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BUSINESS CYCLES IN ITALY: A RETROSPECTIVE INVESTIGATION

by Giuseppe Schlitzer (*)

Abstract

In this paper a statistical analysis of post-war economic fluctuations in Italy is conducted. It is argued that business cycles in this country qualitatively conform to the general character of the phenomenon, a result which confirms existing evidence. A temporal stability analysis of stylized facts shows that some statistically significant changes in the empirical regularities occurred after 1973, which however did not alter the main qualitative features of the business cycle. The evidence thus supports interpretative models which incorporate a stable propagation mechanism. The historical pattern of volatility of economic fluctuations in aggregate output is also examined. Contrary to previous evidence, it is found a higher stability in the post-war era respect to both the pre-war and the inter-war periods.

Contents

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1. Introduction[1]

The purpose of this paper is to conduct a statistical investigation of post-war economic fluctuations in Italy. The statistical analysis of business fluctuations has been a subject of economic research for a long time, at least since the works of Burns and Mitchell (1946) and Friedman and Schwartz (1963, 1982). This strand of research has undergone a new and innovative impulse after the work of Kydland and Prescott (1982) and the surge of the Real Business Cycle theory. Thus, it has become customary to test the validity of theoretical macro-models by comparing measures of the business cycles as derived from these models with those of actual economies, a methodology which was first introduced by the Adelmans (1959). Differently by Burns and Mitchell, whose style of research was mostly based on the graphical inspection of the data, the measurement of the business cycle is today conducted using the modern tools of time series analysis.

There is now available an extensive number of contributions on the measurement of the business cycle conducted in this new fashion.[2] The evidence coming from

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1. I wish to thank Massimo Caruso, Paola Caselli, Riccardo Fiorito, Luigi Guiso, Paolo Sestito, Tommaso Proietti and an anonymous referee for comments on previous versions of the paper. I am also grateful to Paola Casavola, for some useful suggestions concerning the labour market variables, and to Liliana Pulcini and Luciana Santi, for editorial assistance. The usual disclaimer applies.

2. For Europe, Brandner and Neusser (1992) have analized the business cycle of Austria and Germany; Danthine and Girardin (1989) and Béguelin (1992) that of Switzerland; Dolado, Sebastian and Vallés (1992) that of Spain; Correia, Neves and Rebelo (1991) that of Portugal; Vredin and Warne (1991) and Englund, Persson and Svensson (1992) that of Sweden. Economic fluctuations in the US and the UK have been analyzed by Hodrick and Prescott (1981), Baxter (1991), Correia, Neves and Rebelo (1992),

these studies seems to support the view that business cycles are similar in character and almost indipendent of historical periods and institutional contexts or, in other words, that they are all alike.[3]

For what concerns Italy, some evidence can be found in Blackburn and Ravn (1992), Backus and Kehoe (1992), Fiorito and Kollintzas (1993), and Danthine and Donaldson (1993), where the authors conduct international comparisons of business cycle measures. These contributions, however, draw their data from international sources and generally consider limited time periods and set of variables.

In this paper I extend the evidence for Italy in several respects. First, I use post-war quarterly data drawn from domestic sources, covering the largest possible time span. In doing this, I also present stylized facts for the three big branches of the economy, the agricultural, industrial and private services sector, a disaggregation which has so far been neglected in the recent literature. Second, given the extended period covered in the study, I conduct a "stability analysis", to test the robustness of the empirical regularities. Third, I provide some evidence for Italy about the stabilization of economic fluctuations between of pre-war and post-war era, an issue which is now at the center of the macroeconomic literature.

The methodology underlying the research is standard. Once obtained an estimate of the cyclical component of each series, this is classified in terms of "volatility",

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Blackburn and Ravn (1992). Finally, Costello and Praschnik (1992) and Mendoza (1992) have analyzed the business cycle in some developing countries.

3. Lucas (1977).

"persistence" and "comovement" with the GDP, whose cyclical component is taken as a benchmark. The main regularities are then classified as "stylized facts".

The filter that I employ in order to decompose series into "trend" and "cycle" is that of Hodrick and Prescott (1981), which is quite uniformly used in this kind of analysis. This will allow better comparisons of the stylized facts found for the Italian economy with those for the other industrialized countries. Obviously the results may be sensitive to the detrending procedure, so I also conduct a "sensitivity analysis", using alternative trend-cycle decompositions. Results do not appear to vary much across methods. The main caveat of the study is that only univariate detrending procedures are considered, so ignoring possible cointegrating relations among variables. However, this would have implied the imposition of restrictions derived from economic theory, while the main advantage of the approach adopted is that it is as "neutral" as possible.

The paper is organized as follows. Section 2 briefly describes the methodology of the research; Section 3 presents the results obtained for the whole sample period whereas Section 4 presents the results of the stability analysis; Section 5 deals with the stabilization of economic fluctuations in Italy. Results of the sensitivity analysis are in Appendix III. I draw some concluding remarks in the final section.

2. The method

2.1 The trend-cycle decomposition

The first problem that typically arises in the analysis of the business cycle is that of its measurement, i.e. the

problem of the decomposition into trend and cycle. It is well known that there is no general agreement about the way of estimating the two components and no method can be considered superior to the others.

As shown in Appendix III, the long-period behaviour of our set of variables does not seem compatible with standard detrending procedures, that is with a linear, quadratic or cubic trend. Thus the filter employed here is that of Hodrick and Prescott (henceforth HP), which is both a highly flexible tecnique and the most widely used in empirical applications.[4] The extensive adoption of the filter in this kind of analysis have made it a "must", expecially when a cross-countries comparison of stylized facts has to be made.

About the value to assigne to the Lagrange multiplier to parameterize the filter, denoted as μ, I use the conventional value for quarterly series of 1.600. Henceforth the filter obtained for a given μ will be denoted as HP(μ), and the reference to each variable is to be meant to its cyclical component.

Figure 1 shows the trend and cycle components of GDP obtained using different kind of decompositions.

2.2 The measures of persistence, volatility and comovement

Two typical characteristics of the business cycle are "volatility" and "persistence". This means that series are subject to deviations from the long-run path which vary in amplitude and tend to persist for more than one period.

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4. See Hodrick and Prescott (1981) and Prescott (1986). Appendix II contains a detailed description of the filter and its properties.

Another typical feature of the business cycle is the "coherence" or "comovement" among the set of macroeconomic variables, a regularity which has been documented since the first empirical studies.[5]

There are various measures of cyclical volatility and persistence which can be employed. Here I use the most common in practice. Thus volatility is measured in terms of the standard deviation relative to that of GDP, whereas persistence is measured in terms of the first autocorrelation coefficient.

As a measure of comovement, I employ the correlation with GDP up to the fourth lead/lag. Let $\rho(j)$ be the correlation coefficient of a series, X_t, with GDP at $t+j$. Following Fiorito and Kollintzas (1993), X_t is said "acyclical" if:

$$0 \leq |\rho(j)| < .2.$$

If $\rho(j)$ is not close to zero, X_t is said "procyclical" if $\rho(j)$ is positive and "anticyclical" or "countercyclical" if it is negative.[6] Particularly, X_t is "strongly" correlated with the reference cycle whenever:

$$.5 \leq |\rho(j)| \leq 1,$$

whereas it is "weakly" correlated if:

$$.2 \leq |\rho(j)| < .5.$$

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5. See, for example, Burns e Mitchell (1946).

6. The value of .2 roughly corresponds to the value necessary to reject in samples above 100 observations the null hypothesis of a zero correlation coefficient at the 5 percent level in a two-sided t test.

Finally, X_t is said "leading", "coincident" or "lagging" the cycle if the highest $|\rho(j)|$ occurs respectively at $j>0$, $j=0$ or $j<0$.

3. The stylized facts

Two sets of macroeconomic variables are examined in this study.[7] The first consists of the main series of the national product and income accounts at costant prices, and covers the period 1954.Q1-1992.Q4. I also include in this group a price series, as represented by the implicit GDP deflator. The second group consists of variables pertaining to the labour market and covers the shorter period 1959.Q1-1992.Q4. I also report measures of economic fluctuations for the three main sectors of the economy, the agricultural, industrial and private services sectors. I do not consider monetary measures (money supply aggregates, money velocity), interest rates and terms of trade, since no new data has been made recently available and so little could be added to what already said by others.

Results are reported in Tables 1 and 2. All variables have been logged - except for the trade balance and inventory investments, which have been considered relative to GDP - and filtered using HP(1.600).[8]

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7. See the data Appendix for a detailed description of the data set.

8. For reasons of space, in the Tables 1 and 2 only the cross-correlations up to a lag/lead of three periods are reported. All correlations of fourth order were found lower in absolute term. Bold is used to denote the highest correlation coefficient with GDP.

3.1 Demand, supply and prices

The data show how all variables are highly persistent and comove with the reference cycle. Prices display the highest degree of persistence, as one would expect due to the high degree of indexation of the Italian economy.

Variability widely differs across variables. Looking at the output in the three sectors of the economy, the primary sector is the most volatile, about three times GDP, whereas the private services sector is a slightly less volatile than GDP. The industry lies in an intermediate position.

As expected, investments are more volatile than GDP. In the case of machineries and transportation means, the standard deviation is more than five times that of GDP. The inventory investment-GDP ratio is instead less volatile than the reference cycle. Also imports and exports are more volatile than GDP, with a relative standard deviation of 3.5 for the former series. Consumption is much less volatile than GDP, due both to the intertemporal smoothing of Italian households and the low variability of government consumption.

The most interesting results concern the cross-correlations among series, which measure the comovements across the macro-variables. Cyclical fluctuations in the production of the primary sector appear completely indipendent from the rest of the economy, whereas the output of both the services sector and the industry are strongly procyclical, with the higher correlation for the latter sector. Most of the expenditure components appear strongly procycical, fixed investments being the most correlated. Government consumption displays a weakly procyclical pattern and leads GDP by three

quarters.[9] Also exports lead GDP by about three quarters, although the cross-correlation is very weak. Due to the strong procyclical character of imports, the trade balance-GDP ratio has a marked countercyclical pattern, a result which is now considered standard.[10]

A further interesting result concerns the price level. A common opinion is in fact that this variable should move in the same direction of real output over the business cycle.[11] This view has been recently challenged on empirical grounds in a series of papers.[12] For most of the countries examined in these studies, prices are procyclical prior to World War II, and countercyclical thereupon. Over the post-war period results show that prices in Italy are strongly countercyclical, and lead GDP of at least three quarters.

3.2 Employment, productivity and real wages

Table 2 reports business cycle measures of the labour market variables both for the aggregate and the three main branches of the economy. I mantain the GDP as reference series since I consider more interesting to look at the behaviour of these variables relative to the aggregate cycle rather than relative to the sectoral outputs.

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9. Fiorito and Kollintzas (1993), who use the data of the old national accounting drawn from the OECD, find a countercyclical pattern for this variable over the period 1960.Q1-1989.Q3. However, my result does not change also when repeating the analysis over this period.

10. See Backus, Kehoe and Kydland (1992) on the countercyclical character of the trade balance.

11. See, for example, Lucas (1977).

12. See Kydland and Prescott (1990), Cooley and Ohanian (1991), Backus and Kehoe (1992) and Todd Smith (1992).

All series show a high degree of persistence, the real wage in agriculture being the most persistent. However, the measures of volatility and comovement vary a lot.

Again the primary sector emerges as the most volatile, employment in this sector being twice more volatile than aggregate employment. An interesting result is that aggregate employment is less volatile than employment in any of the three sectors, due to some negative correlation of employment flows.

The cross-correlation analysis confirms the almost acyclical character of the primary sector, which contrasts with the strong procyclical character of the services and industrial sectors. The link between the industry and the aggregate economy appears stronger than in the case of services. In both these two sectors, as well as at the aggregate level, employment lags GDP by about two quarters, a delay which is typically due to labour hoarding phenomena.

With respect to labour productivity, all series generally show a strong procyclical and coincident pattern, again with the exception of the primary sector. The cross-correlation with the reference cycle is very strong in the case of the industry.

A final interesting result concerns the real wage. It is well known that the cyclical behaviour of this variable has always been a subject of debate both at the empirical and theoretical levels, at least since the Keynes-Dunlop-Tarshis controversy.[13] The prevailing opinion is that its cyclical behaviour strictly depends on the specific institutional context. In the case of Italy, the evidence presented here

13. Brandolini (1992) provides and excellent survey about the debate.

supports a countercyclical pattern for the real wage, although the link with GDP is not so pronounced.[14]

4. Stability analysis

There is no reason because stylized facts should stay unchanged for long periods of time. Changes in policies or in the institutional context and shocks of several kinds may have a permanent impact both on the trend and the cyclical components of macroeconomic variables. Since the method adopted for detrending should already take into account structural breaks in the trend, it is interesting to verify if any break occurred in the cyclical component of each series. This implies to test the temporal stability of the business cycle measures, which would also allow to see to what extent the stylized facts underlie true empirical regularities.

To test the dynamic stability of the business cycle moments several approaches have been followed in the literature. One common method consists in splitting the overall sample in few subsamples according to the dating of major economic events, like the oil shock.[15] Given that the dating of structural breaks is always subject to judgement, an alternative consists in recomputing moments over time and check their convergence properties.[16] Obvioulsy, different answers can be reached depending on the method adopted, thus

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14. Table 2 refers to the real wage computed using the implicit GDP deflator. Since the outcome is in general sensitive to the price deflator employed (see Brandolini, 1992, on this point), I also used the index of the cost of living, with almost identical results.

15. See for example Gerlach (1988), Baxter and Stockman (1989) and Baxter (1991).

16. See Blackburn and Ravn (1992) and Englund, Persson and Svensson (1992) for an application of this method.

both are considered here.

4.1 The business cycle before and after 1973

I choose the 1973 as the date of a possible structural change since: 1) it is in this year that the definitive break of the "Bretton Wood's aggrement" occurs, which marks the shift to a flexible exchange rate regime; 2) the first oil shock occurs, which leads the country into the period of the so called "double-digit inflation". I thus devided the sample into two subsamples, the first ending in 1972 and the second going from 1973 onward, and compared the measures of economic fluctuations during these two periods.[17] Obviously, the analyis does not allow to distinguish to which of the two events any change in the stylized facts should be attributed.[18]

To evaluate the statistical significance of the changes occurred in the empirical regularities across the two periods I carry out three different tests, one for each moment. To test the temporal stability of the volatility measure, I employ the Bartlett test.[19] To test the dynamic stability of

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17. To obtain a more precise estimate of the cyclical component, the filter HP(1.600) is still applied over the entire sample period.

18. Also Gerlach (1988), Baxter and Stockman (1989) and Baxter (1991) have considered the 1973 to investigate the stability of the business cycle, with special attention to the United States. Perron (1989) has also considered the 1973 in his study of the random walk hypothesis vs. the one-time break hypothesis in the trend component of macroeconomic time series.

19. See Bartlett (1937). The test is distributed as a $X^2(m-1)$, where m is the number of subsamples in which the sample is split. Here the test is not directly performed on the "relative" variances. However, since it will fail to reject the null of constancy of the variance for the

the measures of persistence and co-variability, I employ a standard F-test (Chow-test). On each variable, Y, I run the following regressions:

$$Y_t = \eta + \sum_{j=1}^{4} \beta_j \, Y_{t-j},$$

in the case of autocorrelation, and

$$Y_t = \eta + \sum_{j=-2}^{2} \beta_j \, GDP_{t-j},$$

in the case of cross-correlation with GDP, and test for the constancy of the coefficients between the two subperiods.[20] Since residuals from the two regressions may not be uncorrelated, and the F-test be invalid, I follow Hodrick and Prescott (1981) in computing an index of "relative fit", as given by the ratio of the RSS (Residual Sum of Squares) from the unrestricted regression to the RSS of the restricted regression.[21] This number, which ranges from zero to one, can help to deduce the magnitude of the instability. A number fairly lower than one would be evidence of instability of the underlying cyclical measure.

The results are in Tables 3-8. As can be noted, although figures change across the two periods, the majority of the stylized facts remain "qualitatively" unchanged. Moreover, not all the changes which occur in the data are statistically significant.

GDP series, results can also be interpreted in terms of stability of the relative variances.

20. Hodrick and Prescott (1981) have adopted this approach to test the stability of the cross-correlation measures.

21. It is simply for convenience if I use the residual sum of squares in place of the explained sum of squares, as done by Hodrick and Prescott.

With respect to the variables classified in first group (Tables 3-5), the first regularity to note is the wide and significant drop in the volatility of output in agriculture and fixed investments and its components.[22] GDP appears more sluggish after 1973, due to the increase in the persistence of consumption. For most of the variables the degree of comovement with GDP has grown in the second period. It is to be noted, however, that only some of these changes in the degree of co-variability are statistically significant. A significant change has also occurred in the case of output in the private services sector, whose contemporaneous correlation with GDP has grown from .72 to .93, although it has not reached the level of comovement of industry output yet. In the case of consumption, the contemporaneous cross-correlation with GDP has increased from .62 to .83. Also in the case of exports there has been a significant increase in the correlation with GDP, from acyclical to weakly procyclical. Government consumption moved from an acyclical to a strongly procyclical and leading pattern, a change which is however rejected by the Chow test. A significant decrease in the correlation with GDP has occurred also in the case of construction investments.

Some interesting changes seem to have occurred also with respect to the labour market variables, classified in the second group (Tables 6-8).

First of all, there has been a sharp and significant reduction in the volatility of employment both in the industrial and the services sectors after 1973. There is also been a sharp and significant decline in the volatility of productivity in the primary sector, probably due to the sharp

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22. The high variability of agricultural output (both in absolute and relative terms) is influenced by the marked 1967-1968 cycle. However, also after eliminating this period, the sharp decline in volatility remains.

decline in the volatility of output in this sector.

Second and most important, the link between employment and the aggregate cycle has weakened sharply after 1973, while the converse has occurred for productivity. The change in the cyclical measures is expecially evident for the services sector, where employment has shifted from a consistently procyclical to an acyclical pattern, whereas productivity has shifted from a countercyclical to a consistent procyclical pattern. A possible explanation to this can be an increase in labour hoarding by firms.

Finally, there is evidence of a drastic reduction in the volatility of real wages in both the industry and the services sector, which is particularly evident in the former case. The higher stability of this variable can be attributed to a higher degree of indexation of labour contracts after 1973.

4.2 The dynamic stability of moments

Following a more recent practice, I recompute the business cycle moments over time and check their convergence properties. To check how these are sensitive to the sample size, I recompute recursively each moment starting with an initial sample of 15 years and increase the number of observations at each step up to full sample size. To check how moments are sensitive to the sample period, using a rolling technique I recompute each moment for a fixed sample length (15 years) shifting the sample over time. In the case of comovements, the contemporaneous correlation coefficient is considered.

One can verify the convergence properties of moments through the visual inspection of their sequences in such a way

generated. Here I summarize the main results, which do not differ much, in qualitative terms, from those obtained for other countries.

First of all, recursive moments have appeared much more stable than rolling moments. Both standard deviations and cross-correlation coefficients have shown in fact a high degree of variability relative to the sample period. Moreover, the cross-correlations have shown a high "quantitative" instability but a high degree of "qualitative" stability, that is, the signs of correlation coefficients are robust to the sample period.

As was already noted in the previous section, there has been a significant and steady reduction in the volatility, both absolute and relative, of some variables, e.g. in the case of agricultural ouput, fixed investments, the inventory investments-GDP ratio, total employment and the real wage.[23] With regard to the comovements across variables, there has been in some cases a strengthening of the link to GDP, e.g. for consumption, whose coefficient has raised from .61 above .85, and for exports, which moved from an acyclical (with negative coefficient) to a procyclical pattern. Finally, in the case of employment there has been a gradual reduction in the degree of comovement with GDP, which is consistent with the fact provided in the previous section.

5. Stylized facts in the main OECD countries: A comparison

Given the abundant information now available about the measurement of the business cycle in the main developed

23. Each figure in the plot is referred to the central observation of the 15 years window.

economies,[24] it is possible to carry out a cross-countries comparison of stylized facts. There are several differences among the various studies, not so much due to methodology, given the almost uniform adoption of the Hodrick-Prescott filter, but rather due to the different periods covered or the frequency of the data. Notwithstanding these limitations, I believe that a comparison of the most common business cycle measures may be useful to a better understanding of the phenomenon.

Table 9 reports measures of volatility (V), persistence (P) and comovement (C) for main macroeconomic variables as reported in specific studies of seven OECD countries, plus those computed here for Italy. The records have been collected using a unique source for each country and are based on quarterly data; when several sources were available, I adopted the one considered most comprehensive or the one which covered the largest time span. The overall evidence shows several common "qualitative" regularities among the eight countries, although figures vary a lot.

The highest degree of uniformity concerns the expenditure components, expecially household consumption, which is less variable than GDP/GNP, with the exception of Spain, Austria and, to a lesser extent, the UK, and investments, which are more volatile than GDP/GNP in all cases. A substantial uniformity attains also to the measures for exports and imports. Due to the general strong procyclical character of the latter, the trade balance is countercyclical in all countries.

The main differences can be found for government consumptions. These are acyclical in Switzerland and the UK, countercyclical in Austria, and procyclical in all other

24. See the references in note 1.

cases. Moreover, they are more volatile than GDP and lagging in the US and Spain, whereas they are less volatile than GDP and leading in all other countries.

A high degree of uniformity can be found also with respect to the empirical regularities that characterize the labour market. As anticipated, the main differences concern the real wage, which is countercyclical in Italy and France, and procyclical in the UK, the US and Germany. Productivity and employment are uniformly procyclical, with the latter lagging the cycle except in Austria and Germany. Note that Italy shows the highest degree of volatility of employment and labour productivity. However, one should keep in mind the sharp reduction in volatility after the 70s which affected these variables.

6. Have economic fluctuations been dampened?

So far the volatility of fluctuations in economic activity has been analyzed in relative terms. In this section I examine the historical evolution of the absolute volatility of business cycles in Italy.

It is a well known common opinion that fluctuations in economic activity have been dampned after World-War II.[25] However recently Romer (1986, 1989) for the US and a number of subsequent authors for a series of developed countries have provided evidence of no decrease in the absolute volatility of economic fluctuations.[26]

In the case of Italy, some evidence has been provided

25. See, for example, Zarnowitz and Moore (1986).

26. See Sheffrin (1988), Bergman and Jonung (1989) and Backus and Kehoe (1992).

by Sheffrin and Backus and Kehoe. These authors, however, draw their data from international sources. Moreover, while Sheffrin evalutes the cycle in terms of growth rates, Backus and Kehoe use the HP filter. This section differs from these studies in two respects. First, I use more reliable data, precisely the historical real GDP series as reconstructed by Rossi, Sorgato and Toniolo (1993).[27] Second, given that there is no consensus about the method of decomposition, I conduct the analysis using both growth rates and the HP filter.[28] I also report results for the log-linear trend, although the evidence in this case should be taken with caution. I keep the standard deviation as measure of volatility.

Results are reported in Table 10. As can be seen, with the exception of the log-linear trend, the evidence shows a sharp reduction in the standard deviation of post-war economic fluctuations, respect to both the inter-war and the pre-war periods.[29] Further support to this result is provided by Figure 2, which depicts the pattern of the standard deviation of the cyclical component of real GDP obtained through HP(400). Each observation in the figure is computed using the rolling tecnique over a fixed window of 15 years and is referred to the central year of the window. The plot shows a marked boost in volatility in occasion of the two world wars and a sharp reduction in the standard deviation after the second war, to levels well below those relative to the pre-war period.

Is this enough to conclude in favor of stabilization

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27. The series is in 1938 lira for the period 1890-1951 and in 1985 lira for the remaining period and was thus entirely rebased in 1938 lira.

28. The conventional value of the parameter in the case of annual series is 400.

29. This conclusion does not change if one considers, as post-war period, that going from 1951 to 1984, as in Sheffrin (1988).

policies? Obviously not. In Section 3 it was found that the higher volatility occurs in agriculture, followed by the industry and the services sector in the order. Thus, the reduced volatility of aggregate output could be simply due to the structural change undergone by the Italian economy, which moved from an agricultural to an industrial country and lately witnessed an expansion of the tertiary sector. The role of stabilization policies remains an issue open to future research.

7. Conclusions

Recent years have seen a new and innovative interest of applied and theoretical economists in the measurement of the business cycle. This has been viewed as useful not simply for a better understanding of the phenomenon per se, but rather as a way of testing the validity of theoretical macro-models.

In this study a statistical investigation of post-war economic fluctuations in Italy has been conducted in search of "stylized facts". The approach which has been adopted is one that is as neutral as possible with respect to theoretical considerations.

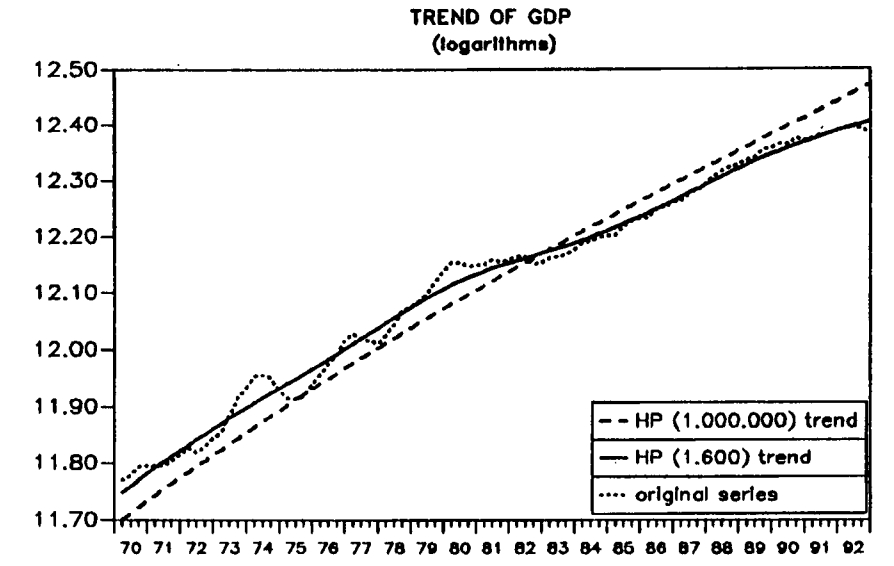
The overall evidence presented shows that economic fluctuations in Italy qualitatively conform to the general character of the business cycle in developed economies. Significant changes in the measures of the business cycles have been reported for some of the variables considered. Some of these (e.g., the higher degree of comovement of industrial and services output with GDP) can easily be attributed to the structural change undergone by the Italian economy; others (e.g., the lower degree of coherence of employment with GDP) can instead be attributed to mutations in the institutional context. However, the general pattern of the comovement among

the macro-variables has not been altered in a substantive manner. The evidence thus favors esplicative models which incorporate a stable propagation mechanism.

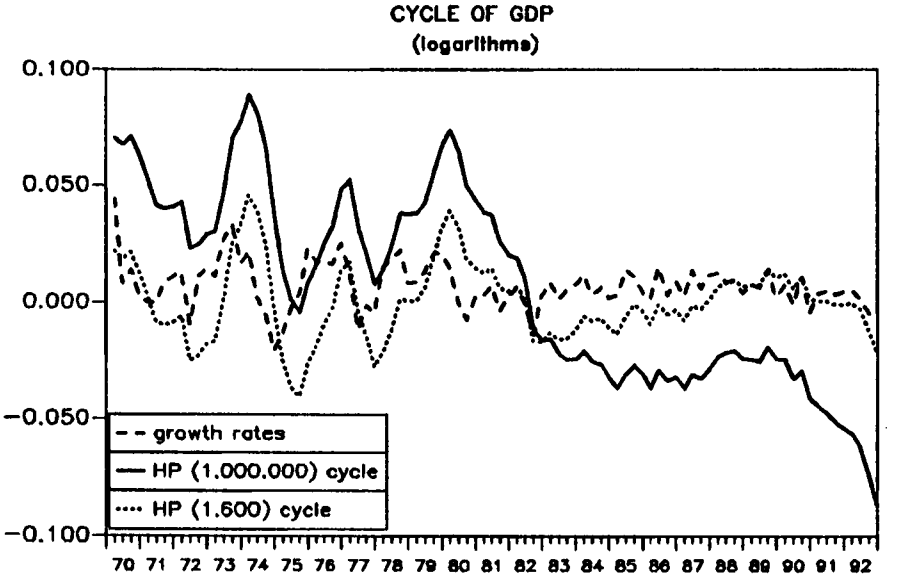
In the last part of the paper the pattern of volatility of economic fluctuations in aggregate output was examined. Contrary to previous evidence, it was fownd a higher stability of the post-war period with respect to both the pre-war and the inter-war periods. As was argued, this is not sufficient to conclude that stabilization policies are effective. The composition of aggregate output has in fact shifted from sectors that are very cyclical (agriculture and manufacturing) to a less cyclical sector (services).

In interpreting the results of this study one should keep in mind the main caveat of the approach followed, i.e. that results may be sensitive to the method of decomposition into trend and cycle. A sensitivity analysis has showed, however, that at least the main facts are robust to the decomposition method.

Fig. 1


TREND OF GDP
(logarithms)
12.50
12.40
12.30
12.20
12.10
12.00
11.90
11.80
11.70
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92
HP (1.000.000) trend
HP (1.600) trend
original series

(a)


CYCLE OF GDP
(logarithms)
0.100
0.050
0.000
−0.050
−0.100
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92
growth rates
HP (1.000.000) cycle
HP (1.600) cycle

(b)

Fig. 2

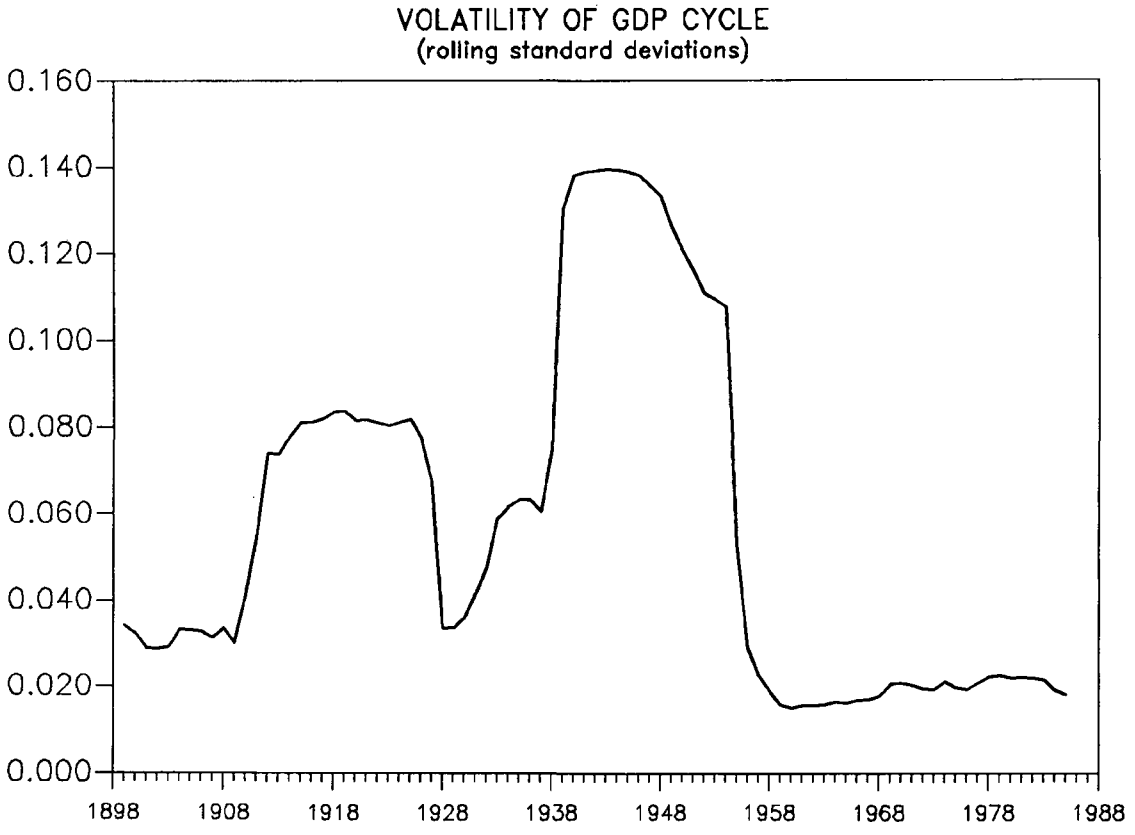

VOLATILITY OF GDP CYCLE
(rolling standard deviations)
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
1898
1908
1918
1928
1938
1948
1958
1968
1978
1988

Table 1

DEMAND, SUPPLY AND PRICES
(1954.Q1-1992.Q4)

Filter: HP(1.600)

	σ (1)	ρ (2)	ρ(j) (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.79	-	-	-	-	-	-	-
Agriculture	2.93	.53	.02	-.01	-.01	**.08**	.00	-.01	-.04
Industry	1.78	.77	.33	.55	.79	**.96**	.77	.51	.28
Services	.94	.82	.27	.48	.67	**.82**	.71	.54	.33
Consumption	.65	.85	.42	.56	.68	**.75**	.66	.52	.29
- households	.82	.85	.44	.58	.69	**.74**	.64	.49	.25
- government	.41	.81	-.13	-.09	.03	.11	.19	.27	**.32**
Fixed investments	2.58	.81	.52	.64	.76	**.83**	.65	.44	.25
- machineries	5.25	.78	.35	.55	.69	**.79**	.66	.51	.30
- transport.	5.36	.69	.32	.43	.54	**.55**	.40	.30	.21
- construction	2.15	.69	.49	.49	.56	**.59**	.42	.24	.12
Inventories	.73	.54	-.22	.07	.33	**.53**	.41	.26	.15
Exports	2.45	.56	-.18	-.10	.06	.22	.21	.21	**.23**
Imports	3.49	.75	.05	.29	.52	**.67**	.62	.50	.36
Trade balance	.58	.68	-.15	-.32	-.45	**-.47**	-.41	-.31	-.16
Prices	1.22	.87	.11	.05	-.07	-.24	-.38	-.53	**-.66**

(1) Relative standard deviation.
(2) 1^ order autocorrelation.
(3) Correlation with GDP_{t+j}.

Table 2

EMPLOYMENT, PRODUCTIVITY AND REAL WAGES
(1959.Q1-1992.Q4)

Filter: HP(1.600)

	σ (1)	ρ (2)	$\rho(j)$ (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.80	-	-	-	-	-	-	-
Total economy									
Employment	.92	.71	.56	**.59**	.54	.48	.30	.15	-.02
Productivity	.98	.66	-.21	.02	.32	**.57**	.54	.42	.32
Real wage	1.09	.66	-.09	-.25	**-.38**	-.35	-.36	-.35	-.29
Agriculture									
Employment	1.97	.45	.05	.12	.20	.27	**.21**	.20	.18
Productivity	3.45	.63	**.19**	-.04	-.11	-.09	-.10	-.11	-.13
Real wage	1.41	.73	.02	-.10	-.23	-.26	-.33	**-.36**	-.29
Industry									
Employment	.99	.78	.65	**.63**	.56	.41	.25	.06	-.11
Productivity	1.61	.69	-.05	.22	.54	**.81**	.69	.53	.37
Real wage	1.23	.66	-.03	-.20	**-.33**	-.28	-.30	-.29	-.25
Services									
Employment	1.69	.48	.27	**.32**	.26	.28	.18	.13	.01
Productivity	1.59	.46	-.15	-.07	.11	.18	**.26**	.20	.20
Real wage	1.24	.40	-.29	-.37	**-.41**	-.35	-.37	-.27	-.18

(1) Relative standard deviation.
(2) 1° order autocorrelation.
(3) Correlation with GDP_{t+j}.

Table 3

STABILITY ANALYSIS
DEMAND, SUPPLY AND PRICES
(1954.Q1-1972.Q4)

Filter: HP(1.600)

	σ (1)	ρ (2)	ρ(j) (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.71	-	-	-	-	-	-	-
Agriculture	3.95	.56	-.03	-.01	.01	**.15**	.01	-.04	-.07
Industry	1.80	.70	.44	.51	.69	**.92**	.69	.53	.45
Services	1.05	.77	.53	.56	.60	**.72**	.52	.37	.22
Consumption	.62	.76	.57	.59	.59	**.62**	.46	.36	.10
- households	.83	.76	.57	.60	.59	**.62**	.45	.33	.07
- government	.52	.81	-.11	-.15	-.08	-.06	.01	.08	**.16**
Fixed investments	3.20	.78	.62	.66	.75	**.85**	.65	.48	.33
- machineries	6.65	.73	.44	.55	.62	**.74**	.60	.52	.37
- transport.	6.90	.70	.44	.49	.58	**.62**	.47	.43	.32
- construction	2.90	.66	.56	.54	.62	**.69**	.50	.31	.19
Inventories	.82	.47	-.30	-.10	.10	**.32**	.19	.11	.19
Exports	2.56	.49	-.10	-.17	-.10	.08	.01	.06	**.14**
Imports	4.12	.75	.25	.35	.47	**.56**	.44	.33	.23
Trade balance	.60	.73	-.25	-.37	**-.42**	-.38	-.32	-.20	-.06
Prices	1.39	.79	.04	.00	-.07	-.20	-.28	-.39	**-.51**

(1) Relative standard deviation.
(2) 1^ order autocorrelation.
(3) Correlation with GDP_{t+j}.

Table 4

STABILITY ANALYSIS
DEMAND, SUPPLY AND PRICES
(1973.Q1-1992.Q4)

Filter: HP(1.600)

	σ (1)	ρ (2)	ρ(j) (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.83	-	-	-	-	-	-	-
Agriculture	1.86	.41	.08	-.04	-.01	.00	-.05	.01	.01
Industry	1.76	.81	.27	.57	.85	**.98**	.80	.49	.17
Services	.85	.87	.11	.44	.74	**.93**	.89	.69	.43
Consumption	.67	.91	.39	.58	.76	**.83**	.79	.63	.43
- households	.81	.91	.41	.61	.77	**.83**	.78	.60	.39
- government	.32	.78	-.13	-.01	.17	.31	.44	.54	**.57**
Fixed investments	2.01	.86	.50	.67	.83	**.85**	.69	.43	.17
- machineries	3.94	.87	.34	.60	.82	**.90**	.79	.54	.24
- transport.	3.89	.67	.24	.41	.53	**.53**	.52	.37	.18
- construction	1.38	.77	.52	.53	.56	**.54**	.37	.18	.03
Inventories	.66	.62	-.16	.20	.53	**.73**	.62	.38	.10
Exports	2.36	.62	-.25	-.06	.17	.34	**.38**	.35	.29
Imports	2.95	.74	-.05	.28	.61	.78	**.79**	.65	.45
Trade balance	.56	.61	-.15	-.34	-.50	**-.54**	-.51	-.39	-.23
Prices	1.08	.83	.07	.01	-.12	-.28	-.55	-.76	**-.85**

(1) Relative standard deviation.
(2) 1ˆ order autocorrelation.
(3) Correlation with GDP_{t+j}.

Table 5

STABILITY ANALYSIS
EMPLOYMENT, PRODUCTIVITY AND REAL WAGES
(1959.Q1-1972.Q4)

Filter: HP(1.600)

	σ (1)	ρ (2)	ρ(j) (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.72	-	-	-	-	-	-	-
Total economy									
Employment	1.19	.84	.74	**.75**	.70	.68	.51	.38	.17
Productivity	.89	.63	**-.48**	-.37	-.10	.20	.11	.08	.22
Real wage	1.43	.70	-.04	-.22	**-.39**	-.34	-.50	-.63	-.67
Agriculture									
Employment	1.91	.58	.02	-.03	.04	.22	.24	.31	**.32**
Productivity	4.42	.66	.03	.06	.03	.02	-.08	-.18	**-.21**
Real wage	1.82	.74	-.01	-.13	-.23	-.23	-.31	-.45	**-.50**
Industry									
Employment	1.32	.85	.76	**.75**	.72	.61	.44	.27	.10
Productivity	1.42	.53	-.16	-.06	.21	**.60**	.43	.39	.46
Real wage	1.62	.69	.05	.17	**-.35**	-.30	-.48	-.61	-.64
Services									
Employment	2.08	.62	.48	**.54**	.44	.49	.36	.28	.05
Productivity	1.59	.46	-.31	**-.37**	-.19	-.18	-.15	.13	.06
Real wage	1.32	.56	-.48	-.51	**-.58**	-.44	-.47	-.49	-.50

(1) Relative standard deviation.
(2) 1ˆ order autocorrelation.
(3) Correlation with GDP_{t+j}.

Table 6

STABILITY ANALYSIS
EMPLOYMENT, PRODUCTIVITY AND REAL WAGES
(1973.Q1-1992.Q4)

Filter: HP(1.600)

	σ (1)	ρ (2)	$\rho(j)$ (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.83	-	-	-	-	-	-	-
Total economy									
Employment	.69	.42	.41	**.45**	.40	.29	.06	-.13	-.27
Productivity	1.03	.68	-.03	.25	.55	.77	**.79**	.62	.39
Real wage	.77	.58	-.11	-.31	**-.41**	-.39	-.27	-.04	.13
Agriculture									
Employment	2.00	.36	.10	.23	**.31**	.30	.20	.14	.07
Productivity	2.61	.55	-.02	-.20	-.28	-.23	-.18	-.09	-.04
Real wage	1.05	.67	.03	-.10	-.25	-.34	**-.37**	-.31	-.15
Industry									
Employment	.68	.55	**.59**	**.56**	.42	.22	.02	-.22	-.38
Productivity	1.71	.76	.05	.38	.71	.93	.83	.60	.32
Real wage	.87	.59	-.03	-.21	**-.34**	-.30	-.13	.06	.17
Services									
Employment	1.37	.28	.04	.07	.08	**.09**	-.04	-.06	-.08
Productivity	1.59	.46	.02	.18	.34	.42	.57	.46	.32
Real wage	1.17	.27	-.25	**-.38**	-.31	-.29	-.29	-.11	.03

(1) Relative standard deviation.
(2) 1° order autocorrelation.
(3) Correlation with GDP_{t+j}.

Table 7

STABILITY ANALYSIS
DEMAND, SUPPLY AND PRICES
(1954.Q1-1992.Q4; break point: 1973.Q1) (1)

	Volatility	Persistence		Comovement	
Variable	Bartlett test	Chow test	Rel. Fit	Chow test	Rel. fit
GDP	1.43	3.99**	.87	1.00	.97
Agriculture	27.41**	.60	.98	.20	.99
Industry	1.08	3.73**	.88	1.20	.96
Services	.51	2.27	.93	3.05*	.90
Consumption	3.57	6.29**	.82	4.37**	.87
- households	1.03	5.53**	.84	3.30**	.89
- government	8.97**	.21	.99	1.28	.96
Fixed investments	8.28**	2.03	.93	3.01*	.90
- machineries	11.29**	2.57*	.92	.93	.97
- transportation	14.16**	3.07*	.90	2.17	.93
- constructions	26.98**	1.09	.96	4.00**	.87
Inventories	.46	1.06	.96	2.06	.93
Export	.25	.89	.97	1.29	.95
Imports	2.95	.04	.99	.99	.97
Trade balance	.47	.55	.98	.72	.97
Prices	.92	1.91	.94	1.65	.94

(1) An asterisk denotes rejection at the 5 percent level, while two asterisks denote rejection at the 1 percent.

Table 8

STABILITY ANALYSIS
EMPLOYMENT, PRODUCTIVITY AND REAL WAGES
(1959.Q1-1992.Q4; break point: 1973.Q1) (1)

	Volatility	Persistence		Comovement	
Variable	Bartlett test	Chow test	Rel. Fit	Chow test	Rel. fit
GDP	.06	3.99**	.87	1.00	.97
Totale economy					
Employment	17.52**	2.41*	.91	7.33**	.77
Productivity	2.07	1.66	.94	8.78**	.74
Real wage	22.57**	2.49*	.91	5.61**	.81
Agriculture					
Employment	.33	.82	.97	.99	.96
Productivity	16.24**	.75	.97	.73	.97
Real wage	17.42**	1.84	.93	.99	.96
Industry					
Employment	26.11**	2.69*	.90	9.01**	.73
Productivity	2.82	2.27	.91	7.81**	.76
Real wage	22.42**	2.47*	.91	6.17**	.80
Services					
Employment	9.65**	2.15	.92	3.14*	.89
Productivity	.07	1.91	.93	4.24**	.85
Real wage	.45	1.52	.94	2.89*	.89

(1) An asterisk denotes rejection at the 5 percent level, while two asterisks denote rejection at the 1 percent.

Table 9

THE ECONOMIC CYCLE IN SOME OECD COUNTRIES (1)

	Families consumption			Government consumption			Fixed investments			Exports			Imports			Trade balance			Employment			Labour productivity			Real wage (2)		
	V	P	C	V	P	C	V	P	C	V	P	C	V	P	C	V	P	C	V	P	C	V	P	C	V	P	C
Austria (1964 - 1989)	1.24	.26	.54 (0)	.50	.68	-.35 (3)	3.08	.55	.74 (0)	-	-	-	-	-	-	2.97	.30	-.34 (0)	.62	.89	.62 (2)	.87	.49	.82 (0)	.93	.43	.19 (4)
Germany (1960 - 1989)	.92	.74	.69 (0)	.95	.41	.26 (4)	2.83	.65	.83 (0)	-	-	-	-	-	-	2.65	.72	-.41 (-2)	.69	.94	.72 (2)	.74	.56	.79 (0)	.97	.77	.58 (3)
Spain (1969 - 1991)	1.38	.76	.66 (1)	1.20	.77	.23 (-1)	3.65	.91	.79 (0)	3.25	.89	-.36 (-5)	4.45	.75	.66 (1)	2.01	.11	-.42 (0)	.94	.84	.71 (-1)	.76	.73	.45 (0)	-	-	-
Switzerland(2) (1967 - 1984)	.71	-	.67 (0)	.73	-	.14 (0)	3.95	-	.89 (0)	1.47	-	.64 (0)	2.26	-	.75 (0)	-	-	-	.58	-	.78 (0)	.66	-	.84 (0)	-	-	-
UK (1956 - 1990)	1.07	.73	.68 (0)	1.00	.63	.15 (0)	2.33	.64	.64 (0)	2.08	.32	.50 (0)	2.26	.63	.56 (0)	.90	.51	-.34 (1)	.70	.77	.61 (-4)	.95	.34	.40 (0)	1.11	.53	.24 (0)
USA (1960 - 1989)	.74	-	.80 (0)	1.14	-	.37 (-5)	3.20	-	.90 (0)	3.0	-	.49 (-2)	2.90	-	.75 (0)	-	-	-	.60	-	.88 (-1)	.60	-	.83 (0)	.52	-	.49 (0)
France (1960 - 1989)	.96	-	.73 (2)	.78	-	.61 (4)	3.00	-	.78 (0)	3.02	-	.60 (0)	4.60	-	.82 (0)	-	-	-	.62	-	.68 (-1)	.80	-	.78 (0)	.83	-	-.53 (0)
Italy (1954 - 1989)	.81	.86	.74 (0)	.42	.77	.30 (3)	2.57	.82	.83 (0)	2.38	.55	.23 (3)	3.50	.77	.67 (0)	.65	.71	-.53 (0)	1.01	.49	.54 (-2)	1.12	.45	.56 (0)	1.07	.64	-.36 (-1)

Sources:
Austria and Germany: Brandner and Neusser (1992).
Spain: Dolado, Sebastian and Vallés (1992).
Switzerland: Danthine and Girardin (1989).
UK: Blackburn and Ravn (1992).
USA and France: Fiorito and Kollintzas (1993).

(1) V, P and C denote respectively the measures of volatily, persistence and comovement as defined in the text. The highest absolute correlation coeofficient is reported (in parenthesis, the lead (+)/ lag (-) respect to GDP). For Switzerland, the contemporaneous correlation is reported.
(2) For the USA and France, the real wage is relative to the manufacturing sector.

Table 10

VOLATILITY OF GDP CYCLE
(1890-1991)

	Growth rates	HP(100)	Hp(400)	HP(1600)	Log-Linear trend
Pre-war period (1890-1914)	.048	.032	.034	.042	.059
Inter-war period (1922-1939)	.031	.044	.058	.060	.038
Post-war period (1951-1991)	.022	.019	.018	.029	.147

APPENDIX I

Data sources and description

Demand, supply and prices

For the period 1970.Q1-1992.Q4 the data are the official ones (1985 prices), as provided by the National Statistical Institute (ISTAT) in seasonal adjusted form. Golinelli and Monterastelli (1990) have reconstructed the (seasonally adjusted) quarterly data before 1970 of the old accounting. I used the growth rates drawn from the Golinelli and Monterastelli series to extend backward the official series.

The output series for the three branches of the economy are value added at market prices. For the industrial and services sectors, the Golinelli-Monterastelli series are available only disaggregated in subsectors, and have thus been obtained via aggregation. The industrial sector also includes the construction sector.

Employment, productivity and real wages

The employment series are drawn from the quarterly "labour force survey" conducted by the ISTAT. The data are in units of employees and are seasonally adjusted using the X11ARIMA filter.

Since the ISTAT survey provides figures only for the entire services sector, a series for employment in the State services sector was obtained and then subtracted from the total to obtain employment in private services. The employment series in the State services sector was obtained as follows. For the period 1970-1992, I considered the corresponding

series of the national accounting, which is expressed in "standard units". For the period 1959-1969, the series has been estimated. I first regressed the share of employment in the State services sector to total employment in services on the ratio of the respective values added over the period 1970-1992 (the R^2 of the regression was equal to .75). The estimate of the employment ratio for the period 1959-1969 was then used to compute the State services employment series.

The (nominal) wage series are the blue-collar hourly contractual wages, as provided by the ISTAT for the industry, the agricultural sector, and the commercial and residential services sector. The latter was taken as a proxy of the wage in the entire private services sector. The national wage was computed as an average of sectoral wages weighted by their respective employment series.

APPENDIX II

The Hodrick-Prescott filter

In this section I briefly review some properties of the HP filter, without giving formal proofs. More detailed descriptions can be found in Danthine and Girardin (1989) and King and Rebelo (1993), but one should also see Hodrick and Prescott (1981) and Prescott (1986).

The method consists in deriveing the values of the trend from the problem:

$$\underset{\{\tau_t\}_t}{\text{Min}} \sum_{t=1}^{N} (x_t-\tau_t)^2 + \mu \sum_{t=3}^{N} [(\tau_t-\tau_{t-1}) - (\tau_{t-1}-\tau_{t-2})]^2,$$

where x_t denotes the natural logarithm of the original series and τ_t the trend. The cyclical component of the series is computed, once obtained τ_t, as:

$$c_t = x_t - \tau_t.$$

The problem may be interpreted as follows. The first term in the objective function is an index of the "degree of fit" of the trend to the original series, while the second term is an index of its variability, defined in terms of second differences. The shape of the trend clearly depends on the multilier, μ, which is to be fixed a priori. At $\mu=0$, τ_t will coincide exactly with x_t; viceversa, at $\mu=\infty$ the trend variability will be zero, which is equivalent to estimate a log-linear time trend.

Now let $c' = [c_1\ c_2\ \ldots\ c_T]$ and $\tau' = [\tau_1\ \tau_2\ \ldots\ \tau_t]$, then the problem can be rewritten in matrix form as:

$$\underset{\tau}{\text{Min}} \; c'c + \mu(K\tau)'K\tau$$

with

$$K = \begin{bmatrix} 1 & -2 & 1 & 0 & 0 & . & . & . & 0 & 0 & 0 \\ 0 & 1 & -2 & 1 & 0 & . & . & . & 0 & 0 & 0 \\ 0 & 0 & 1 & -2 & 1 & . & . & . & 0 & 0 & 0 \\ . & . & . & . & . & . & . & . & . & . & . \\ . & . & . & . & . & . & . & . & . & . & . \\ 0 & 0 & 0 & 0 & 0 & . & . & . & 1 & -2 & 1 \end{bmatrix}$$

It can be shown (see Danthine e Girardin, 1989, for a proof) that the solution to the problem is given by:

$$\tau = A^{-1} x$$

where $A = (I + \mu K'K)$, and I is the identity matrix.

A property of the filter is that it renders stationary integrated series up to the fourth order. In fact, one can write the solution as $\tau_t = G(L)x_t$, where G(L) is a polynomial in the lag operator, from which one gets:

$$c_t = [1 - G(L)] = C(L)\, x_t,$$

and it can be shown (see King and Rebelo, 1993) that:

$$C(L) = \frac{\mu(1 - L)^2(1 - L^{-1})^2}{1 + \mu(1 - L)^2(1 - L^{-1})^2},$$

which implies four differentiations of the original series.

The HP filter can be assimilated to a high band pass filter in the frequency domain. The Fourier transfom of C(L) is in fact given by:

$$\underline{C}(w) = \frac{4\mu[1 - \cos(w)]^2}{1 + 4\mu[1 - \cos(w)]^2}$$

where $-\pi \leq w \leq \pi$. At $w=0$, that is at the low frequencies, $\underline{C}(w)=0$, while at $w=\pi$, that is at the high frequencies, $\underline{C}(w)=16\mu/(1+16\mu)$, which approaches 1 when μ goes to infinity. The filter C(L) tends then to eliminate the low frequencies.

Since the shape of the trend is sensitive to the value of the Lagrange multiplier, a central problem is to set a value for μ. If c_t and $(1-L)^2\tau_t$ are identically and indipendently distributed normal random variables, with zero mean and variances given by σ_c and σ_τ respectively, it can be shown that the solution to the problem is equivalent to $E(\tau_t|x_t)$, if $\mu=\sigma_c^2/\sigma_\tau^2$. In this case the multiplier has a clear interpretation in terms of the relative variability of the two components. It follows that the value to assigne to μ should be derived on the basis of some prior view about the variability of the two components. Hodrick and Prescott (1981) have proposed to use $\mu=1.600$ for quarterly series, since $1.600=(5)^2/(1/8)^2$ and 5% seems a plausible measure of the mean deviation from trend in a quarter, whereas 1/8 (of 1%) seems a plausible measure of the quarterly growth rate of the series.[30] As noted by Prescott, in this case the filter can be assimilated to a high pass band filter eliminating all frequencies of 32 quarters or more.

However the hypothesis about the probability distribution of c_t and $(1-L)^2\tau_t$ are generally considered not realized in practice, so that the choice of μ remains arbitrary. Some authors have justified the use of 1.600 on

30. "Our prior view is that a five percent cyclical component is moderately large as is a one-eight of one percent change in the growth rate in a quarter" (Hodrick and Prescott, 1981, p. 7).

other grounds. For instance, Danthine and Girardin (1989), who have analyzed the stylized facts of Switzerland, have argued in favor of this value because of the higher temporal stability of the various measures of the business cycle, compared to those obtained under alternative specifications of μ.

APPENDIX III

Sensitivity analysis

This section reports the results obtained using alternative trend-cycle decompositions to test the robustness of the empirical regularities. The evidence on this issue is mixed. For instance Blackburn and Ravn (1991) and Fiorito and Kollintzas (1993) find that the majority of these measures are robust both quantitatively and qualitatively, whereas Baxter (1991) and Canova (1991) reach partially different conclusions.

As alternative filters I consider: 1) the first differences, to take account of unit root behaviour; 2) HP(400) and HP(6.400).[31] I do not consider more standard detrending procedures based on a linear, quadratic or cubic trend, since there is evidence that this are inconsistent with our data set. To ascertain this, I regressed the log of each variable on a linear, quadratic and cubic trend and computed Chow tests of the stability of the regression coefficients, again taking the 1973.Q1 as the date of the structural break. As the Chow test will most probably be invalid, because of the autocorrelation of residuals, - which in this case represent the cyclical component - I also computed the indexes of relative fit between the two subperiods. The results, reported in Tables 10-11, show substantial reductions in the degree of fit in almost all cases when the coefficient vector is

31. It is well known that after the influencial contribution of Nelson and Plosser (1982) the non-stationarity of economic time series has been taken almost as a "stylized fact". Recent and abundant developments on the unit-root econometrics, however, have put into light several weaknesses of common tests for integration (see Perron, 1989, Rappoport e Reichlin, 1986 and 1989, Reichlin, 1989, Kwiatkowski et al., 1992, and Schlitzer, 1993 on this issue). Thus, I do not perform formal tests of integration on the original series.

constrained to be costant over the entire sample period.

The results of the stability analysis using the alternative decompositions are in Tables 12-17. As can be seen, apart from some expected outcomes such as the strong reduction in the degree of persistence when the first difference filter is applied, the main regularities remain qualitatively unchanged.

There are however some results worth noting. First, the leading character of exports disappears under HP(400) and the first difference filter (1-L). Second the lead of government consumption to GDP is also highly sensitive to the filter. Finally, under the first difference filter the lagging character of employment is less clearcut.

Table 11

SENSITIVITY ANALYSIS
DEMAND, SUPPLY AND PRICES
(1954.Q1-1992.Q4; break point: 1973.Q1)

Trend:	Linear		Quadratic		Cubic	
Variable	Chow test	Rel. fit	Chow test	Rel. fit	Chow test	Rel. fit
GDP	880.81	.08	11.13	.82	10.78	.77
Agriculture	72.77	.51	21.15	.70	11.63	.76
Industry	602.52	.11	21.79	.70	4.61	.89
Services	1241.50	.06	51.62	.49	35.59	.51
Consumption	1175.20	.06	43.98	.53	61.62	.38
- households	1005.20	.07	31.50	.61	50.55	.42
- government	959.83	.07	64.07	.44	76.54	.33
Fixed investments	336.12	.18	76.39	.39	10.82	.77
- machineries	35.42	.68	9.24	.84	11.57	.76
- transportation	109.64	.41	13.70	.79	50.02	.88
- constructions	613.38	.11	255.47	.16	32.26	.53
Inventories	27.02	.74	4.89	.91	5.56	.87
Export	1031.60	.07	51.49	.49	23.52	.61
Imports	639.99	.11	84.85	.37	32.95	.53
Trade balance	9.79	.89	40.21	.55	26.47	.58
Prices	437.40	.15	1190.70	.04	475.90	.07

(1) Critical values: 3.00 (5%), 4.61 (1%).
(2) Critical values: 2.60 (5%), 3.78 (1%).
(3) Critical values: 2.37 (5%), 3.32 (1%).

Table 12

SENSITIVITY ANALYSIS
EMPLOYMENT, PRODUCTIVITY AND REAL WAGES
(1959.Q1-1992.Q4; break point: 1973.Q1)

Trend:	Linear		Quadratic		Cubic	
(1) Variable (2)	Chow test	Rel. fit (3)	Chow test	Rel. fit	Chow test	Rel. fit
GDP	523.81	.13	10.06	.83	3.32	.92
Total economy						
Employment	68.27	.53	4.26	.92	36.81	.50
Productivity	188.60	.29	8.73	.85	40.81	.48
Real wage	240.31	.24	156.11	.24	64.47	.36
Agriculture						
Employment	15.13	.83	9.91	.83	38.20	.49
Productivity	21.98	.78	16.98	.75	43.41	.46
Real wage	235.29	.24	215.76	.19	122.42	.23
Industry						
Employment	230.95	.25	7.67	.87	51.40	.42
Productivity	52.86	.59	8.24	.86	16.90	.69
Real wage	268.37	.22	102.85	.33	36.91	.50
Services						
Employment	22.98	.77	6.78	.88	3.22	.92
Productivity	271.67	.22	40.39	.55	19.84	.65
Real wage	121.71	.38	249.53	.17	91.50	.29

(1) Critical values: 3.00 (5%), 4.61 (1%).
(2) Critical values: 2.60 (5%), 3.78 (1%).
(3) Critical values: 2.37 (5%), 3.32 (1%).

Table 13

SENSITIVITY ANALYSIS
DEMAND, SUPPLY AND PRICES
(1954.Q1-1992.Q4)

Filter: HP(400)

	σ (1)	ρ (2)	ρ(j) (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.71	-	-	-	-	-	-	-
Agriculture	3.34	.48	.07	.02	.02	**.12**	.01	-.01	-.06
Industry	1.79	.69	.12	.40	.71	**.95**	.67	.36	.08
Services	.90	.73	.02	.30	.57	**.81**	.66	.45	.19
Consumption	.58	.77	.18	.40	.58	**.71**	.62	.47	.19
- households	.76	.76	.21	.42	.59	**.71**	.60	.45	.16
- government	.40	.72	**-.23**	-.23	.10	.03	.06	.14	.20
Fixed investments	2.40	.70	.33	.48	.66	**.79**	.56	.31	.09
- machineries	5.13	.68	.18	.42	.59	**.74**	.57	.38	.12
- transport.	5.41	.58	.13	.27	.41	**.45**	.26	.16	.09
- construction	2.16	.57	.33	.32	.43	**.51**	.32	.13	.03
Inventories	.84	.50	-.25	.08	.37	**.61**	.44	.23	.08
Exports	2.68	.48	-.21	-.15	.01	**.19**	.14	.11	.09
Imports	3.65	.68	-.14	.13	.43	**.61**	.53	.39	.24
Trade balance	.63	.60	.02	-.21	-.39	**-.44**	-.40	-.30	-.16
Prices	1.03	.75	.34	.32	.19	-.02	-.20	-.40	**-.60**

(1) Relative standard deviation.
(2) 1^ order autocorrelation.
(3) Correlation with GDP_{t+j}.

Table 14

SENSITIVITY ANALYSIS
DEMAND, SUPPLY AND PRICES
(1954.Q1-1992.Q4)

Filter: HP(6.400)

	σ (1)	ρ (2)	ρ(j) (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.83	-	-	-	-	-	-	-
Agriculture	2.67	.58	-.03	-.05	-.04	**.05**	-.02	-.01	-.03
Industry	1.76	.82	.45	.64	.83	**.96**	.80	.59	.39
Services	.97	.86	.42	.59	.73	**.84**	.74	.59	.41
Consumption	.71	.89	.54	.65	.73	**.76**	.67	.54	.35
- households	.88	.89	.56	.66	.73	**.75**	.65	.51	.30
- government	.46	.86	-.03	.01	.11	.19	.24	.31	**.34**
Fixed investments	2.64	.86	.61	.71	.80	**.84**	.69	.50	.32
- machineries	5.38	.83	.45	.61	.72	**.79**	.69	.55	.37
- transport.	5.33	.75	.44	.54	.61	**.62**	.48	.39	.29
- construction	2.09	.75	.57	.57	.60	**.61**	.46	.30	.17
Inventories	.66	.57	-.18	.07	.30	**.49**	.40	.27	.19
Exports	2.32	.63	-.10	-.01	.14	.29	.30	.32	**.34**
Imports	3.45	.80	-.23	.41	.59	**.69**	.62	.52	.38
Trade balance	.57	.74	-.25	-.38	-.46	-.46	-.39	-.28	-.14
Prices	1.60	.93	-.05	-.12	-.21	-.32	-.42	-.51	**-.59**

(1) Relative standard deviation.
(2) 1° order autocorrelation.
(3) Correlation with GDP_{t+j}.

Table 15

SENSITIVITY ANALYSIS
DEMAND, SUPPLY AND PRICES
(1954.Q1-1992.Q4)

Filter: (1 - L)

	σ (1)	ρ (2)	ρ(j) (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.24	-	-	-	-	-	-	-
Agriculture	4.03	-.15	.06	-.03	-.09	**.26**	-.05	.02	-.10
Industry	1.83	.19	.04	.10	.26	**.89**	.21	.11	.04
Services	.90	.29	.00	.20	.24	**.74**	.30	.23	.16
Consumption	.59	.39	.17	.28	.33	**.54**	.32	.41	.13
- households	.74	.33	.17	.29	.30	**.53**	.30	.39	.11
- government	.43	.41	.04	-.03	.22	.14	.17	**.20**	.15
Fixed investments	2.42	.09	.14	.11	.24	**.67**	.17	.10	.01
- machineries	5.18	-.08	.05	.17	.14	**.54**	.12	.17	-.01
- transport.	6.07	.05	.06	.09	.23	**.35**	-.01	.03	.03
- construction	2.61	.01	.15	.01	.17	**.46**	.12	.03	.04
Inventories	1.01	-.08	-.23	.03	.09	**.49**	.07	-.06	.00
Exports	3.40	-.05	.07	-.03	.08	**.34**	.12	.06	.09
Imports	3.63	.24	-.08	.09	.29	**.49**	.22	.13	.12
Trade balance	.68	.01	-.12	-.11	**-.21**	-.14	-.11	-.08	-.02
Prices	1.50	.68	-.09	-.05	-.08	-.22	-.19	-.21	**-.33**

(1) Relative standard deviation.
(2) 1^ order autocorrelation.
(3) Correlation with GDP_{t+j}.

Table 16

SENSITIVITY ANALYSIS
EMPLOYMENT, PRODUCTIVITY AND REAL WAGES
(1959.Q1-1992.Q4)

Filter: HP(400)

	σ (1)	ρ (2)	$\rho(j)$ (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.72	-	-	-	-	-	-	-
Total economy									
Employment	.84	.53	.43	**.48**	.43	.39	.19	.03	-.15
Productivity	1.02	.56	-.25	.00	.36	**.66**	.57	.37	.21
Real wage	1.10	.54	-.03	-.20	**-.33**	-.23	-.25	-.20	-.12
Agriculture									
Employment	2.24	.39	.00	.05	.14	**.21**	.14	.12	.10
Productivity	3.85	.58	**.08**	.01	-.06	-.03	-.06	-.07	-.10
Real wage	1.36	.61	.12	-.02	-.14	-.16	-.23	**-.27**	-.17
Industry									
Employment	.86	.62	.54	**.55**	.47	.31	.12	-.10	-.28
Productivity	1.71	.62	-.15	.14	.51	**.84**	.64	.42	.22
Real wage	1.28	.55	.00	-.17	**-.31**	-.19	-.19	-.15	-.10
Services									
Employment	1.83	.37	.17	**.24**	.17	.22	.13	.12	-.01
Productivity	1.76	.37	-.18	-.10	.11	.18	**.23**	.13	.12
Real wage	1.34	.27	-.20	-.27	**-.30**	-.22	-.25	-.15	-.06

(1) Relative standard deviation.
(2) 1ˆ order autocorrelation.
(3) Correlation with GDP_{t+j}.

Table 17

SENSITIVITY ANALYSIS
EMPLOYMENT, PRODUCTIVITY AND REAL WAGES
(1959.Q1-1992.Q4)

Filter: HP(6.400)

	σ (1)	ρ (2)	ρ(j) (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.84	-	-	-	-	-	-	-
Total economy									
Employment	1.02	.80	.62	**.63**	.58	.50	.34	.20	.05
Productivity	1.01	.75	-.18	.02	.27	.48	**.49**	.43	.37
Real wage	1.09	.74	-.12	-.27	-.38	-.38	**-.41**	-.39	-.34
Agriculture									
Employment	1.89	.53	.13	.18	.25	**.29**	.23	.22	.19
Productivity	3.32	.69	-.07	-.12	**-.16**	-.14	-.14	-.13	-.14
Real wage	1.53	.82	-.07	-.18	-.27	-.31	-.35	**-.37**	-.31
Industry									
Employment	1.15	.85	**.68**	.66	.57	.43	.29	.12	-.04
Productivity	1.57	.74	.01	.25	.53	**.77**	.69	.58	.46
Real wage	1.18	.71	-.04	-.19	-.32	-.31	**-.34**	-.33	-.31
Services									
Employment	1.58	.54	.30	**.35**	.30	.32	.22	.17	.06
Productivity	1.47	.52	-.06	.00	.15	.21	**.29**	.23	.22
Real wage	1.25	.57	-.33	-.40	**-.44**	-.40	-.40	-.32	-.24

(1) Relative standard deviation.
(2) 1ª order autocorrelation.
(3) Correlation with GDP_{t+j}.

Table 18

SENSITIVITY ANALYSIS
EMPLOYMENT, PRODUCTIVITY AND REAL WAGES
(1959.Q1-1992.Q4)

Filter: (1 - L)

	σ (1)	ρ (2)	$\rho(j)$ (3)						
Variable			J: -3	-2	-1	0	1	2	3
GDP	1.00	.26	-	-	-	-	-	-	-
Total economy									
Employment	1.00	.05	.16	.27	.15	**.29**	.06	.13	.03
Productivity	1.19	.07	-.12	-.11	.10	**.59**	.17	.02	-.01
Real wage	1.39	.04	.05	.00	**-.23**	.17	-.06	.00	.07
Agriculture									
Employment	2.94	-.03	.06	.01	.09	**.17**	.02	.03	.00
Productivity	4.38	-.01	.00	-.02	**-.15**	.06	-.03	.00	-.10
Real wage	1.67	.21	.10	.04	-.07	.11	-.01	**-.12**	.03
Industry									
Employment	1.04	.05	.22	**.25**	.24	.19	.14	.07	.04
Productivity	1.87	.04	-.10	-.04	.14	**.79**	.12	.06	.00
Real wage	1.56	.07	.09	.00	**-.25**	.16	-.01	.03	.09
Services									
Employment	2.39	-.19	.04	**.23**	-.05	.19	.03	**.18**	.04
Productivity	2.30	-.17	-.04	-.16	.14	.10	**.16**	-.07	.02
Real wage	2.05	-.18	-.11	-.04	-.12	.11	**-.12**	.00	-.01

(1) Relative standard deviation.
(2) 1ˆ order autocorrelation.
(3) Correlation with GDP_{t+j}.

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