working hours and the positions in underground activities lead the business cycle by about a year, causing a rise in the underground employment ratio ( $\rho_{+1} = 0.55$ ). Conversely, regular employment displays a phase shift in the direction of lagging the cycle by one year. Thus, labour input dynamics is characterized by a leading phase with the increase in irregular work and, after two years, a second phase with a large increase in regular employment, resulting from a shift of labour input from the underground to the regular market. This adjustment makes the ratio of underground to total employment over the cycle negative ( $\rho_{\max} = -0.59$ , after two years). Underground employment acts as a buffer stock for adjusting the labour input during the business cycle: as soon as the aggregate activity starts to rise, there is an immediate reaction in terms of underground labour utilization. When the rise in economic activity is robust (one year after the turning point), a stronger labour demand leads to a shift towards the most rigid tier of the labour market, adjusting the regular labour input over the business cycle. The economy is characterized by a labour reallocation mechanism over the cycle.

As to the amplitude of fluctuations, the statistics reported in Table 1 point towards the following business cycle regularities:

1. irregular full-time equivalent workers present a cyclical variation almost twice that of the total GDP, 1.85. The persistence is very modest, since the coefficient of autocorrelation at the first delay is 0.54, and becomes almost zero at lag 2;
2. the regular full-time equivalent workers are nearly as volatile as total GDP, with a relative standard deviation as large as 1.09. The coefficient of autocorrelation is quite high at the first lag (0.81) and declines after two years to 0.40;
3. the ratio of underground to total full-time equivalent employment has a relative volatility of 1.85 and a low persistence, with a coefficient of autocorrelation equal to 0.57 at lag 1 and -0.12 at lag 2.

These cyclical characteristics indicate that the input of underground employment is far more flexible than the regular one, suggesting that the use of irregular labour input plays an important role over the business cycle. The higher volatility, as compared to regular labour input, implies that marginal adjustments occur through this channel of the labour market.

It is worth recalling that we are considering full-time equivalent workers and it is not possible to distinguish irregularly registered extra hours of work (*labour-intensive margin*) and/or irregular workers (*extensive margin*). However, the cyclical regularities analysed so far indicate that the resources allocated to the underground economy are mostly motivated by flexibility requirements. This may lead to suppose that the hidden labour input is largely involved in "intensive" (number of hours) rather than "extensive" (number of positions) use.

The high volatility along with the low persistency shown by the irregular labour input may therefore indicate that a large percentage of the irregular labour input is in the form of variation in hours per worker.

### 3.2 Employment relative to market GDP business cycle

Analysis of the cyclical behaviour of labour input can be repeated by considering the market GDP as an index of aggregate economic activity, obtained by leaving out from the aggregate product an estimation of underground activities (as indicated above).

**Table 2: cyclical behaviour of Italian employment relative to market GDP**

	$\rho$	$\rho_{max}$	Lead (+) / lag (-)	$\sigma_i$	$\sigma_i / \sigma_Y$	AR
Underground workers	<b>0.45</b>	<b>0,54</b>	+1	0.027	1.33	0.54; -0.07
Regular workers	0.14	0.37	-1	0.016	0.79	0.81; 0.40
Underground employment ratio	0.24	<b>0.49</b>	+1	0.027	1.33	0.57; -0.12

*The null hypothesis of no correlation is rejected for the correlation coefficients marked in bold*

The cyclical statistics shown in Table 2 confirm the regularities commented upon in the previous section, with a few important exceptions:

1. The degree of co-movement of the labour input (both regular and irregular) with market GDP appears to be less strong compared to Table 1; moreover, for the regular labour input, the null hypothesis of no correlation with the market GDP cannot be rejected by the data.
2. Regular employment displays a substantially lower standard deviation than that of market GDP ( $\sigma_i / \sigma_y = 0.79$ ), whereas the variable fluctuates almost as much output

when considering total GDP. The low volatility of employment is a well-known stylized fact in European countries. This is confirmed for the Italian economy only for regular labour input fluctuations against market GDP fluctuations. In fact, the relative volatility of underground employment is always much larger than the regular one. Moreover, in absolute terms, the volatility of irregular employment is considerably stronger than GDP volatility (total and market GDP).

3. The underground employment share has a pro-cyclical dynamic, and it leads the business cycle by one period. This is a consequence of the pro-cyclical dynamic of underground employment, along with the fact that regular employment is uncorrelated with the market GDP. This is an important result, and it shows that by excluding the hidden production from the GDP, the labour (resources) reallocation mechanism over the cycle vanishes.

#### **4. Concluding remarks**

In this paper we investigated the long-run patterns and cyclical properties of the underground employment time series. For cyclical analysis, we considered two different reference variables for the Italian business cycle: the total GDP and the market GDP. The regularities displayed in Table 1 and 2 suggest that focusing on real GDP rather than total GDP characterizes the cyclical components of the labour input and leaves us to assess the dynamic relationship among them.

Three results deserve to be highlighted. First, the sluggishness of regular employment relative to the different aggregate economy indexes, as suggested by the small contemporary co-movement.

Second, regular employment is pro-cyclical and lagging relative to the total cycle, whereas it displays no correlation with the market cycle. This evidence looks odd, and it may suggest that: i) the regular labour input contributes to the share of production that is unreported to fiscal authorities, ii) the leading character of underground activities might generate a positive production externality (for instance, by increasing the productive scale of firms and pushing up regular labour demand) as a sort of *labour drag effect*, iii) real rigidities operate in the labour market.

Finally, the total GDP business cycle shows that a complex dynamic *labour reallocation mechanism* is working in the economy, eventually causing a shift of employment from underground to the regular market, whereas the market GDP business cycle shows how sluggish regular employment is compared to underground labour input.

Overall, the data demonstrate that underground and market activities are the different faces of the same coin, both worth allowing for when analyzing the labour market's working mechanisms.

## References

- Allingham M.G., Sandmo A. (1972), Income tax evasion: a theoretical analysis, *Journal of Public Economics*, 1, pp. 323-38
- Bianco, G. (2002) *Il Lavoro e le Imprese in Nero*. Carocci, Rome.
- Bovi M., (1999), Un miglioramento del metodo di Tanzi per la stima dell'economia sommersa in Italia, *ISTAT, Quaderni di Ricerca* 2, 5-51.
- Busato, F. and Chiarini B. (2004), Market and underground activities in a two sector dynamic equilibrium model, *Economic Theory*, 23, pp. 831-861.
- Busetta P. and Giovannini E. (eds), (1998), *Capire il Sommerso*, Liguori Editore, Naples.
- Camera dei Deputati, (1998) Lavoro nero e minorile. Atti Parlamentari XIII Legislatura, Commissione XI (lavoro pubblico e privato).
- Chiarini B. and Marzano E. (2004) Dimensione e dinamica dell'economia sommersa: un approfondimento del Currency Demand Approach. *Politica Economica* 3, 303-334.
- Cowell F.A. (1990), Cheating the Government, The MIT Press, Cambridge, Massachusetts.
- Economic Journal, *Controversy: on the Hidden Economy*, 109, N.456, 1999.
- Giles D.E.A. (1997), Testing for asymmetry in the measured and underground business cycles in New Zealand, *Economic Record*, 72, 225-32.
- ISTAT (2005), La misura dell'economia sommersa secondo le statistiche ufficiali, *Statistiche in Breve*, 22 September 2005, Rome.
- Lucifera C. (2003), *Economia Sommersa e Lavoro Nero*, Il Mulino, Bologna.
- Lutkepohl H. and Kratzig M. (2004), *Applied Time Series Econometrics*, Cambridge, Cambridge University Press.
- Marigliani M., Pisani S. (2006), Le basi imponibili IVA. Aspetti generali e principali risultati per il periodo 1982-2002, Ministero dell'Economia e delle Finanze, *Documenti di Lavoro dell'Ufficio Studi*, 2006/1.
- OECD (2002), *Measuring the Non-Observed Economy. A Handbook*, www.oecd.org.
- OECD (2002a), Italy, Economic Surveys, No. 4, Paris.
- OECD (2005), Italy, Economic Surveys, No. 7, Paris.
- Ravn M.O. and Uhlig H. (2001), On adjusting the H-P filter for frequency of observations, *Working Paper 479, CESifo*.
- Schneider, F. and Enste D.H. (2002). *The Shadow Economy. An International Survey*. Cambridge University Press, Cambridge.
- Spanos A. (1999), *Probability Theory and Statistical Inference*, Cambridge University Press; Cambridge.
- Zizza R. (2002) Metodologie di stima dell'economia sommersa: un'applicazione al caso italiano. *Banca d'Italia, Temi di Discussione* 4.